



**THE PROCEEDINGS OF  
SLIIT INTERNATIONAL  
CONFERENCE ON ADVANCEMENTS IN  
SCIENCES & HUMANITIES**

***"RESEARCH FOR BETTERMENT  
OF HUMANITY"***  
***3<sup>rd</sup> & 4<sup>th</sup> DECEMBER 2021***

ORGANIZED BY



**FACULTY OF  
HUMANITIES & SCIENCES**

**PROCEEDINGS OF THE  
SLIIT INTERNATIONAL CONFERENCE ON ADVANCEMENTS  
IN SCIENCES AND HUMANITIES [SICASH]**

***‘Research for Betterment of Humanity’***

3<sup>rd</sup> & 4<sup>th</sup> December, 2021  
Colombo, Sri Lanka

Organized by  
**Faculty of Humanities & Sciences (FHS)**



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### **Message from Joint Editors**

We are indeed delighted and proud to present the Proceedings of SICASH 2021 - the second international conference organized by the Faculty of Humanities and Sciences within two consecutive years. In the first SICASH conference fifty papers were submitted along with ten poster presentation. In this conference we have selected 89 papers after double blind review process from seven tracks namely: Natural Sciences (21), Education (17), English Language & Literature (16), Law (13), Nursing & Health Sciences (9), Mathematics & Statistics (7) and Psychology (6) which is a concrete proof that SICASH is gaining recognition and popularity among the academic community here and abroad.

The concept of engagement scholarship has strongly emerged over the past two decades as part of the continuing dialogue and a social process between the society and the academic institutions. Through such rigorous research process we strive to generate, exchange, and apply mutually beneficial and socially useful knowledge and practices. SICASH offers opportunities to young academics and undergraduate students through the six tracks namely Natural Sciences, Law, Nursing, Education, Psychology and English Language & Literature to submit their findings to a learned audience for discussion and acceptance.

We very sincerely thank the eminent key note speakers, plenary speakers, all the authors and paper presenters, reviewers, chairpersons and the the judges for their continuous support to make SICASH a success story. We are also grateful to the Chancellor, Vice Chancellor, Deputy Vice Chancellor for their continuous support and also for their congratulatory messages to SICASH 2021. Our special thanks to the Dean/FHS for his leadership, dedication, support and encouragement to successfully bring out this Proceedings. Last but not least we thank all the academic and non-academic staff of the FHS for their commitment and support without which we would not have been able to successfully organize this international conference.

**Prof. T. Thanaraj**  
**Prof. Sarath Peiris**  
 Joint Editors in-Chief



### **Message from the Chancellor**

I am delighted to send this congratulatory message to the organizers of the SICASH 2021 conference, for their invaluable contribution in collaborating the event amidst these challenging times of a global pandemic. The conference which is due to be held on 03rd & 04th December will be the ideal platform to bring together not only researchers, professionals, and academics but also students who will be able to showcase their research findings.

Since its foundation, the Faculty of Humanities and Sciences has been providing a strong base to nurture inspiring young students to excel highly in their studies by adapting latest teaching methods involving modern technology and research. Apart from its excellence pedagogy, the faculty has gain wide recognition for its research achievements in Natural Sciences, Law, Nursing, Education, Psychology, English Language and Literature. This is the 2nd conference organized by the faculty since the inaugural session held in 2020, and we foresee that the faculty is bound for more great accomplishments in research and academic distinction in the future.

New knowledge and findings cannot be generated without any research and development (R&D) activities, and SICASH conference will allow participants to engage in discussions and exchange ideas of their research outcomes in an open forum. I earnestly hope that in the years to come the faculty can acquire more wisdom, enthusiasm, and expertise from a broad spectrum of related personnel to help maintain its contributions to our society in the field of Humanities & Sciences. This young faculty has emerged as a highly significant contributor to the success of our institute and keeps empowering new ideas and research findings constantly.

I would like to express my sincere appreciation to the organizers for their valuable contribution and efforts in establishing such a commendable event and wish all the participants of this year's SICASH conference all the success in their future accomplishments.

**Prof. L. L. Ratnayake**  
Chancellor



### **Message from the Vice-Chancellor**

Congratulations to the Faculty of Humanities and Sciences of SLIIT on hosting the SLIIT International Conference in Advancements on Sciences and Humanities (SICASH) 2021, for the second consecutive year.

We live in an era where newly emerging global challenges demand researchers and policy makers to address multidimensional issues. It is timely that the conferences of the nature of SICASH are organized to disseminate insights and knowledge which can be significant vehicles for generating scientific and societal impact, especially at a time people are struggling to navigate through a post-covid world.

SICASH provides a platform for both local and international renowned and emerging scholars to share their research findings in a multitude of areas such as Natural Sciences, Law, Education, English Language and Literature, Nursing, and Psychology. I commend the efforts of the Dean and the staff of the Faculty of Humanities and Sciences in successfully organizing this event and offer my best wishes for a productive conference.

**Prof. Lalith Gamage**  
Vice Chancellor



### **Message from the Deputy Vice Chancellor**

I am delighted to provide a congratulatory message to the organizers and participants of SICASH 2021. The Faculty of Humanities and Sciences at SLIIT is known for its high-quality academic programs and innovative research. SICASH 2021 is built on the success of SICASH 2020. The conference is a venue for multidisciplinary research covering a broad range of subject areas. It is, therefore, an excellent forum for scholars from different disciplines to meet, identify and discuss research synergies and collaborate to solve the challenging problems faced by the world. The world is slowly recovering from the Covid-19 pandemic, which reminds us of the importance of basic and applied research. The pandemic has also reinforced the need to advance the frontiers of knowledge through international collaborations and multidisciplinary approaches.

I am pleased to note the significant interest from the local and international scholars in SICASH 2021. The organizers led by Dr Malitha Wijesundera, Dean of the Faculty of Humanities and Sciences, have made considerable efforts to deliver an exciting conference program with prominent keynote speakers. The SICASH conference series is becoming a pre-eminent international forum for high-quality research and examining the best solutions to the complex problems of today and tomorrow.

I thank the organizers for their untiring efforts and time and the participants for joining SICASH 2021. I wish all participants and the organizers continued success with their scholarly endeavours.

**Prof. Nimal Rajapakse**  
Deputy Vice-Chancellor



### **Message from the General Chair**

I am delighted to send this congratulatory message to SICASH 2021, which is the second international multi-disciplinary conference of our Faculty. I am indeed very proud to record here that we laid a strong foundation by successfully conducting SICASH 2020, the first international conference of our Faculty in which fifty high quality research papers were presented along with ten Poster Presentations.

Subsequently we brought out SLIIT Journal of Humanities and Sciences (SJHS) which is the first research journal of the Faculty the second one of the University. I understand more than one hundred papers will be presented in SICASH 2021 and I am also hopeful that some of the high quality papers will be included in the second issue of SJHS.

We are very passionate about high quality research as research has been the major foundation on which human knowledge was built and developed. It is quite satisfying that we are able to contribute in our small way for the enhancement of human knowledge through SICASH and also through the publication of SJHS. I am hopeful to make major strides through these activities to get recognition in the national and international academia and research communities.

I take this opportunity to express my sincere thanks to the co-chairs, the joint editors, the organizing committee and all the academic and non-academic members of the Faculty for their dedication, commitment and hard work to make SICASH2021 a success. I also gratefully recognize the contributions made by the authors, paper presenters, reviewers, session chairs, judges without whose support this conference would not have been possible.

Best wishes for a successful SICASH 2021!

**Dr.Malitha Wijesundara**

Dean/Faculty of Humanities & Sciences



### **Message from Co-Chair**

The need of researching in different fields for the well-being of human beings has attracted tremendous interest in the world today. Multidisciplinary research is driving humankind towards sustainable development. The interest of the research field has moved from an era where it was focused on an individual area to a period in which a combination of different but compatible areas is dominated. The main purpose of the Faculty of Humanities and Sciences of Sri Lanka Institute of Information Technology in organizing the annual international research conference is to provide a platform to the local and international researchers from different but interconnected areas including Natural sciences, Law, Education, Nursing and Health sciences, Mathematics and statistics, and English language and literature to present their invaluable findings. Further, we have set our goal to provide a forum for the budding researchers to meet experienced and well-qualified personalities in their respective fields to tune their carrier pathways. Moreover, we believe that SICASH 2021 will be an ideal symposium where researchers from different fields could nourish themselves in their respective fields, as well as in other relative fields, where possible collaborations could be established. Such partnerships would lead to novel research projects which would bring glory to the country, Sri Lanka.

The contribution of the reviewers, judges, and the sessions chairs in succeeding this conference is remembered with heartfelt gratitude. I would like to recognize the SICASH organizing committee for their contribution in cultivating the research field and harvesting the products which lead to the betterment of humanity.

I take this opportunity to appreciate all the paper presenters for their enormous effort in doing research and congratulate them for presenting their findings at SICASH 2021.

**Dr. Thambiyagodage Charitha Jayaruk**

Asst. Professor/ School of Science and Education



### **Message from Co-Chair**

I am pleased to send this message to SLIIT International Conference on Advancements in Sciences and Humanities (SICASH 2021), the annual conference of the Faculty of Humanities and Sciences, Sri Lanka Institute of Information Technology.

Organized under the theme 'Research for Betterment of Humanity', SICASH 2021 provides an opportunity for researchers from a variety of disciplines to showcase how their research can lead to finding solutions to the problems faced by the world and humanity today, and lead to the creation of a better future. Being a multi-disciplinary conference, SICASH not only provides a forum for both amateur and mature researchers to present their research findings to the research community, receive constructive feedback, and exchange ideas, but also to discover opportunities for future inter-disciplinary collaborations.

It is a pleasure to note the significant interest that the conference, despite its recent origins, has generated among the research community with a large number of researchers submitting papers and expressing an interest in presenting their research at SICASH 2021. The papers submitted to the conference were subject to double blind review by discipline experts to maintain quality and only papers of the highest standard were selected for presentation at the conference.

I would like to take this opportunity to congratulate all paper presenters, and thank the Dean and other members of the organizing committee for their dedication and hard work in organizing SICASH 2021.

Best wishes for a successful and productive conference.

**Dr. Kushanthi S. Harasgama**  
Asst. Professor/ School of Law

## CONTRIBUTIONS from FOUR KEY NOTE SPEAKERS

**Prof. Siri Gamage**

Adjunct Associate Professor  
School of Social Science and Psychology  
Western Sydney University  
Australia

During the British Empire, Eurocentric knowledge, epistemology and research methodologies were introduced to higher education institutions in the former colonies like Ceylon through various disciplines in natural and social sciences as well as the humanities. The medium of instruction was English and in most instances the professors also came from Western backgrounds. Local academics had to obtain Western qualifications to be able to join the teaching and research process. Text books and journals that were recommended had their origins in European or later American contexts. Knowledge paradigms and research methodologies were developed in the West and transmitted to learners in higher education institutions in the colonies. This shift in the way knowledge was constructed and transmitted had far reaching consequences on the academia to the extent that some have identified a) academic dependency on Western European and American knowledge b) marginalisation and even erasure of local/indigenous epistemologies and knowledge construction methods. Globally, an unequal knowledge order has emerged. Those working in metropolitan centres(capitals of former empires) have access to better resources, journals, funding, and institutional prestige. Those working in the former colonies, apart from possessing a dependent mentality and orientation, suffer from the lack of such working conditions. In this keynote speech, I will expand on this phenomenon with a focus on social sciences and humanities while providing some ideas about the path forward in order to provide an education and research orientation that can liberate the academics and students from academic dependency and captive mind set.



**Prof. James J. Cochran**

Department of Information Systems  
Statistics, and Management Science  
Culverhouse College of Commerce and Business  
Administration University of Alabama  
USA

Recent growth in the amount of data we collect, store, and analyze has been astounding. Experts predict that 175 zettabytes (175,000,000,000,000,000,000 bytes) of data will be available worldwide by 2025, and recent annual growth rates in available data exceed 60%. This creates many new opportunities – not only for learning and understanding, but also for abuse and exploitation.

In this environment, politicians, executives, policy makers, and citizens are increasingly encouraged to make *data driven* decisions. If the data used in decision making are meaningful and legitimate, a data driven approach to decision making is sound. If, on the other hand, the data used in decision making are misleading or erroneous, a data driven approach to decision making is perilous.

Thus, it is imperative that each of us legitimately question all data presented to us and have a basic understanding of how to determine (to some reasonable degree) if data we are considering in decision making are meaningful and legitimate. Additionally, and perhaps more importantly, each of us needs to understand when others who are questioning the meaningfulness and legitimacy of data we have produced and/or are using are acting in a reasonable manner.

Quality data can be a powerful tool for addressing societal problems and transforming systems that (often inadvertently) perpetuate these problems into systems that confront and tackle these problems. When collected in an appropriate manner, data can act as sunlight (illuminate and disinfect). However, data that are to be used to accomplish these lofty goals must be unimpeachable.

When collecting data that will be used to effect change under the most alarmingly difficult conditions – war, famine, terrorism, disease, destruction, corporate corruption, despots – we must be particularly sensitive to how data are collected. Small inadvertent and seemingly benign mistakes can be magnified – legitimately and illegitimately – and then used to question the veracity of the data and impeach the integrity of those responsible for collecting the data.

Unfortunately, a formal education in statistics generally does not generally equip one to handle these circumstances. How does a statistician anticipate and contend with these conditions? What are the potential ramifications for the analyses, the project, the

statistician, and the data collectors? What are the ramifications for those who were to be aided by the data?

Consideration of these concerns is particularly critical when the data to be collected are ultimately to be used to develop and support programs designed to address the most alarmingly difficult conditions. These risks are amplified by the current contentious political climate in which individuals maintain the existence of alternative facts and politicize missteps in data collection for political and personal gain. At this critical juncture in history, it is particularly imperative that data to be used to develop and support programs designed to address the most alarmingly difficult conditions are collected with extreme care and diligence. Our ability to solve such problems and enhance the quality of life (especially for the less fortunate among us) depends on this.

**Dr. Bimali Indrarathne**

Department of Education  
University of York  
United Kingdom

Whether humanity is fairly represented in research is a growing concern in many fields. For example, a review on publications in behavioural science highlights that the vast majority of samples in research comes from Western, Educated, Industrialized, Rich and Democratic (WEIRD) populations. Several reviews of research in language science also show a similar picture. This questions how far the existing research findings can be generalized to the large language learning-teaching communities from non-WEIRD backgrounds. In addition to sampling biases, there are other issues such as heavy domination of Western scholarship in the field and underrepresentation of non-native speaker authors. Another issue in this field is that the research findings are not easily accessible to practitioners because publications are not freely available to a wider population and the highly technical and specialised language in them may be unintelligible to people outside the research community. Open Science practices have given rise to several initiatives in order to address such issues. This includes open access journal articles, making research data and instruments available (e.g., IRIS project) and making research finding widely and openly accessible to practitioners (e.g., OASIS project). SLA for All? initiative (Andringa & Godfroid, 2018) has attempted to address the sampling issue by inviting replications of second language acquisition studies in non-WEIRD contexts. In this talk, I will discuss these key issues in detail and highlight the implications of some open science practices drawing examples from my own research in non-WEIRD contexts.

**Prof. Jeanne Marecek**

Senior Research Professor and  
Wm. Kenan Professor Emerita  
Swarthmore College  
USA

Psychology was latecomer to the academic scene in Sri Lanka. It entered university settings in the late 1980's, as the stepchild of other disciplines—philosophy, psychiatry, and sociology. In the following 30 years, Sri Lankan psychologists have worked hard to establish a home of their own and to solidify the identity of the field. I briefly trace the accomplishments of these psychologists. Then I turn attention to the present. Today, psychology in Sri Lanka is growing rapidly, albeit unevenly. The time is ripe for disciplinary reflexivity—a scrutiny of the possibilities and pitfalls of psychology as it developed in North America and Europe. What lessons are there for future developments in psychology in Sri Lanka? Psychologists in Western countries have begun to call into question presumptions that have long been taken for granted. For example, since its beginning 150 years ago, the field has tried to model itself on natural sciences like physics. But, as critics point out, persons are not like atoms or chemical elements. They do not behave in accord with general laws. Instead, their actions are guided by their intentions, aspirations, moral visions, relations with others, ethical commitments, and so on. These are shaped in turn by their cultural and societal surround. Other critics have pointed out ways in which psychology has played handmaiden to social values. Too often, psychological knowledge has been laced with racist, sexist, and colonialist assertions. Yet other critics have taken issue with the “quantitative imperative” that promoted to a blind trust in numerical scales and tests based on populations in Western high-income countries. Academic psychologists who seek knowledge about Sri Lankan persons must endeavor to decolonize psychology. A decolonized psychology ought to center on Sri Lanka, attending to the norms and rules of its local cultures and to local lifeways, worldviews, moral visions, and practices. Such a decolonial gaze will offer a counterpoint to some assumptions of conventional Western-centric psychologies. A good example is individualism, an assumption that sees the attainment of individuation and separation as the goal of children's development and that extols people who “march to the beat of their own drum”, defying social rules. Individualism underlies much of Western-centric psychology, such as theories of the self; prescriptions for childrearing; and definitions of mental health. Further, decolonizing clinical and counseling psychology requires that psychologists learn about local idioms of distress—the patterned ways that psychological suffering manifests itself. They also can gain knowledge of the socially sanctioned “sick role” in Sri Lanka and the local practices of alleviating psychological suffering.

## Plenary Speakers for Different Tracks

### Natural Sciences



**Prof. Saravanamuthu Vigneswaran**  
Civil and Environmental Engineering  
University of Technology Sydney  
Australia

***Title of speech: "Improved removal of organic micropollutants from water"***



**Dr. Ian J. Tetlow**  
Department of Molecular and Cellular Biology  
University of Guelph  
Ontario  
Canada

***Title of speech: "A Polyglucan with versatile functionality"***

### Education



**Senior Prof. Shironica P. Karunanayaka**  
Professor in Educational Technology  
The Open University of Sri Lanka

***Title of speech: "Converging Technology and Pedagogy in the Digital Age"***



**Dr. Kapila Bandara**  
Dean  
Faculty of Education  
University of Colombo  
Sri Lanka

***Title of speech: "Future is not an encounter but a creation of Education"***

## English Language and Literature



**Dr. Lesley Dick**

Manager English Language Training (ELT) Project  
British Council  
Sri Lanka

***Title of speech: "Lessons from lockdown : Online teacher training in Sri Lanka"***



**Dr. Reva Ramiah**

English Language Development Coordinator & Senior Lecturer  
Faculty of Science and Engineering,  
Curtin University  
Australia

***Title of speech: "Enabling learning through language across the curriculum – what every subject teacher needs to know"***

## Law



**Dr. Asanga Gunawansa**

Lead Legal Counsel for Colombo of Colombo Law Alliance  
Legal Consultant, Green Climate Fund  
Visiting Professor  
University of Moratuwa

***Title of speech: "Right to Water: Some key challenges faced by developing countries when developing Water Infrastructure"***



**Justice Saleem Marsoof PC**

Non-Resident Judge of the Supreme Court of Fiji  
Former Justice of the Supreme Court of Sri Lanka

***Title of speech: "Importance of legal research for the advancement of science and humanity"***

## Nursing and Health Sciences



**Prof. S.S.P. Warnakulasuriya**  
Dean  
Faculty of Nursing  
University of Colombo  
Sri Lanka

*Title of speech: "Revitalizing nursing education and research for future trends"*

## Mathematics and Statistics



**Prof. Bala Rajaratnam**  
Department of Statistics,  
University of California,  
Davis  
USA

*Title of speech: "Mining correlations from big data"*

## Psychology



**Prof. Gameela Samarasinghe**  
Department of Sociology  
University of Colombo  
Sri Lanka

*Title of speech: "Beyond psychologizing – addressing psychosocial needs of people in Sri Lanka"*

**SICASH 2021 – PROGRAMME**  
**Inauguration Ceremony**  
**03 December 2021**

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8.30 AM	8.40 AM	Welcome & National Anthem
8.40 AM	8.45 AM	Traditional lighting of the Oil Lamp
8.45 AM	8.55 AM	Welcome Address by General Chair – <b>Dr. Malitha Wijesundara</b>
8.55 AM	9:00 AM	SICASH Video Presentation
9:00 AM	9:10 AM	Address by the Vice-Chancellor of SLIIT- <b>Prof. Lalith Gamage</b>
9:10 AM	9:20 AM	Address by Co-Chair <b>Dr. Thambiliyagodage Charitha Jayaruk</b>
9:20 AM	9:35 AM	Address by the Chief Guest <b>Prof. Ranjith Senaratne</b> Chairman, National Science Foundation
9:35 AM	10.20AM	Keynote Speech – <b>Prof. James J. Cochran</b> University of Alabama, USA
10:20 AM	11:05 AM	Keynote Speech – <b>Prof. Siri Gamage</b> Western Sydney University, Australia
11:05 AM	11.15 AM	Address by Co-Chair <b>Dr. Kushanthi S. Harasgama</b>
11.15 AM	11:20 AM	End of Inauguration Ceremony

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# Natural Sciences



2021  
**SICASH**  
SLIIT INTERNATIONAL CONFERENCE ON  
ADVANCEMENTS IN SCIENCES & HUMANITIES

## Development of Ginger, Turmeric and Pomegranate Peel Extracts Incorporated Pasteurized Milk with Immune Boosting Active Compounds

Jayathilake, P.A.L.\*<sup>1</sup>, Jayasinghe, M. A.<sup>1</sup>, Walpita, J.<sup>2</sup> & Dilani, K.P.R.I.<sup>2</sup>

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### ABSTRACT

The purpose of this study was to develop a pasteurized milk that could improve human immune responses due to active compounds of ginger, turmeric and pomegranate peel extracts with acceptable sensory properties and to evaluate proximate composition, physiochemical properties and microbial acceptance of developed pasteurized milk. Active compounds of plant extracts were identified through GCMS analysis and the best formulation for the product was selected through a sensory evaluation by 5 point hedonic scale. The formulation of 300ppm of ginger, 100ppm of turmeric and 300ppm of pomegranate was found to be significantly best with relevant to aroma, mouthfeel, taste and overall acceptability at 5% level of significance. Proximate composition of milk samples was determined at first days of shelf life. Total plate count, coliform content and yeast and mould content were evaluated at 1<sup>st</sup> day, 3<sup>rd</sup> day and 5<sup>th</sup> day of storage to confirm 5 days of shelf life. The pH and titratable acidity of milk samples were checked every day of shelf life and antioxidant activity and gallic acid equivalent phenolic content of milk samples and plant extracts were determined at first days of shelf life. When considering physiochemical properties of the final product, antioxidant activity ( $40.615 \pm 0.447$ ) and gallic acid equivalent total phenolic content ( $0.532 \pm 0.004$ ) were significantly higher ( $p < 0.05$ ) in the newly developed product. Antimicrobial properties of plant extracts were checked using agar well diffusion method against *Bacillus subtilis*, *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa* and *Candida albicans*. All 3 extracts have shown inhibition towards selected pathogenic bacteria and fungi.

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## INTRODUCTION

Immunity system includes special organs, cells and chemicals that fight infection (microbes). It spreads throughout the body and involves many types of cells, organs, proteins, and tissues. Crucially, it can distinguish one's body tissue from foreign tissue self from non-self. Dead and faulty cells are also recognized and cleared away by the immune system. Due to recent corona pandemic situation, researchers have focused on developing a healthy immune system through natural ingredients. Thus, the attraction towards immunity-boosting and healthpromoting food products has significantly increased. Fresh milk is considered as one of the most popular beverages in the world and ginger(Zhou, Deng and Xie, 2006), turmeric (Bose et al., 2015)and pomegranate (Ross,Selvasubramanian and Jayasundar,2001)are believed as promising herbal ingredients that could enhance human immunity due to their active compounds.

This study was done to develop a value added pasteurized milk by incorporating ginger and turmeric oleoresins and pomegranate peel extracts and aims on flavouring and enriching of milk with immunity enhancing ability from selected plant extracts and evaluating the consumer preference for pasteurized milk.

## MATERIALS AND METHODS

Ginger and turmeric oleoresins were obtained by Soxhlet extraction and pomegranate peel extract was also taken (Attia E. A., 2019). Those were incorporated into fresh milk as the best formulation obtained from the sensory evaluation conducted by a semi trained panel. Then, milk was pasteurized, filled into sterile glass bottles and stored in

refrigerator at 4°C for further experiments.

GCMS analysis was conducted to identify active compounds of plant extracts and antimicrobial properties of plant extracts against pathogenic bacteria; *Bacillus subtilis*, *Staphylococcus aureus* (ATCC 29213), *Escherichia coli* (ATCC 25922), *Pseudomonas aeruginosa* (ATCC 27853) and pathogenic fungi; *Candida albicans* obtained from the Faculty of Medical Sciences, University of Sri Jayewardenepura were determined through the inhibition zone taken from agar well diffusion test (Balouiriet.al.,2016).

As the proximate composition of the final product, moisture content (AOAC 2005), protein content (AOAC 978.04), fat content (Gerber method), carbohydrate content (Al-Abdulkarim et.al, 2012) and ash content (AOAC 923.03) were determined. Titratable acidity(Weerasekaraet.al., 2010), pH, antioxidant content (Gjorgievskiet. al, 2013) and total phenolic content (Ainsworth and Gillepse, 2007) of final product were determined as physiochemical properties. In order to analyze microbial acceptability of final product total colony count, yeast and mould count and coliform count were determined.

## RESULTS AND DISCUSSION

The formulation of 300ppm of ginger, 100ppm of turmeric and 300ppm of pomegranate was found to be significantly best at 5% level of significance.

### GCMS analysis

According to the GCMS analysis, the pharmacologically important active compounds identified in ginger oleoresin are Zingerone, -curcumin, Eucalyptol, Zingiberene, Limonene, -sesquiphellandrene, -bisabolene, Phenol, 2,4-bis(1,1-dimethylethyl), Eicosane and Heneicosane. The pharmacologically important active compounds in turmeric oleoresin were -curcumin, Ar-tumerone, Tumerone, Curlone, Zingiberene and -sesquiphellandrene.

Tetradecane, Eicosane, Phenol, 2,4-bis(1,1-dimethylethyl), Pentadecanoic acid, Glaucine, n-Hexadecanoic acid and Octadecanoic acid were the pharmacologically active compounds identified in pomegranate peel extract.

### Proximate composition of final product

Proximate composition of milk samples includes moisture, protein, fat, carbohydrate and ash. Thus, those were determined at the first days of shelf life. Table 1 shows the proximate composition of final product.

**Table 1.** Proximate composition of final product

Parameter	Developed sample	Control
Moisture%	87.41 ± 0.45	86.79 ± 0.09
Fat%	3.73 ± 0.06	3.80 ± 0.10
Protein%	3.06 ± 0.44	2.94 ± 0.04
Carbohydrate%	4.73 ± 0.06	4.81 ± 0.09
Ash%	0.69 ± 0.03	0.64 ± 0.01

There were no significance differences between samples with respect to moisture content, fat content, protein content and carbohydrate content. However, there was a significant difference between samples in ash content. This may be due to higher ash content of plant extracts.

### Physiochemical properties of final product

The pH, titratable acidity, antioxidant activity (DPPH radical scavenging activity%) and gallic acid equivalent phenolic content of milk samples were determined.

**Table 2.** Physiochemical properties of product

Parameter	Developed sample	Control
PH	6.77 ± 0.01	6.78 ± 0.02
Titratable acidity	0.153±0.003	0.152±0.003
Antioxidant activity (%)	40.615±0.447	29.402±0.526
Total phenolic content (mg/ml)	0.532±0.004	0.369±0.001

When considering antioxidant activity and total phenolic content, there were significant differences ( $p < 0.05$ ) between control milk sample and developed milk sample in DPPH radical scavenging activity% and total phenolic content. However, there were no significant differences ( $p > 0.05$ ) between control and developed milk samples with respect to pH and titratable acidity.

### Microbial evaluation of the product

Total plate count, coliform content and yeast and mould content were evaluated at the 1<sup>st</sup> day, 3<sup>rd</sup> day and 5<sup>th</sup> day of storage to confirm 5 days of shelf life. Table 3 shows the total colony count, yeast and mould count and coliform count throughout the shelf life of the product.

Total colony count of product (developed sample) was lower than control sample and there were no yeast and mould and coliform count during shelf life. This may be due to antimicrobial properties of plant extracts. There were no coliform and yeast and mould count throughout the shelf life.

### Antimicrobial activity of plant extracts

In order to identify antimicrobial activity of plant extracts, agar well test was conducted. All plant extracts showed inhibition towards selected Gram positive and negative bacteria and fungi. Table 4 shows inhibition zone of plant extracts and combined ratios of plant extracts against selected bacteria and fungi.

### CONCLUSIONS

All three selected plant extracts were effective in suppressing pathogenic strains of gram- positive and negative bacteria and fungi. Henceforth, it can be suggested that the final milk has an antimicrobial effect. The total antioxidant and phenolic contents have greatly increased by the addition of selected plant extracts. Thus enhancing the pharmacological importance of the product. Plant extracts incorporated innovations complied with sensory properties and proximate compositions compared to standard milk products.

### ACKNOWLEDGEMENT

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**Table 3.** Total Plate Count, Yeast and Mould Count and Coliform Count of Product during Shelf Life

Storage period	Parameter	Microbial count in milk samples (CFU/ml)	
		Control	Developed milk sample
Day 01	Total Plate Count	< 10	< 10
	Yeast and Mould	Nil	Nil
	Coliform	Nil	Nil
Day 03	Total Plate Count	$2.0 \times 10^3$	< 10
	Yeast and Mould	Nil	Nil
	Coliform	Nil	Nil
Day 05	Total Plate Count	$4.2 \times 10^3$	$1.9 \times 10^3$
	Yeast and Mould	Nil	Nil
	Coliform	Nil	Nil

**Table 4.** Inhibition zone of plant extracts against different microorganism

	Inhibition zone (mm)				
	<i>Bacillus subtilis</i>	<i>Staphylococcus aureus</i>	<i>Escherichia coli</i>	<i>Pseudomonas aeruginosa</i>	<i>Candida albicans</i>
Control milk sample	0	0	0	0	0
Developed milk sample	0	0	0	0	0
10% concentration of plant extracts	22	19	19	23	30
20% concentration of plant extracts	25	22	24	26	32
30% concentration of plant extracts	28	25	27	30	40
Ginger extract	17	17	15	11	15
Turmeric extract	13	12	0	11	12
Pomegranate peel extract	20	25	30	27	30

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## A Health Risk Assessment of Soft Drinks According to Limits of the American Heart Association

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### ABSTRACT

There is a growing trend in soft drinks consumption by young adults in Sri Lanka. However, the excessive added sugar in instant drinks results in health risks. Moreover, the upper and lower exposure limits of added sugar in soft drinks have not been scientifically assessed in comparison to the accepted limits of the American Heart Association (AHA). Thus, this study identifies the maximum and minimum exposure levels to added sugar from soft drinks within the accepted limits of AHA. According to AHA the maximum daily exposure to added sugar through soft drinks is 2.93 g/day for females and 4.23 g/day for males. This study consists of an online survey and a laboratory analysis. Stratified random sampling was employed in the selection of respondents for the study. Seven soft drinks were randomly purchased at the local market; the total and reducing sugar content were analyzed by the Lane-Eynon method. The results showed the male exposure range was 0.8 to 7 g/day whereas females were 0.8 to 12 g/day. In this population about 10% of women and 3% of men are at the risk from minimum exposure level while 51% of women and 22% of men are at risk from maximum exposure level. This selected population's exposure range is from 0.8 to 12 g/day of an overall value of 42% of people of the study. According to the results, there is a potential risk for enamel erosion because the observed pH levels were considerably below the threshold level of 5.5. To avoid the negative cumulative effects of added sugar on the body, it is preferable to teach young adults to be aware of excessive added sugar from fast drinks.

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## INTRODUCTION

Instant drinks are heavily consumed mainly because of their sweet taste and energy booster due to their high calorific content. Leading beverage companies promote those drinks heavily while owning a significant market share. Instant drinks are non-alcoholic beverages that typically containing fruit acids, sweetening agents, and natural or artificial flavours and colourings. The National Institute of Industrial Research Project (2012) stated that in Sri Lanka soft drinks per capita consumption is 21 bottles per year. Nevertheless, previous literature proved that exposure to the high intake of soft drinks is associated with different health risks as follows. Hu et al., (2010) and Greenwood et al., (2014) mentioned type-2 diabetes as a global public health concern parallels to obesity along with the increased consumption of soft drinks.

Adolescents' mental health problems are connected with mental agony and hyperactivity due to the high intake of soft drinks (Lien et al., 2006). Hence it is clear that there should be a paradigm shift from artificial drinks to natural alternatives because of the above bad effect on overall health. Some of the alternatives for carbonated soft drinks are lime juice, fruit juices, vegetable juices, and king coconut. Another nutritional concern among young people is insufficient consumption of vegetables and fruits.

The WHO recommends taking at least 400 g of fruit and vegetables per day for adults, excluding potatoes, sweet potatoes, cassava, and other starchy roots. In the Sri Lankan context, it is difficult to satisfy this level among the adult population. Therefore, there is a necessity to build an appropriate strategy that can fill the gap between what is recommended for vegetable/fruit intake and what is

happening in general. However, according to the American Heart Association, drinks are the major source of added sugars, accounting for 47 % of all added sugars (Sánchez-Pimienta et al., 2016). In the given 47%; soft drinks are responsible for 25% of added sugar. Consequently, they recommend maximum daily exposure to added sugar as 2.93 g/day for females and 4.23 g/day for males. The objective of this study is to evaluate the health risk of young adults due to the consumption behavior of soft drinks.

## MATERIALS AND METHODS

This study consisted of a socio-economic survey and laboratory analysis. The widely consuming soft drinks are identified in the survey and the regularity of consumption and questions regarding their health condition are also questioned. The targeted group was early adulthood with the age range from 18 to 24 years.

During the questionnaire; respondents' weight and height were questioned and then the BMI value above 25 respondents were removed. The much favoured first seven soft drinks were identified and those brands were randomly purchased at the local market and labelled as S1, S2, S3, S4, S5, S6, and S7. Those samples were analyzed for total sugar and reducing sugar content using a modified Lane-Eynon method (Cole, 1933) and pH. This social survey was completed with 101 men and 99 women (n = 200).

The minimum and maximum exposure ranges were computed individually for the two samples depending on gender and the entire population. The results were compared to the American Heart Association's recommended levels (9.3g/day for females and 4.23g/day for males). In lab analysis, Fehling's solution A

was prepared in the lab by dissolving 69.28 g copper sulphate ( $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ ) in distilled water, diluting to 1000 mL, filtering, and storing in an amber colour container. The Fehling's B solution was then prepared by dissolving 346 g potassium sodium tartrate ( $\text{KNaC}_4\text{H}_4\text{O}_6 \cdot 4\text{H}_2\text{O}$ ) in 500 mL distilled water and 100 g NaOH in separate distilled water.

These two solutions were mixed and diluted to a final volume of 1000 mL. That filter was kept in an amber-coloured container. Two solutions, solution 1 and solution 2, were combined and make the clearing agent. The quantity of the two solutions used varies in relation to the colour intensity of the soft drink. Clearing agent solution 1 was made mixing Zinc and Acetate  $\{\text{Zn}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot 2\text{H}_2\text{O}\}$  60 g and 7.5 mL of glacial Acetic Acid ( $\text{CH}_3\text{COOH}$ ). Then it was topped up to 250 mL. Clearing agent solution 2 was made mixing Potassium Ferro-cyanide 26.5 g in distilled water and it was topped up to 250 mL.

The first step was to standardize Fehling's solution for inverted sugar. 4.75g of analytical research (AR) grade sucrose was accurately weighed and put in a 500 mL volumetric flask with 50 mL of distilled water. 5 mL concentric HCl was added and set aside for 24 hours and using phenolphthalein as an endpoint indicator, the solution was neutralized with NaOH. It was thoroughly mixed before being transferred in 25 mL increments to a 100 mL volumetric flask and made up to volume (1 mL = 2.5 mg of invert sugar) and then it was titrated against Fehling's solution. The factor for Fehling's solution was calculated by using the following formula;

Let Titre =  $V_1$  (in mL)

The factor for Fehling's solution  
 $= (\text{Titrate} \times 2.5) / 1000$   
 $= 0.0025 \times V_1 = \text{----- g}$

Then to determine the total sugar, 5 mL of the sample was weighted and 1 mL of 3 M HCl of 15 mL and 20 mL distilled water was added into a volumetric flask and it was boiled for 1 minute.

Then the clearing agent was added. If the the colour was light, 2 mL was added, and if colour was dark, 10 mL was added. Following that, 2-3 drops of phenolphthalein indicator were added. Then 20% NaOH was added to neutralize the solution. It was then topped up to 250 mL and filtered. Fehling's A solution (5 mL) and Fehling's B solution (5 mL) were combined, and mL of water was added. It was stained with methylene blue. Titration was performed to calculate the total sugar and 5 mL of the sample was weighted. Methylene blue was added to it and then titration began and ended when a brick-red precipitate developed.

The reducing sugar was then determined by weighing 5 mL of sample and adding 100 mL of distilled water to a volumetric flask. The total and reducing sugar the content was calculated using the following formula.

$$\text{Total reducing sugars \%} = \frac{0.0025 \times V_1 \times 2 \times V_2 \times 100}{V_3 \times V_0} = \frac{0.25 \times V_1 \times V_2}{V_3 \times V_0} = x\%$$

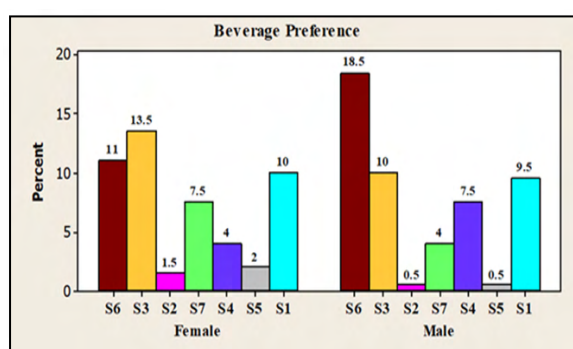
Where,  $V_0$  = Volume of the sample,  $V_2$  = Dilution volume for the sample &  $V_3$  = Burette reading

## RESULTS AND DISCUSSION

The total population consists of 50.5% male and 49.5% female whereas all the participants were healthy individuals. Results disclosed that all the soft drinks preferences by the respondents varied in the order of  $S_6 > S_3 > S_1 > S_4 = S_7 > S_5 > S_2$ . Considering the gender, the preference by female respondents varied as in the order

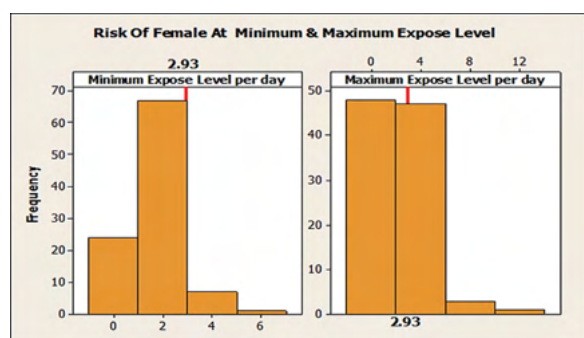
of  $S3>S6>S1>S7>S4>S5>S2$  whereas preference by males varied as in the order of  $S6>S3>S1>S4>S7>S5>S2$ . According to Figure 1, it was clear that the female's highest preference was for S3, whereas the male's highest preference was for S6. The lowest female's preference was for S2 and the male's least preference was for S2 and S5.

**Figure 1.** showed the soft drink preference of male and female populations separately



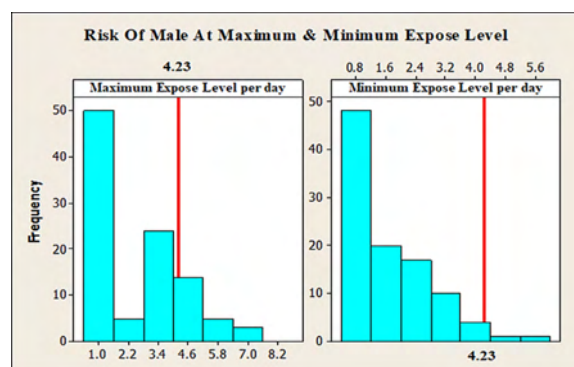
The exposure level of females was 0.8 to 12 g/day and the male exposure range was 0.8 to 7.6 g/day based on the AHA recommended values for females and males 2.93 g/day and 4.23 g/day respectively. When considering the female sample  $10\pm1.2\%$  were at the risk at minimum exposure range and  $51\pm1.4\%$  were at the risk at maximum exposure range (Figure 2).

**Figure 2.** Risk of the female population at a minimum and maximum exposure level



$3\pm0.8\%$  male respondents were at the risk at minimum exposure range and  $22\pm1.1\%$  were at the risk at maximum exposure range (Figure 3).

**Figure 3.** Risk of the male population at a minimum and maximum exposure level



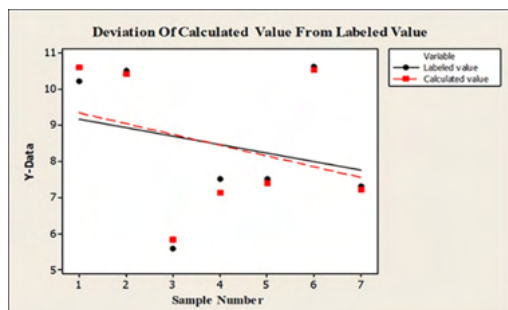
The selected population exposure range was from 0.8 to 12 g/day while  $42\pm1.7\%$  of the total population was at the risk of the above-mentioned health risks due to excess usage of added sugar.

The American Heart Association (AHA) recommends a female and male maximum daily intake of added sugar from the soft drink is 2.93 g/day and 4.23 g/day respectively. However,  $42\pm1.7\%$  of the selected population exceeded the regulatory standards of the American Heart Association whereas females are the most susceptible group. Similarly, it stated that type 2 diabetes in women was popular due to the higher consumption of sugar-sweetened beverages (Schulze et al., 2004).

Then the total sugar content of samples was in the order of  $S1>S6>S2>S5>S7>S4>S3$  which was considered as the added sugar content. It was obvious that all the samples showed a medium sugar level which was indicated by the colour code amber. The non-reducing sugar content was in the order of  $S5>S1>S7>S2>S6>S4>S3$ . The deviation of

labelled value with calculated value also was examined (figure 4).

**Figure 4.** The deviation of labeled value with the calculated value



According to Figure 4; it was obvious that the labelled values that appeared on the bottle label are not different from the calculated values.

Results revealed that all the soft drinks were acidic at room temperature. Those beverages with a pH<4.0 are potentially harmful to the dentition (Reddy et al., 2017). As per the Journal of Canadian Dental Association (Dawes, 2003), erosion of root dentin and enamel happens when pH values reach threshold values of 6.7 and 5.2–5.5, respectively. Teeth erode in the pH range of 2.0 to 4.0, although surface enamel starts to demineralize as the pH drops below 5.5 when the external milieu of the oral cavity becomes under-saturated and started enamel erosion (Cheng et al., 2009). Considering the health risk due to the consumption of instant drinks, this dietary intake should be compensated by natural drinks. One of the solutions suggested through this study is to increase the dietary intake of freshly squeezed vegetable and fruit juice which is cost-effective, convenient, and calorie appropriate. Other solutions suggested are lime, lemon, and passion-fruit juice, and king-coconut water.

However, the regulatory standard often World Health Organization (WHO) for daily sugar intake is 25 grams. Besides, the

American Heart Association (AHA) recommends that daily intake of added sugar should be 25 grams for women, 38 grams for men, and 12 grams for children (Johnson et al., 2009). The natural alternatives for carbonated soft drinks are lime juice, fruit juices, vegetable juices, and king coconut. In the Sri Lankan scenario, king coconut is compatible and more nutritious. The nutritional profile of 7 to 8 months old king coconut has been reported by previous literature as glucose 2-3 g/100 mL, fructose 2-3 g/100 mL, sucrose 0.1g/100 mL, potassium 1900-2500 mg/L, chlorides 1200-1600 mg/L, calcium 100-200 mg/L, energy 17.4 kcal/100 mL, and carbohydrates 4g/100 mL (Thamban C et al., 2007). (Norman 1978) mentioned that fresh fruits and vegetables helped to repair the body and boost metabolic processes whereas Dobrinan et al., 2014) discovered when compared to carbonated orange juice, natural lemon juice had no sugar residues/invert sugar.

## CONCLUSIONS & RECOMMENDATIONS

### Conclusions

The levels of added sugar in the selected soft drinks are varied in descending order of S1>S6>S2>S5>S7>S4>S3. Those soft drinks may cause dental damage as they all are acidic.

The selected healthy population exposure range was from 0.8 to 12 g/day where female and male maximum daily intake of added sugar from the soft drink should be ranged from 2.93 g/day and 4.23 g/day. Moreover, women's exposure range was high when compared with the male's exposure range. 42 % of the selected population exceeds the regulatory standards of the American Heart Association. It is important to shift from instant drinking habits to natural drinks to ensure healthy adults in the future.

Even though this study was limited to 200 participants from 18-24 years of age; this work was preliminary with a long-term objective to expand further in future.

### Recommendations

New health standards suitable for the Sri Lankan context should be formulated for the dietary behavior of soft drinks and other sugary drinks consumption covering all the vulnerable subgroups and educate society. The distribution channel for the local natural drinks or juices should be popularized and made available within the country.

### ACKNOWLEDGEMENT

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## Synthesis of Amine Functionalized Silica- $\text{Cu}_4\text{O}_3$ Adsorbent from Rice Husk for Efficient Removal of Crystal Violet from Aqueous Solution

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### ABSTRACT

Silica based Nano adsorbent (SCN) synthesized using rice husk as the raw material via sol- gel pathway. Silica nanoparticles were successfully functionalized with 3-aminopropyl triethoxysilane (APTES) via in-situ functionalization method. Synthesized nanoparticles were characterized by XRD and FT-IR. The equilibrium adsorption capacity of 0.02g of SCN to adsorb 10 mg/L crystal violet (CV) was 20.09 mg/g. The influence of pH, adsorbent dosage, and initial CV concentration on adsorption of CV to SCN were studied. The equilibrium data for CV adsorption on SCN well fitted to Freundlich model, with a Freundlich adsorption capacity of 8.23 mg g<sup>-1</sup>. The adsorption of CV could be best described by the pseudo-second order model with 0.99 linier regression coefficient.

## INTRODUCTION

In recent years, environmental pollution by synthetic dyes is a serious problem due to their negative eco-toxicological effects and bioaccumulation in wildlife (Kishor et al., 2018). Industrial wastewater is one of the critical sources of water contamination. The effluent from the textile, leather, paper, paint, acrylic, cosmetics, plastics, pharmaceutical industries negatively impact the environment in many aspects. It has been estimated that over 10,000 of different pigments and dyes are used industrially (Usgodaarachchi et al., 2021). Also, over  $7 \times 10^5$  tons of synthetic dyes are annually produced worldwide for the purpose of coloring. Also, above mentioned industries, use dyes in order to color their products and also consume substantial volumes of water (Kishor et al., 2018; Piaskowski et al., 2018). In the textile industry approximately 12% of synthetic dyes are lost during the manufacturing and dyeing operations, also 20% of these lost dyes enters in to water stream as industrial wastewater (Tissera et al., 2020). Crystal violet (CV) dye is a highly water-soluble cationic dye and huge amount to CV used in the textile industry. It has been recognized to be a carcinogenetic compound to both humans and animals with various other health implications such as respiratory track issues, irritation to skin and eyes. Adsorption is an interesting technique for the removal of pollutants from wastewater. This technique engages with the most promising advantages, such as high efficiency, simplicity and reusability. The most important requirement for a good adsorbent is a

large interface (Li et al., 2018). Thus, porous materials are widely considered as potential adsorbents because of their intrinsic high specific surface area. Another common material for this dye removal process is silica nanoparticles. Some of its characteristics such as high surface area, ease of preparation, low-cost precursors, high compatibility for various surface modifications and acute toxicity makes it a very appealing alternative for this purpose.

In this work, CuO/SiO<sub>2</sub>/APTES nano-adsorbate was synthesized via the sol-gel method. Sol-gel technique is well established in the formation of nano-scale silica with desirable physical properties. Silica is a polymer of silicic acid with crosslinked SiO<sub>4</sub> in a tetrahedral shape, having a SiO<sub>2</sub> stoichiometry. CuO/SiO<sub>2</sub> mixed oxides are important ceramic materials that as inorganic supports. Such prepared material was characterized by Fourier transform infrared (FT-IR) and X-ray diffraction (XRD) spectroscopy. This nanocomposite was used as an efficient adsorbent for the removal of cationic CV from an aqueous solution.

## MATERIALS & METHODS

### Materials

The raw material, rice husk (RH) was obtained from a rice mill in the "Gampaha" district, Sri Lanka. All reagents used were of analytical grade, and their solutions were made using ultrapure water. Sulfuric acid (98%, H<sub>2</sub>SO<sub>4</sub>), hydrochloric acid (37 % HCl), sodium hydroxide, 2-propanol, 3-aminopropyl triethoxysilane (APTES), toluene, dichloromethane, and diethyl

ether were purchased from Sigma-Aldrich (USA). Crystal violet (CV) was purchased from Sisco research laboratories (India).

### **Washing and acid treatment**

Dirt, mud, and suspended soils in RH were removed by washing thoroughly with deionized water. The metallic impurities in RH were reduced to negligible levels by refluxing with 10 % hydrochloric acid for 5 hours at 80 °C. The solution was filtered and the husk was washed thoroughly with distilled water until the filtrate was free from acid. The RH was oven dried at 70°C for 15 hours.

### **Thermal treatment**

The acid leached RH from 2.2 was burnt in a muffle furnace at 600 °C for 4 h to remove all the hydrocarbons. The product obtained is referred to as acid leached-RHA in the text hereafter.

### **Preparation of the silica precursor**

RHA (10 g) was refluxed with 3.5 M sodium hydroxide at 80 °C for 5 hours with vigorous stirring. The solution obtained was filtered through Whatman filter paper (no. 1) to obtain a colorless viscous solution. This solution was designated as Na<sub>2</sub>SiO<sub>3</sub> stock solution.

### **Preparation of SiO<sub>2</sub>/CuO/APTES adsorbate**

Initially, 8.42 ml of APTES was dissolved in 1:1 (V/V) mixture of 2-propanol and deionized water. Then the prepared CuCl<sub>2</sub> solution was added to the APTES solution by maintain 1:1 mole ratio of APTES to Cu<sup>2+</sup>. Then Na<sub>2</sub>SiO<sub>3</sub> stock solution was drop wisely added to the APTES-Cu solution. Then, 0.5M H<sub>2</sub>SO<sub>4</sub> was dropped to Na<sub>2</sub>SiO<sub>3</sub>-Cu-APTES solution until a pH of 4 was obtained. The resulting gel mixture was aged at room temperature for 12 h. The aged silica gel was washed thoroughly with

deionized water until free from sulfate anions and pH became neutral. The washed gel was dried at 80 °C for 12 h. This dried powder is referred as SCN in the text.

### **Materials characterization**

The crystalline structure of SCN was examined by an Advance Bruker system X-ray diffractometer. The X-rays were generated at 30 mA current and 40 kV voltage equipped with a Cu target and CuK (λ = 0.15406 nm) were selected. Samples were scanned in the range of diffraction angle (2θ) 5 to 90° at 2°/min scanning rate. FT-IR spectra of the SCN and the amine surface-modified nanoparticles were acquired in the range of 400–4000 cm<sup>-1</sup> using an ATR device employing the ABB MB3000 FT-IR spectrophotometer.

### **Adsorption properties**

Batch studies were carried out where a known weight of the adsorbent was added to 50 ml of a known concentration of CV solution at a specific pH and shaken at 200 rpm in a Stuart orbital shaker at room temperature. The desired pH (in range of 2 – 14) of the dye solution was achieved via adjustment with 0.1 M HCl or 0.1 M NaOH solutions. Aliquots were withdrawn at pre-determined time intervals over 2 hours. The concentration of CV was calculated by measuring absorbance at 590 nm using a Shimadzu UV-1900 spectrophotometer. The amount of CV adsorbed at time t ( $q_t$ ) was calculated according to the equation 1.

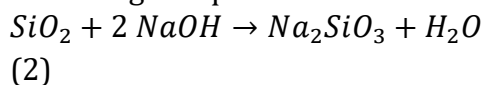
$$q_t = \frac{(C_0 - C_t)}{m} V \quad (1)$$

Where, C<sub>0</sub> is initial concentration of adsorbate (mg/l), C<sub>t</sub> is concentration of adsorbate at time (min) t (mg/l), m is mass of adsorbent (g) and V is volume of solution (l).

For the adsorption kinetics studies, the adsorbent dosage was varied (20 - 100 mg) and was kept in contact with a CV solution (10 mg/l) concentration at the optimized pH. The agitation speed was fixed at 200 rpm. The concentration at time  $t$  ( $C_t$ ) and amount of CV adsorbed at time  $t$  ( $q_t$ ) were determined by using the same procedure described above. For the adsorption isotherm studies, the optimized weight of adsorbent was placed in contact with five different initial concentrations of MB solutions (5 - 25 mg/l) at the optimized pH. The agitation speed was fixed at 200 rpm, and the concentration at equilibrium ( $C_e$ ) and amount of CV adsorbed at equilibrium ( $q_e$ ) was determined.

## RESULTS AND DISCUSSION

RH on burning above 500 °C gives RHA, which contains a very high percentage of crystalline silica. The RHA consists mainly of silica (>90%) and some metallic impurities such as  $Fe^{3+}$ ,  $Ca^{2+}$ ,  $Na^+$ ,  $K^+$ , and  $Mg^{2+}$ . However, if it is burnt after preliminary acid leaching treatments amorphous silica is produced. Such produced silica refluxed with NaOH to synthesize  $Na_2SiO_3$  according to equation 2.

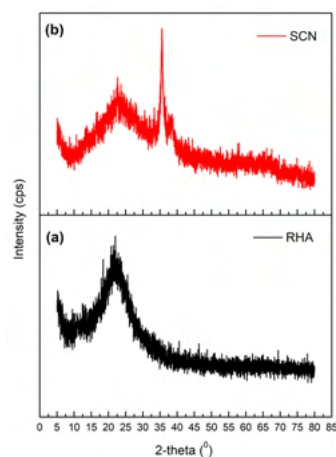


### XRD analysis

As shown in figure 1 (a), XRD pattern of the as-received RHA obtained from the burning of the acid leached RH yielded amorphous silica. The XRD pattern of amorphous silica showed the diffuse peak over the  $2\theta$  value range into  $10^\circ$  to  $35^\circ$ . Also, diffraction pattern perfectly matches with ICDD DB card No. 01-082-1556 by confirming amorphous nature in synthesized silica. Similarly figure 1 (b) shows diffraction pattern of SCN nanocomposite. The diffraction peak at

$2\theta$  value centered into  $22.66^\circ$  suggesting presence of silica in amorphous nature. Also, detailed profile analysis of SCN by X'pert High Score Plus software confirmed that diffraction pattern matched with ICDD DB card No. 01-082-1556 and 01-083-1665 by suggesting presence of amorphous silica and paramelaconite ( $Cu_4O_3$ ). However, among the three polymorphs of copper ( $CuO$ ,  $Cu_2O$ , and  $Cu_4O_3$ ),  $Cu_4O_3$  phase is very difficult to synthesize and it contains copper in  $Cu^+$  and  $Cu^{2+}$  valence states.

**Figure 1.** XRD Pattern of (a) acid leached RHA and (b) SCN

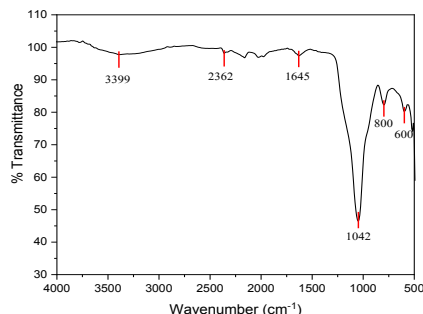


### FT-IR analysis

FT-IR measurements were performed in order to identify the chemical functionality of the SCN. Figure 2 illustrates the FTIR spectrum obtained for the SCN sample. The broad adsorption band centered into  $3400\text{ cm}^{-1}$  could be ascribed to O-H stretching of the silanol group (Si-OH) and physisorbed water in SCN. As shown in figure 2, vibration bands centered at  $2362$  and  $1645\text{ cm}^{-1}$  describe the C-H stretching vibration of  $CH_2$  and N-H bending vibration of the  $NH_2$  groups by suggesting that silica framework have occurred by APTES. Silica exhibits Si-O-Si symmetric and asymmetric stretching vibrations at wavenumber  $1042$  and  $800$

cm<sup>-1</sup>. Also, vibration band at 601 cm<sup>-1</sup> assigned to the Cu-O asymmetric stretching.

**Figure 2.** FT-IR spectra of SCN

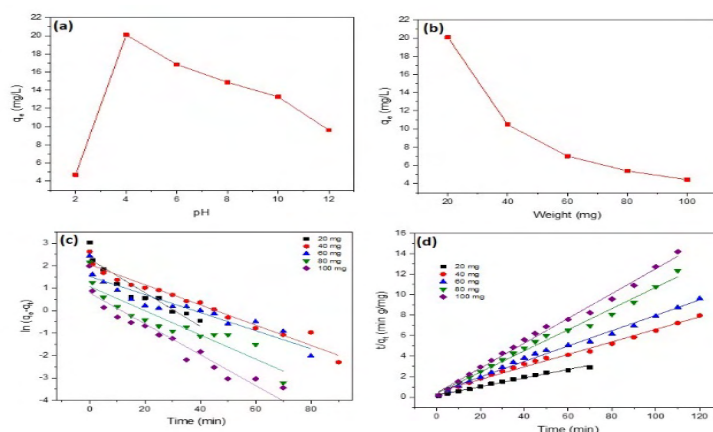


### Adsorption studies

The equilibrium adsorption kinetics and isotherm describing the interactive behavior between adsorbates and adsorbent. Adsorption kinetics data vary important in the design and analysis of sorption systems. It is well established that the pH of the system exerts profound influence on the adsorptive uptake of adsorbate molecule presumably due to its influence on the surface properties of the adsorbent and ionization/dissociation of the adsorbate molecule. As shown in figure 3 (a), maximum equilibrium adsorption capacity of CV is obtained at pH 4.0 (20.09 mg/g) and further increase in pH did not influence towards increment in

the adsorption capacity. Adsorbent dose is an important parameter that strongly influences the adsorption process by affecting adsorption capacity of the adsorbent. As shown in figure 3 (b), the influence of adsorbent dose on CV adsorption by SCN was investigated in the range of 0.02–0.1 g, 0.02g of adsorbent loading shows excellent adsorption capacity. The decrease in adsorption capacity with increasing dose of SCN at constant CV dye concentration and volume may be attributed to saturation of adsorption sites of adsorbent due to particulate interaction. Figure 3 (c) and (d) shows pseudo-first-order and pseudo-second-order kinetics model for adsorption of CV to SCN. Obtained results were summarized in following table 1. As concluded in table 2 pseudo-second-order kinetic model plots of  $\frac{t}{q_t}$  vs  $t$  show good agreement between experimental  $q_{e,exp}$  and calculated  $q_e$  values. The correlation coefficients ( $r_2^2$ ) of all the adsorbent dosages for the pseudo-second-order kinetics model are greater than 0.99. Therefore, results revolved that the adsorption of CV to SCN follows pseudo-second order kinetic model.

**Figure 3.** (a) Effect of pH on adsorption of CV on SCN, (b) Effect of SCN dosage on CV adsorption, (c) Pseudo-first-order and (d) Pseudo-second-order kinetics model for adsorption of CV to SCN

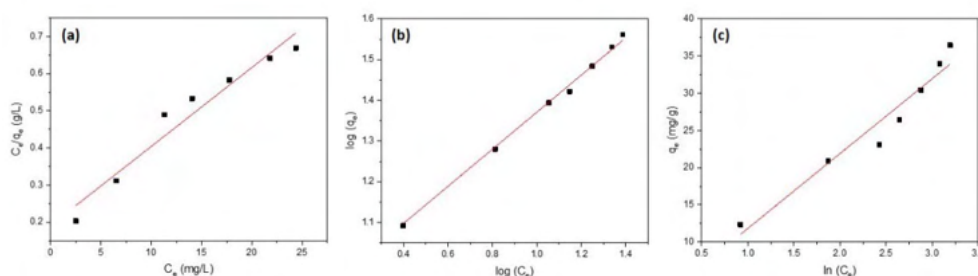


**Table 1.** Kinetic parameters for adsorption of CV to SCN

Adsorbent weight (mg)	$q_{e,exp}$ (mg g <sup>-1</sup> )	Pseudo-first order model			Pseudo-second order model		
		$q_e$ (mg g <sup>-1</sup> )	$k_1$ (min <sup>-1</sup> )	$r_1^2$	$q_e$ (mg g <sup>-1</sup> )	$k_2$ (g mg <sup>-1</sup> min <sup>-1</sup> )	$r_1^2$
20	20.8033	9.9171	0.07481	0.8826	20.9349	0.0090	0.9938
40	13.8102	7.7932	0.04494	0.9594	13.3773	0.0073	0.9907
60	11.4777	4.5943	0.04027	0.8697	11.3067	0.0118	0.9917
80	8.6693	2.9273	0.05385	0.8398	8.68804	0.0276	0.9993
100	7.3198	2.2016	0.06873	0.9078	7.25491	0.0354	0.9928

The adsorption isotherms for the adsorption of CV into SCN studied in order to further explore the adsorption behavior. As shown in figure 4 three typical adsorption isotherms Langmuir, Freundlich, and Temkin models are utilized to fit the experimental data. The

summarize isotherm data are tabulated in following table 2. The best fit with a correlation coefficient of 0.9986 was obtained for the Freundlich model suggesting that the adsorption of CV to SCN follows Freundlich adsorption model.

**Figure 4.** (a) Langmuir, (b) Freundlich and (c) Temkin adsorption isotherm models of CV adsorption onto SCN**Table 2.** Parameters calculated by Langmuir, Freundlich and Temkin adsorption isotherm models

Temperature (K)	Langmuir			Freundlich			Temkin		
	$q_m$ (mg g <sup>-1</sup> )	$K_L$ (L mg <sup>-1</sup> )	$r^2$	$K_F$ (mg g <sup>-1</sup> )	$n$	$r^2$	$K_T$ (L g <sup>-1</sup> )	$b$	$r^2$
298	47.04	0.1112	0.9385	8.2328	2.2057	0.9986	1.1942	246.30	0.9329

## CONCLUSIONS

In this study, amorphous silica prepared using agricultural waste RH was used as the starting material. We have fabricated

porous silica based adsorbent by chemical modification. SCN adsorbent produced shows excellent adsorption capacity towards CV adsorption. The maximum adsorption capacity was

observed at pH 4. Adsorption of CV to SCN was best fitted to pseudo-second order kinetic model where cationic CV molecules and anionic SCN are adsorbed onto the same surface simultaneously as revealed by Freundlich isotherm model.

## ACKNOWLEDGMENT

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## Exploration of Electrical and Optical Characteristics of Cuprous Oxide Synthesized Using Benedict's Reagent

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### ABSTRACT

In the current study, cuprous oxide ( $\text{Cu}_2\text{O}$ ) nanoparticles were synthesized using Benedict's reagent. In this reaction, glucose was used to reduce copper(II) citrate complex to obtain yellow, orange and red colour  $\text{Cu}_2\text{O}$  by varying the reaction time and temperature. The synthesized  $\text{Cu}_2\text{O}$  nanoparticles were fabricated on Fluorine-doped Tin Oxides glass plates by using doctor bade method to obtain thin films for characterization. The electrochemical impedance and UV-Visible spectra were used to characterize the three cuprous oxide films for electrical conductivity and calculate their direct energy band gap to test the suitability of material for diverse applications. Nyquist plot of thin films of  $\text{Cu}_2\text{O}$  were characterized by electrochemical impedance spectroscopy. Simulated results of Nyquist plots clearly revealed that charge transfer resistance of the red colour  $\text{Cu}_2\text{O}$  thin film was lower than that of yellow and orange colour thin films. The maximum absorption peak at 300 nm confirmed the presence of  $\text{Cu}_2\text{O}$  in all the samples. The broad absorption peak around 610 nm in the UV-visible spectra of red cuprous oxide was an evidence for the presence of copper nanoparticles in this sample. The direct energy band gaps of samples of  $\text{Cu}_2\text{O}$  were calculated from tauc plots using the results of UV-visible spectra. Values of direct band gap of yellow, orange and red colour cuprous oxides nanoparticles found to be 2.15, 2.72 and 2.45 eV respectively.

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## INTRODUCTION

The Roman artists achieved unusual color changes in glass by introducing material containing noble metals prior to be molten. Striking optical effects have been obtained with the emergence of metallic nanoparticles in glazed ceramics in the middle age (Caiger-Smith, 1991). Therefore, nanotechnology is also evident in ancient civilizations. The Celtic-red enamels dating from 400 to 100 BC contain copper and cuprous oxide ( $\text{Cu}_2\text{O}$ ) nanoparticles, while most of the red-tesserae used in Roman mosaics were made of glass containing copper nanocrystals (Brunet, 1991; Colomban, 2003). However, ancient civilizations did not realize the unique properties and potential of their preparations. Recent technological advancements have revolutionized the synthesis, characterization, and applications of nanoparticles, which are gradually becoming an integral part of the society.

Because of their potential uses in electronics, photonics, and catalysis, inorganic materials such as metals, semiconductors, and metal oxides have been the focus of intense research. Cuprous oxide is one of the most enticing inorganic materials due to its wide range of potential applications in solar energy conversion, catalysis, sensing, magnetic storage and electrode materials in lithium ion batteries. Cuprous oxide is a narrow bandgap (2.2 eV) p-type semiconductor that is abundant and low cost (Abdu, 2009). Because of this, it can also absorb a substantial portion of the solar spectrum. Preparation of thin films of cuprous oxide using thermal oxidation, chemical bath deposition, electrodeposition, and in

alkaline electrolytes exhibit p-type semiconductor character of  $\text{Cu}_2\text{O}$  due to

the presence of vacancies of  $\text{Cu}^+$  ions. This study reports the preparation of  $\text{Cu}_2\text{O}$  using Benedict's reagent and glucose as the reducing agent in the reaction and characterization of thin film of  $\text{Cu}_2\text{O}$  for development of diverse applications. The material characterization by electrochemical impedance and UV-visible spectroscopy have been reported with the preparation of the thin films of synthesized  $\text{Cu}_2\text{O}$  nanoparticles on Fluorine-doped Tin Oxides (FTO) glass plates using doctor blade method.

## METHODOLOGY

### Synthesis of $\text{Cu}_2\text{O}$ nanoparticles

The following method was used to prepare Benedict's reagent in the laboratory for synthesis of  $\text{Cu}_2\text{O}$  nanoparticles. 50 g of anhydrous sodium carbonate and 86.5 g of citric acid was dissolved in 400 ml of deionized water in a beaker under vigorous stirring at 75 °C. 100 ml of 0.346 mol  $\text{dm}^{-3}$  copper (II) sulfate pentahydrate solution was added to this mixture and mixed thoroughly. 5 mol  $\text{dm}^{-3}$  sodium hydroxide was added to the above solution in the beaker under stirring until the pH value of the mixture reached ten.

To obtain  $\text{Cu}_2\text{O}$  nanoparticles, 20 ml of 1.65 mol  $\text{dm}^{-3}$  of glucose solution was slowly added to each 100 ml of Benedict's solutions in three conical flasks kept on a hotplate set at 160 °C under vigorous stirring. The mixtures reached 50 °C in 10 minutes forming a yellow colour precipitate. At that instance, one of the solutions was taken out from the hot plate and cooled down in an ice bath when the yellow colour precipitate dominated. The Orange colour precipitate appeared when the temperature of the solutions reached 60 °C after 20 minutes. At that moment one heated solution was taken out from the hotplate and kept in an ice bath to obtain the orange colour  $\text{Cu}_2\text{O}$  particles. The red  $\text{Cu}_2\text{O}$  precipitated in the third solution in the conical flask when

temperature reached to 80 °C after 30 minutes.

Precipitates as prepared were separated from each solution and washed three times with deionized water using centrifugation at 3600 ppm for 1 minute. The washed precipitates were collected into three Petri dishes and dried in an oven at 100 °C. The yellow, orange and red colour Cu<sub>2</sub>O were labeled as samples 1, 2 and 3 respectively. Three samples were stored in a desiccator until use for characterization.

### **Preparation and characterization of Cu<sub>2</sub>O films**

1 cm × 2 cm size of Fluorine-doped Tin Oxides (FTO) glass plates were cleaned in an ultrasonic bath with 1 drop of conc. HNO<sub>3</sub> in 100 ml deionized water and deionized water alone for 5 minutes respectively. Washed glass plates were boiled in acetone, ethanol and isopropyl alcohol solution in a beaker on a hot plate at 80 °C for 15 minutes respectively. 2 mg of samples and 0.5 ml of deionized water were placed in a mortar. The mixture of each samples was grinded in the mortar using pestle for 15 min separately until a tiny paste of samples were obtained. 2 drops of paste of samples were spread on the conducting area of the FTO glass sheets placed on the hotplate at 100 °C for 10 min until thin films on glass sheets were obtained for each sample.

The films of Cu<sub>2</sub>O samples were characterized with the impedance spectroscopy and mott-schottky analysis using a computer coupled with Metrohm Autolab PGSTAT204 to find the impedance of the thin films in the range of 0.1 Hz to 1 MHz and flat band potential respectively. The MS performances and measurements of electrochemical impedance spectroscopy of the prepared Cu<sub>2</sub>O thin films were evaluated using a three-electrode configuration with copper oxide thin film on FTO, Ag/AgCl electrode, and Pt Electrode as working electrodes, reference

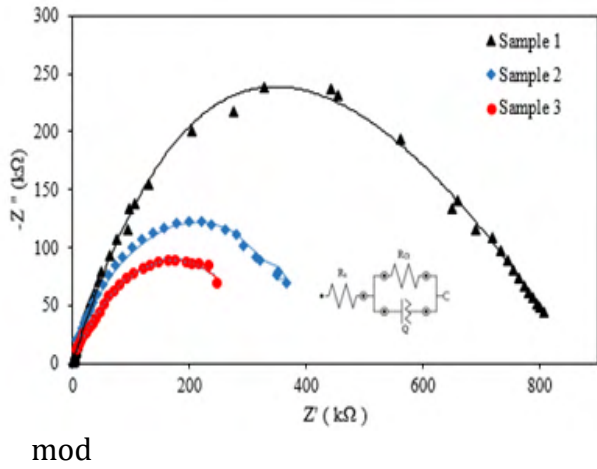
electrode, and counter electrode, respectively. The electrolyte used was 10 mM CH<sub>3</sub>COONa solution at pH 6.5. The optical characterizations of Cu<sub>2</sub>O films were analyzed using UV-Visible spectrophotometer (Genesys 10s UV-Vis).

## **RESULTS AND DISCUSSION**

### **Analysis of Electrochemical impedance spectroscopy**

Figure 1 illustrates the impedance spectra of the three samples of synthesized Cu<sub>2</sub>O on the FTO glasses. The electrochemical impedance spectroscopy (EIS) was used to study the conductivity and charge transfer of the materials. The semicircle in the Nyquist plot at high frequencies is characteristic of the charge transfer process and the diameter of the semicircle is an indicator of the charge transfer resistance (R<sub>ct</sub>). As evidence from the plots, the real impedance of the sample no 3 is lower than the other samples. Table 1 indicates simulated results of the equivalent circuits of the films using electrochemical fit drawn for the Nyquist plots. The simulated values of R<sub>ct</sub> provide clear evidence that the electrical conductivity of sample 3 (red color copper (I) oxide) is higher than the other two samples.

**Figure 1.** Nyquist plot for three samples of Cu<sub>2</sub>O of thin film and Equivalent circuit



**Table 1.** Simulated results of series resistance ( $R_s$ ), charge transfer resistance

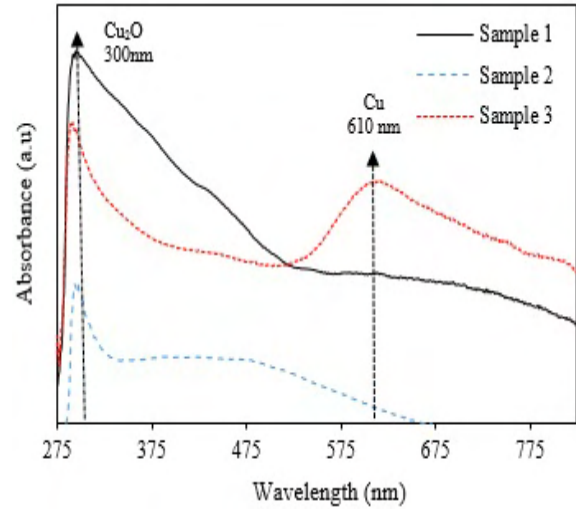
Sample number	1	2	3
$R_s$ (k $\Omega$ )	1.98	0.862	0.274
$R_{ct}$ (k $\Omega$ )	792	408	348
Q (CPE)	Y0(nMmho*s^N)		
N	0.994	0.995	0.993

( $R_{ct}$ ) and Constant phase element (Q) for three samples of Cu<sub>2</sub>O.

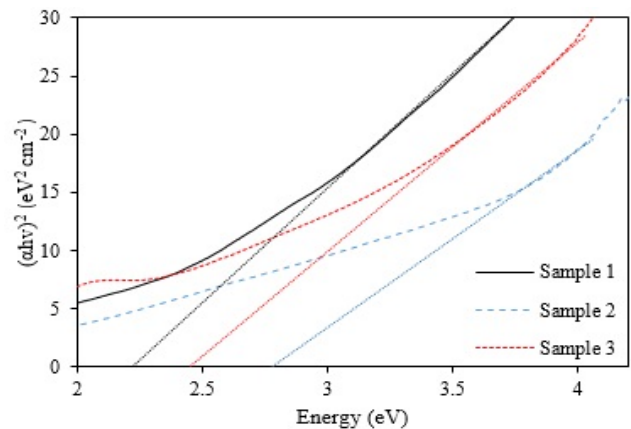
### Uv-visible Analysis

The UV-visible spectra for three samples of thin films of Cu<sub>2</sub>O synthesized using glucose and Benedict's reagent at pH 10 are shown in fig 2. As can be seen from this figure, common peak of maximum absorption for three samples are exhibited approximately around 300 nm. This strong peak is attributed to the formation of cuprous oxide (Dutta, 2015). The UV-visible spectra of red colored Cu<sub>2</sub>O sample illustrated a broad peak at 610 nm in the range 530 nm to 800 nm for the presence of Cu nanoparticles (Abhinav, 2015). Direct energy band gap of cuprous oxide sample numbers 1, 2 and 3 calculated from the intercepts at the x axis of the linear region of tauc plot (fig 3), are 2.15, 2.72 and 2.45 eV respectively.

**Figure 2.** Uv-visible absorption spectrum for three samples of Cu<sub>2</sub>O



**Figure 3.** Tauc plots for three sample of Cu<sub>2</sub>O nanoparticles

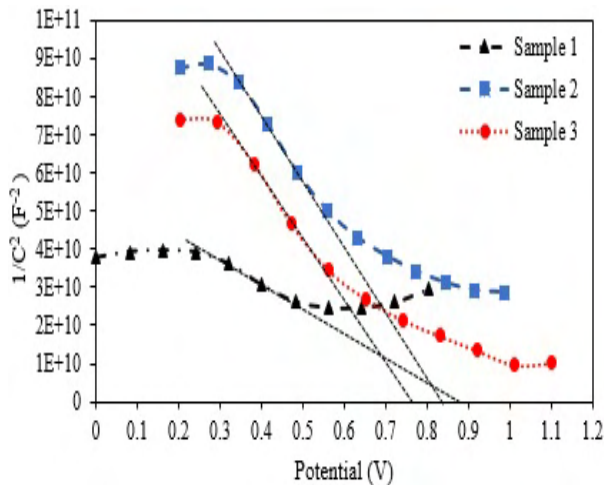


### Mott-Schottky measurements

Figure 4 illustrates the plot of mott-schottky measurements for thin film of p-type Cu<sub>2</sub>O samples on the FTO glasses. The values of flat band potentials of three samples were determined from the intercept of the graph plotted potential vs reciprocal square capacitance. The flat band potentials of three samples of p-type cuprous oxides ( $E_{FB(pH \text{ vs } AgCl)}$ ) were determined as 0.87, 0.85 and 0.75 V vs. Ag/AgCl, respectively in a 0.01 moldm<sup>-3</sup>

sodium acetate solution of pH 6.5 for sample no 1, 2 and 3 respectively.

**Figure 4.** Mott-Schottky plot for thin films of three samples of Cu<sub>2</sub>O

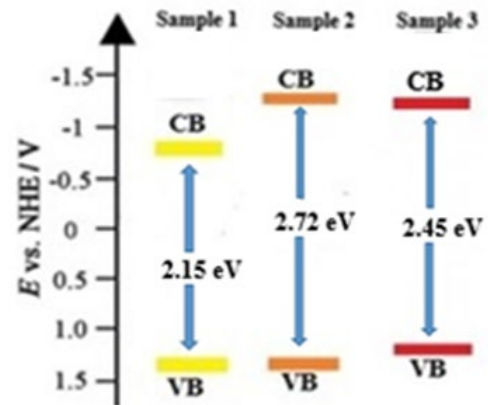


Generally, the potential measured against an Ag/AgCl reference can be converted into normal hydrogen electrode (NHE) potentials by using Equation (1).

$$E_{FB \text{ (vs NHE)}} = E_{FB \text{ (pH vs AgCl)}} + E_{AgCl} + 0.059 \times \text{pH} \quad (1)$$

The measured pH value of the electrolyte is approximately 6.5, and  $E_{AgCl} = 0.197 \text{ V}$  (An, 2014). Therefore, the calculated flat-band positions of Cu<sub>2</sub>O are 1.45, 1.43 and 1.33 V vs. NHE (pH 0). With band energy gap and valance bands of three samples, the conduction band of Cu<sub>2</sub>O samples number 1, 2 and 3 are estimated to be - 0.7, - 1.29 and - 1.12 V vs. NHE (pH 0). The figure 5 illustrates the energy band diagram for Cu<sub>2</sub>O nanoparticles which were synthesized by glucose and Benedict's reagent which had a pH value of ten.

**Figure 5.** Schematic representation of the energy band diagram for Cu<sub>2</sub>O samples through Benedict's reaction with glucose



## CONCLUSIONS

In Summary, three different colored nanoparticles of p-type Cu<sub>2</sub>O were successfully synthesized by reaction of Benedict's reagent with glucose. The experimental findings revealed that the lower value of charge transfer resistance of red color sample of Cu<sub>2</sub>O was due to the presence of Cu nanoparticles in Cu<sub>2</sub>O compared with the yellow and orange colour samples. The direct band energy gap for three samples of Cu<sub>2</sub>O were calculated and found to be 2.15, 2.72 and 2.45 eV. Much effort is still needed to understand the modification of particle size and morphology of Cu<sub>2</sub>O nanoparticle to enhance the conductivity and to fabricate devices for diverse applications using thin films of synthesized Cu<sub>2</sub>O nanoparticles

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## Effect of consumption of commercially available vegetables and fruits with calcium rich foods

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### ABSTRACT

The human body receives the required calcium content through foods and beverages. However, some vegetables and fruits may interfere with the calcium sorption to the body due to the presence of inhibitors such as phytates, oxalates, and citric acid, etc. This work is focused to study some commonly consumed vegetables and fruits that could inhibit the calcium sorption process. Commercially available vegetables, and fruits were studied by varying calcium concentration and contact time. The calcium sorption efficiencies were measured by immersing cut (~1 cm<sup>2</sup>) vegetables and fruit samples in calcium test standard solutions and in calcium-rich milk solution prepared by commercially available non-fat milk at different time intervals. The results revealed that spinach and navel orange have demonstrated the highest calcium sorption efficiencies which ranged (10.01 ± 0.02) mg to (18.68 ± 0.46) mg and (3.85 ± 1.09) mg to (5.09 ± 0.32) mg per 10 g sample, respectively for 1-hour sorption in 100 ppm calcium standard test solution. This increase of calcium sorption could be due to the presence of oxalate in spinach and citric acid or ascorbic acid in orange which could bind with calcium effectively. This study further revealed that calcium sorption from milk by vegetables and fruits increases as a function of time. Therefore, it is highly recommended not to consume calcium-rich foods within two hours of the main meal which contains vegetables and fruits as it would cause adverse effects on the human body due to calcium deficiency.

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## INTRODUCTION

According to the National Health Association (USA), adults between 19 and 50 are required to have an average daily intake of 1000 mg of calcium ions (Beto, 2015). Since the human body cannot produce calcium itself, it is important to provide calcium from external sources, mainly from the food supplements such as milk, yogurt, and cheese. Further, humans consume vegetables and fruits to obtain other nutrients such as vitamins, minerals, and dietary fibers for healthy living. In general, the human digestive system processes vegetables and fruits within one or two hours after consumption (Miller et al. 2001). If calcium inhibitor foods such as vegetables and fruits are taken within the digestive period, they can have a detrimental effect on the body because those can absorb or adsorb calcium up to 30 % from the meal. (Amalraj & Pius, 2015) As a result, the digestive process would be disturbed causing numerous health issues including calcium deficiency. Having consumed vegetables and fruits along with calcium-rich foods for a prolonged period can lead to forming calcium-based precipitates which yields kidney stones and other disorders in the body (Von Unruh et al., 2004).

Oxalic acid, citric acid, and phytates are naturally found in vegetables and fruits which can bind with calcium and form insoluble salt complexes, thus decreasing the calcium sorption (absorption and adsorption) to the body (Nguyen & Savage, 2013). Even though, there is not much evidence available on the calcium sorption of vegetables and fruits, sorption from other food items such as peanut (Keisling, & Walker, 1982) and soft drinks (Høstmark, et al., 2011) are available in literature. Therefore, it is essential to study the

calcium sorption efficiency of vegetables and fruits to understand the available calcium content to the body even if the foods are rich calcium supplements. Hence, the dietitians and nutritionists can prescribe suitable meal plans to patients who are suffering from calcium deficiencies and related diseases. In this study, commonly consumed and commercially available vegetables, and fruits such as spinach (*Spinacia oleracea*), green bean (*Phaseolus vulgaris*), carrot (*Daucus carota*), navel orange (*Citrus sinensis*), red apple (*Malus domestica*), and pineapple (*Ananas comosus*) were studied to determine the calcium sorption efficiency as a function of time which is not available in literature. Since the effect of calcium oxalate is significant for humans and it exists in high quantities, this study was focused to determine sorption efficiency of calcium by vegetables and fruits.

## MATERIALS & METHODS

All chemicals required for the study were purchased from Sisco Research Laboratories (Pvt) Ltd. Mumbai, India. The distilled water was obtained from the in-house supply.

### Sample collection

The vegetables for the study such as spinach (*Spinacia oleracea*), green bean (*Phaseolus vulgaris*), and carrot (*Daucus carota*), and fruits such as navel orange (*Citrus sinensis*), red apple (*Malus domestica*), and pineapple (*Ananas comosus*) were purchased from local markets in Rajagiriya, Western Province, Sri Lanka. The collected samples were cleaned with distilled water, dried in the air, and placed in a clearly labeled polyethylene bag until further use.

## **Determination of calcium sorption ranges**

### **Preparation of calcium standard solutions**

A 1000 ppm (1000 mg/L) calcium chloride standard stock solution was prepared by dissolving 1000 mg of calcium chloride in 1 L of distilled water. The standard stock solution was diluted to prepare a series of 100 ppm, 80 ppm, 60 ppm, 40 ppm, and 20 ppm test standard solutions.

### **Sample preparation**

Purchased vegetables and fruits were washed with distilled water and cut into 1 cm × 1 cm sized pieces. About 15 g of samples from each cut vegetable and fruit was weighed and placed in 25 mL of test standard solutions prepared in 2.2.1 in labeled beakers. All samples were soaked in test standard solutions for 1 hour and 2 hours, respectively.

### **Calcium detection**

After 1 hour and 2 hours of time intervals, samples were separated from the soaking solutions and dried in an air oven (memmert UNB 100) at 105 °C for 3 hours. A 10 g sample was weighed from a dried sample and placed in a muffle furnace (SR 1 Shimaden) set at 550 °C for 3 hours. The resulted white (grey) ash was treated with 6 mol L<sup>-1</sup> hydrochloric acid until the ash got dissolved. The same procedure was triplicated to enhance the accuracy and repeatability. An aliquot from each ash solution was aspired to the Atomic Absorption Spectroscopy instrument (Hitachi Zeeman-3000) and flame photometer (Esico Model-1385) to determine the amount of calcium in each sample.

## **Determination of calcium sorption in milk**

### **Sample Preparation**

A 250 mL milk stock solution was

prepared by dissolving 10 g of non-fat milk powder in boiled water as a calcium-rich source. About 15 g of samples from each cut vegetable and fruit, was weighed and placed in 25 mL of milk stock solutions labeled as 15 min, 30 min, 45 min, 1 hour, and 2 hours. The calcium content of each vegetable sample, fruit sample, and milk sample was measured separately as references. After the above stated time intervals, samples were separated from milk solutions.

### **Calcium detection**

The calcium content of each vegetable and fruit sample soaked in milk solution was measured as explained before. The remaining milk solutions were wet digested and followed the same procedure to determine the calcium concentration after the sorption studies. According to the flame photometer data, the calcium concentration of the original milk solution was found out to be 28.4 ppm which is significantly lower for a regular fat free milk solution (Melse-Boonstra, 2020; Buchowski, 2015).

## **RESULTS AND DISCUSSION**

### **Calcium sorption**

The sorption process was performed in 20 ppm, 40 ppm, 60 ppm, 80 ppm, and 100 ppm calcium test standard solutions. The data collected for 20 ppm and 100 ppm solutions are discussed here. The second column of Table 1 shows the initial calcium content of each vegetable and fruit sample studied. The third and fourth columns show the variation of calcium contents after soaked with 20 ppm calcium test standard solutions for one hour and two hours while the columns fifth and sixth show the variation with 100 ppm calcium test standard solutions.

**Table 1.** Initial and final calcium content of vegetables and fruits

Sample	Without soaking (mg/10 g)	Soaked in 20 ppm (mg/10 g)		Soaked in 100 ppm (mg/10 g)	
		1 hour	2 hours	1 hour	2 hours
Spinach	10.01 ± 0.02	12.82 ± 0.12	13.18 ± 0.22	18.68 ± 0.46	19.98 ± 0.17
Green bean	3.71 ± 0.02	3.96 ± 0.02	4.08 ± 0.15	5.78 ± 0.14	5.72 ± 0.16
Carrot	3.30 ± 0.03	3.71 ± 0.13	3.78 ± 0.12	5.57 ± 0.02	5.83 ± 0.16
Navel orange	3.85 ± 1.09	4.05 ± 0.43	4.05 ± 0.04	5.09 ± 0.32	5.95 ± 0.72
Red apple	0.62 ± 0.59	0.65 ± 0.25	0.67 ± 0.11	0.82 ± 0.68	0.83 ± 0.35
Pineapple	1.35 ± 0.42	1.44 ± 0.05	1.48 ± 0.12	1.85 ± 0.76	1.88 ± 0.76

The calcium sorption percentage (efficiency) can be calculated from the results in Table 1 using equation (1).

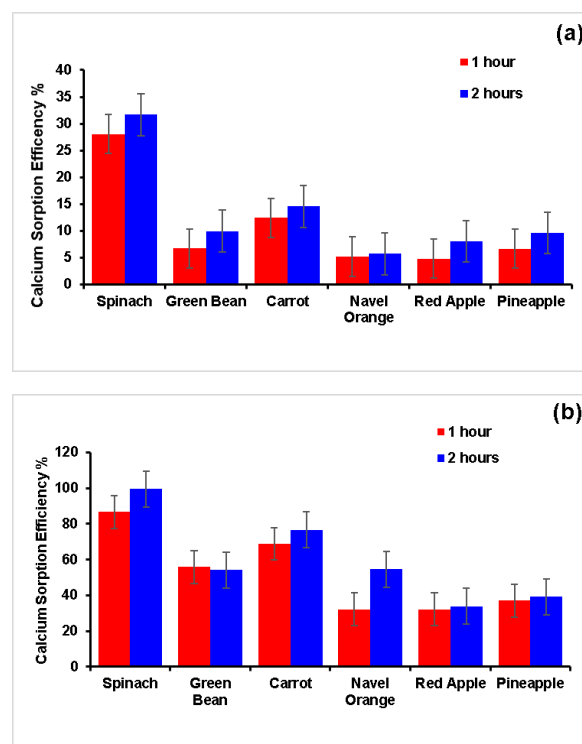
$$Ca \% = \frac{(Final\ Ca\ mass - Initial\ Ca\ mass) \times 100\%}{Initial\ Ca\ mass} \quad (1)$$

The calcium sorption efficiencies of each vegetable and fruit are shown in Table 2 and plotted in Figure 1.

Figure 1 demonstrates that the samples soaked in 100 ppm calcium standard test solution showed the highest sorption efficiency for all vegetables and fruits while the samples soaked in 20 ppm showed the lowest sorption efficiency. Intermediate sorption efficiencies were demonstrated by 40 ppm, 60 ppm, and 80 ppm calcium test standard solutions which are not discussed here. As seen in Figure 1 (b), after two hours of sorption, the calcium content in spinach had been doubled which reflects the existence of a significant amount of oxalate as previously reported (Liyanage & Jayasundara, 2020).

**Table 2.** Ca sorption efficiency for 20 ppm and 100 ppm soaking

Sample	Soaked in 20 ppm %		Soaked in 100 ppm %	
	1 hour	2 hours	1 hour	2 hours
Spinach	28.07	31.67	86.61	99.60
Green bean	6.74	9.97	55.80	54.18
Carrot	12.42	14.55	68.79	76.67
Navel orange	5.19	5.71	32.21	54.55
Red apple	4.84	8.06	32.26	33.87
Pineapple	6.67	9.63	37.04	39.26

**Figure 1.** Calcium sorption efficiency for fruit and vegetable samples soaked in test standard solutions (a) 20 ppm (b) 100 ppm

Further, from Figure 1, it can be concluded that all vegetables demonstrated significantly higher calcium sorption compared to all the fruits studied. In addition, Figure 1 shows significant calcium sorption rates

for all vegetables and fruits in the first hour of the study. This can be explained as there could be a higher amount of calcium binding substances such as oxalate ions, ascorbic acid, citric acid, and phytates present at the beginning of the process. As the available binding sites are reduced, the rate of calcium sorption also decreases as reflected in the second hour of the process. Among the selected vegetables and fruits, spinach and orange had the highest calcium content while carrot and red apple showed the lowest calcium content.

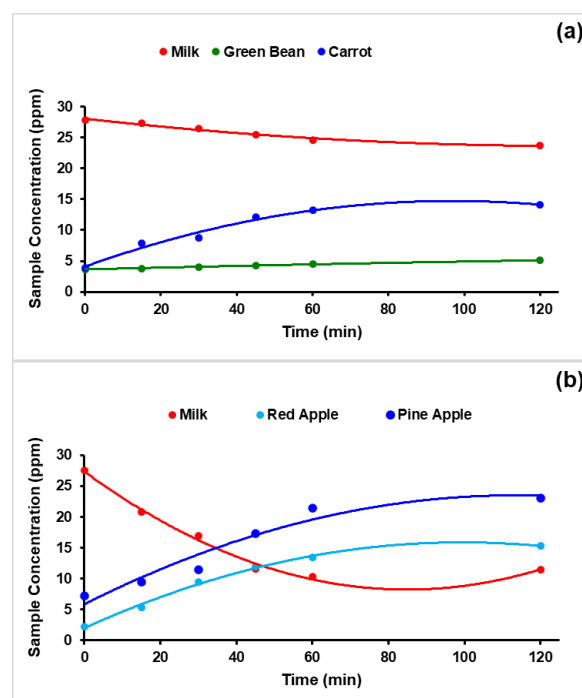
It has been demonstrated that the spinach contained a significant amount of soluble and insoluble oxalates which can get bounded with calcium (Liyanage & Jayasundara, 2020). Further, research revealed that orange contained a high amount of calcium binding compounds such as citric acid and ascorbic acid (Shrestha & Bhattarai, 2016). Therefore, it can be concluded that the consumption of especially spinach and navel orange decreases the available amount of calcium to the body.

Green bean and carrot also demonstrated relatively higher calcium sorption efficiencies which indicated that these vegetables could also contain calcium binding substances while red apples and pineapples have a relatively low calcium binding substance (Nitithan et al. 2004). From the results, it can be observed that there is no significant difference between one hour and two-hour sorption for both calcium test standard concentrations. However, it can be concluded that for all the samples, the sorption rate is higher for the first hour compared to the second hour due to the availability of binding sites.

## Kinetics of calcium sorption efficiency

One of the objectives of this study was to investigate the calcium sorption efficiency from calcium-rich foods. There is a significant amount of calcium enriched food items available in the market and for this study, commonly consumed milk was selected. Since there was no significant difference between the two time frames as shown in Table 2 and Figure 1, calcium sorption efficiency from milk solutions was measured in shorter time intervals during the first hour of study. Therefore, three additional data points were collected at 15, 30, and 45 minutes to observe the trend of calcium sorption efficiency.

**Figure 2.** Calcium concentration variation of milk with selected (a) vegetables and (b) fruits. (Dots represent the experimental data points and the solid lines represent the second-order polynomial fit in the form of  $y=ax^2+bx+c$  to the experimental data points)



Collected data are shown in Figure 2 and it shows the variation of calcium concentration of milk in the presence of vegetables and fruits. According to

Figure 2, it showed that calcium concentration of vegetables and fruits varied with time and reached equilibrium approximately in an hour. Further, it demonstrated that the rate of change of calcium concentration with time was higher in fruits than in vegetables as in Figure 2 (b). In both cases, the calcium concentration in milk decreased as a function of time while the calcium concentration of vegetables and fruits increased accordingly. Therefore, it can be concluded that approximately in an hour calcium absorption, adsorption, and desorption processes might occur to reach the equilibrium as shown in Figure 2. The solid lines in the plot are second-order polynomial fits which demonstrated the sorption process complexity. Further, it can be predicted that the calcium sorption from milk and other calcium-rich foods with spinach and navel orange would be higher according to the data in Figure 2.

Therefore, from this study, it has been revealed that the consumption of calcium-rich foods with vegetables and fruits within an hour or two of a meal might decrease the amount of available calcium for the human body. Therefore, it is essential to avoid the consumption of calcium-rich foods within the digestion period of the main meal such as lunch. The experiment was not conducted overnight as the digestion of vegetables and fruits would complete within 1-2 hours; hence, it is impossible to predict calcium sorption occurrences after that period.

## CONCLUSIONS

The calcium sorption efficiencies onto some vegetables and fruits were studied. From the results, it was observed that spinach has the highest calcium sorption efficiency. It was observed that vegetables and fruits could absorb/adsorb calcium nutrients from

calcium-rich food supplements such as milk.

The sorption of calcium could be due to the presence of calcium binding substances such as oxalates, ascorbic acid, citric acid, and phytates. Therefore, it is highly recommended not to consume calcium-rich foods within an hour of the main meal which contains vegetables and fruits as it would cause adverse effects on the human body due to calcium deficiency. Furthermore, patients who are vulnerable to kidney stones should avoid spinach and high calcium supplements as much as possible.

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## Use of Morphological Traits to Identify Turfgrass Collections Belonging to Three Commonly Used Species in Sri Lanka

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### ABSTRACT

Turfgrass is the world's leading ground cover and an essential component in landscaping. It is used mainly in lawns, sports fields, golf courses, and some other places where environmental adaptability, cultural needs, quality, and appearance rely on the correct identification of suitable turfgrass species. In most cases, there are no stable morphological characteristics that distinguish closely related grass species. Therefore, a morphological analysis was undertaken to address the misidentification of turfgrass species and morphological traits using eleven turfgrass collections belonging to genera *Axonopus*, *Zoysia*, and *Cynodon*. Morphological diversity among grass collections was evaluated using a descriptor prepared for grass weeds under plant house conditions. Fifteen morphological parameters were evaluated fifteen weeks after establishment. Parametric data were analyzed by one-way ANOVA for three different genera separately. Results revealed that the morphological parametric traits show significant differences ( $P < 0.05$ ) among turfgrass collections at the genus level. Moreover, the dendrograms obtained from the morphological analysis were clearly separated into three clusters. The dendrogram constructed by morphological data was again divided into sub-clusters, and eleven collections were separated individually, indicating that they are different from each other.

## INTRODUCTION

Turfgrass is a diverse plant group in the family Poaceae, including about 600 genera and 9,000 to 10,000 species (Watson and Dallwitz, 1992). About 40 species belong to subfamilies Pooideae, Panicoideae, and Chloridoideae, which are currently used as turfgrasses (Turgeon, 2002). Turfgrass is utilized for various purposes in home lawns, sports grounds, golf courses, and public areas like parks and roadsides. The establishment and maintenance of turfgrass is of economic importance with different land-use types, including luxury gardens, golf courses, and sports grounds (Kimball, 2011). While turfgrass improves the landscape's esthetic value by greening the land, it also provides many other benefits such as soil moisture conservation, erosion mitigation, and safe and comfortable surfaces for sports players. The turfgrass industry is becoming more and more popular in Sri Lanka. However, it is still not sufficiently structured because quality planting materials are insufficient, and people are less aware of suitable grass species for different purposes.

In Sri Lanka, many native and imported species belong to *Axonopus*, *Zoysia*, *Cynodon*, *Stenotaphrum*, *Digitaria*, and *Paspalum* genera. *Axonopus* and *Zoysia* species are popular in-home lawns and commercial landscaping, whereas *Cynodon* species are usually seen in sports grounds. *Stenotaphrum* species are also seen in lawns, though not commonly used (De, 2017; Riaz *et al.*, 2010).

A quality lawn grass should have a creeping growth habit, moderate growth rate, resistance to regular mowing and

trampling, weeds, pests, and diseases (Majeau *et al.*, 2000; Kopp and Jiang, 2013; Busey, 2003). However, to meet the expected outcomes of turfing, proper management and maintenance are crucial. Hence, selecting suitable planting material is a pre-requisite for well-identified grass species to aid proper management and maintenance of the lawn.

Plant species are usually characterized using morphological traits since it is relatively an easy and inexpensive way of characterization. Although morphology is helpful in species identification, it may not be reliable in grasses, particularly within the same genus, because, within one common genus, there are many distinct species with very similar morphological features. Distinct species within the same turfgrass genus based on morphological traits alone are problematic because of the high morphological similarity (Yaneshita *et al.*, 1997).

Limited morphological diversity among turfgrass species is caused by similarities in genetic composition, environmental influences, and the emergence of intraspecific hybrid species due to cross-pollination and lack of reproductive barriers between different species. On the other hand, the appearance and quality of the turf are affected by their response to environmental conditions such as light intensity, temperature, water, and soil pH (Huang *et al.*, 1997). Sometimes even within a turfgrass population that belongs to the same genus, there may be two or more highly similar species and their interspecific hybrids; thus, species are mixed within that population (Anderson, 2000). That is the most common problem in uncharacterized

grass collections. A high level of morphological similarity between the species is a problem in understanding taxonomic relationships among species. Because of this problem, people identify a single species by different names or different species in a single name.

Correct identification of turfgrass species has many advantages, and it may help in the proper establishment and maintenance of the lawn, which improves the appearance of the turf. A better understanding of the genetic diversity, population structure, and gene flow within and among turfgrass species could aid in the utilization of these materials in future breeding and continued genetic improvement (Kimball, 2011). Researchers can use that information in the breeding process to enhance the external appearance and improve the responses to abiotic and biotic stresses. Taxonomists can use this information to compare the similarities between species. Correct turfgrass species identification safeguards buyers from being misled in the market.

However, according to the authors' knowledge, the research conducted in Sri Lanka to discover the turfgrass species used in landscaping is scarce. Thus, this study attempted to morphologically identify several collections of commonly used turfgrass species (*Axonopus*, *Cynodon*, and *Zoysia* grass) in Sri Lanka and identify the tested grass collections at the species level.

## MATERIALS AND METHODS

This study evaluated five *Axonopus*, four *Zoysia*, and two *Cynodon* turfgrass collections. Sources of plant material included some residential lawns, private turf sellers, and Royal Botanic Gardens, Peradeniya. The experiment was conducted as a Completely Randomized Design (CRD), and turfgrass sods were

established in plastic trays under plant house conditions at the Royal Botanic Gardens, Peradeniya. Two trays per grass collection were used, and the growing medium contained topsoil, coir dust, compost, and sand into 3:1:1:1 ratio, respectively. Four sods were established in a plastic tray, as illustrated in Figure 1. According to the requirement, irrigation and manual weeding were practiced as routine work, and fertilizer application and mowing were not practiced throughout the experimental period. Measurements were taken from each experimental unit in each replicate for each species.

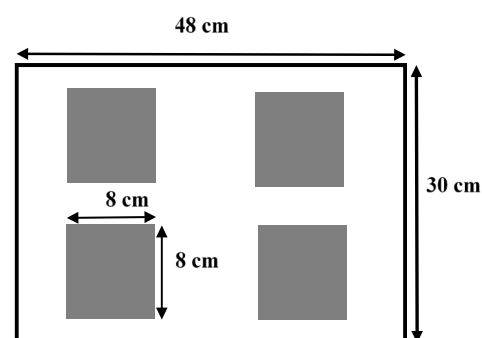
### Environmental parameters

Light intensity, temperature, and relative humidity were recorded between 11.00 a.m. to 12.00 p.m. inside the greenhouse throughout the experiment.

### Morphological characteristics

Morphological characteristics were evaluated fifteen weeks after planting as described by Hafliger and Scholz (1980). Score data were recorded for a life form, nature of culm, shape of the leaf blade, leaf margin, leaf tip, ligule, leaf sheath, and hairiness. Two measurements were taken from each experimental unit in each replicate for each species collection for measurable data.

**Figure 1.** Establishment of sods in a plastic tray



### Plant characteristics









Plant characteristics, life form, culm, hairiness, length of the culm, inter-nodal length of first bottom two nodes, and turf spread were considered. Length of the culm and inter-nodal length were measured using the standard measuring ruler. The spread of the turf was measured using a grid system. One square centimeter grid was used to count the ground coverage.

### Leaf characteristics

The shape of the leaf blade, leaf tip, leaf color, leaf margin, ligule, leaf sheath, length of the leaf blade, the width of the leaf blade, and leaf area were considered as the leaf parameters. The second leaf from the tip was used to evaluate the leaf characteristics in each grass species. A color chart was constructed to observe the leaf color by changing red, blue, and green values (Table 1).

Ligules were observed under the light microscope, and the standard measuring ruler was used to measure the length and width of the leaf. Leaf area was measured by "ImageJ" software. The data were analyzed using the SAS ((ver. 9.1; SAS Institute Inc., Cary, NC) computer package. Dendrograms were created by cluster analysis. Parametric data were analyzed using the one-way ANOVA method, and mean separation was done through the Least Significant Difference (LSD) procedure.

**Table 1.** A color chart developed to observe the leaf color

Color	Color	R	G	B
1		20	160	50
2		60	200	70
3		50	200	40
4		30	180	20
5		30	140	20
6		30	120	20
7		30	100	20
8		30	80	20

## RESULTS AND DISCUSSION

### Environmental conditions

During the research period, temperature, light intensity, and relative humidity in the greenhouse ranged between 24-28°C, 60-84 Klux, and (65-84)%, respectively.

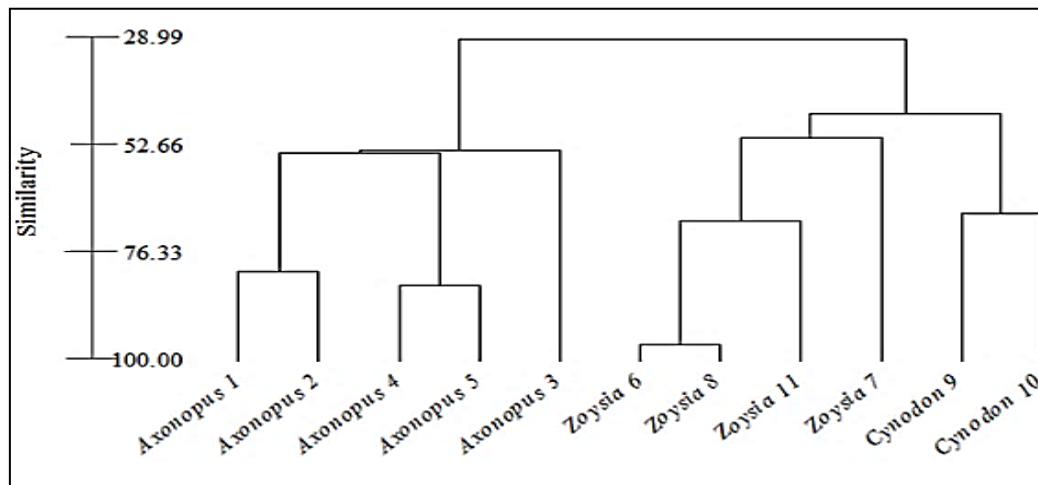
### Morphological analysis

#### Cluster analysis

The dendrogram was generated by analysis of thirteen morphological parameters (life form, culm, length of culm, length of leaf blade, width of leaf blade, leaf area, leaf blade, leaf margin, leaf tip, leaf color, leaf sheath, ligule, and hairiness) of 11 grass collections is shown in figure 2.

In the morphological study, all grass collections were treated as distinct individuals. At the 50.8% similarity level, two main clusters have been separated (Figure 2). The *Axonopus* collections were all grouped in one primary cluster. Collections of *Zoysia* and *Cynodon* were found in another large cluster. *Zoysia* group has been divided into three sub-clusters at 69% similarity level. The study was conducted during the *Maha* season, which was rainy and cloudy. The temperature inside the plant house was near-optimal (24-28°C).

**Figure 2.** Dendrogram generated by the analysis of morphological parameters (Note: *Zoysia* 11 has not been evaluated here, and the ground cover percentage was excluded from the analysis)



Warm-season turfgrasses like *Cynodon* and *Zoysia* prefer temperatures between 27 and 35°C. During the research period, no inflorescence characters were noticed. Low light intensity inside the plant house might have caused the non-emergence of inflorescence. Therefore, the floral morphology has not been included in the study.

#### **Analysis of *Axonopus*, *Zoysia*, and *Cynodon* Grass Collections**

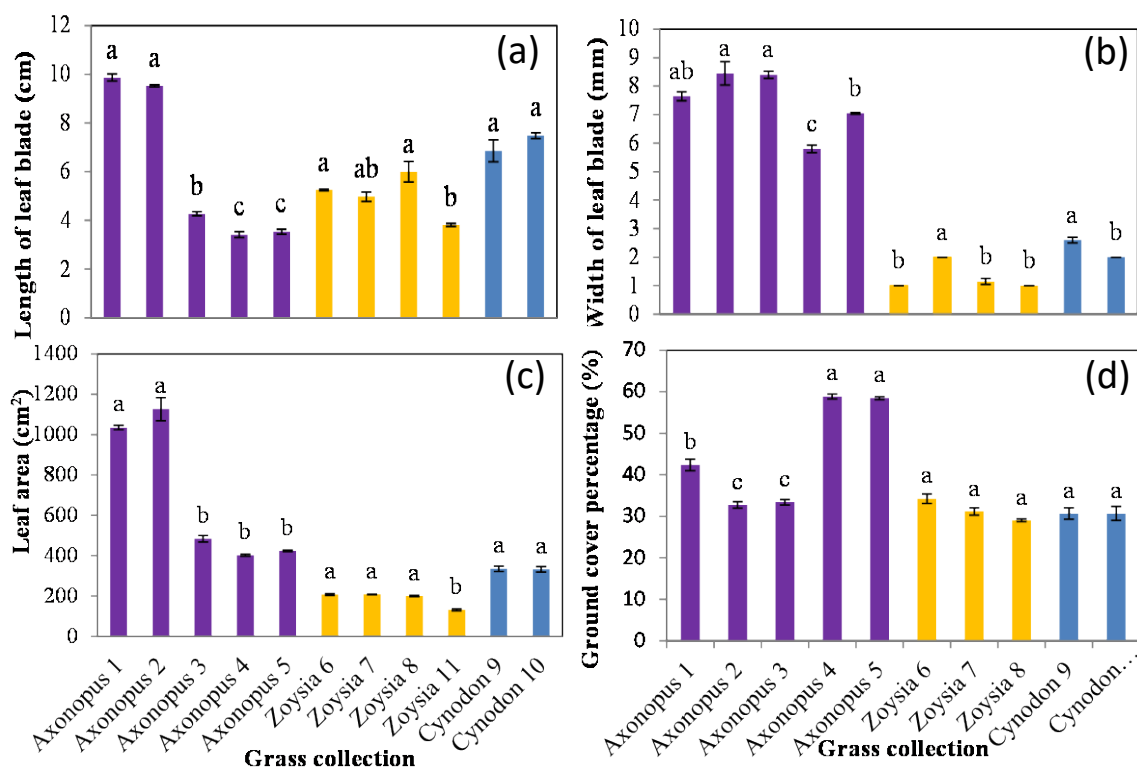
Length and width of the leaf blade, leaf area, ground cover percentage, and culm length were analyzed for three different genera separately. As shown in Figure 3a, leaf length was significantly different between the *Axonopus* collections and the *Zoysia* collections. It was not significantly different within the two *Cynodon* collections. Within the *Axonopus* collections, leaf length was significantly higher in *Axonopus* 1 and 2, and within the *Zoysia* group, it was significantly higher in *Zoysia* 8.

Leaf width was significantly different among the grass collections of all three genera (Figure 3b). Within *Axonopus* collections, leaf width was significantly lower in *Axonopus* 4. Figure 3c shows a significant difference in leaf area within the grass collections of *Axonopus* and

*Zoysia*. *Axonopus* 1 and 2 have significantly higher leaf areas than the other *Axonopus* collections. Leaf area was not significant among *Cynodon* collections. As shown in Figure 3d, the ground cover percentage was significantly different within *Axonopus* and *Zoysia* collections. *Axonopus* 4 and *Axonopus* 5 showed the highest ground cover percentage.

When selecting grasses for turf, their leaf characters are crucial. Leaf size and shape affect ground cover. The leaf color affects the turf's appearance. The *Axonopus* collection was divided into three groups based on leaf length and leaf width. *Axonopus* 1 and 2 had 9.5-10 cm leaf length and 7-8 mm leaf breadth. *Axonopus* 3 (leaf length 4-4.5 cm and leaf width 8-9 mm). The third group *Axonopus* 4 and 5, had 3.3-3.6 cm leaf length and 5-6 mm leaf width. There are 8-14 cm long and 6-8 mm broad *Axonopus compressus* leaf blades and 30 cm long and 2-6 mm wide *Axonopus affinis* leaf blades under variable environmental conditions (Hafliger and Scholz, 1980). *Axonopus* 1 and 2 display *Axonopus compressus* leaf characteristics. However, without floral characters, it is early to conclude.

**Figure 3.** Leaf characteristics of *Axonopus*, *Zoysia*, and *Cynodon* grass collections; **(a)** Length of the leaf blade, **(b)** width of the leaf blade, **(c)** leaf area, and **(d)** ground cover percentage. Different letters indicate a significant difference at  $P < 0.05$  within a genus



According to the leaf textures of *Z. machrostachya* and *Z. japonica* are coarse (leaf widths > 2mm), *Z. pacifica* and *Z. minima* are fine (leaf widths 2 mm), and *Z. matrella* was somewhere in between (Tsuruta *et al.*, 2011). *Zoysia matrella* (L) usually has 4-5 cm long and 2-5 mm wide leaf blades. In the present study, *Zoysia* 7 had the widest leaf (2 mm) and the longest leaf (4.5-5.3 cm), which could be either *Zoysia japonica* or *Zoysia matrella*.

According to Hafliger & Scholz. (1980) the leaf blades of *Cynodon dactylon* (L.) are 5-16 cm long and 2-5 mm wide. This information supports *Cynodon* 9 and 10 being *Cynodon dactylon* because they had leaf blades 6.4-7.6 cm long and 2 mm wide.

### Culm length of grass collections

Culm length was not significantly different in any of the three genera (data not shown). Hafliger and Scholz. (1980) have reported that culm length of different grass species as *Axonopus compressus* (Sw.) P.B. (15-50 cm), *Axonopus affinis* Chase (25-30(-70) cm). Based on our data, all the *Axonopus* specimens were between 15 and 19 cm long, and all are comparable to *Axonopus compressus*. *Cynodon dactylon* (L.) has a culm length of 25-45 mm (Ernst *et al.* 1980), and in this study, the culm length of *Cynodon dactylon* ranged between 25-28 cm. Therefore, *Cynodon* collections used in this study have culm lengths comparable to those mentioned by Hafliger and Scholz. (1980). In this study, *Zoysia* collections showed culm lengths between 12-18 cm. As Hafliger and Scholz *et al.* (1980) mentioned,

*Zoysia matrella* (L) Merr has (20-30 cm) culm length. Therefore, this reason did not support the *Zoysia* collections used in this study to be *Zoysia matrella*.

Although we were able to differentiate the collections to a greater extent in this study, some turfgrasses such as Bermuda grass (*Cynodon* spp.) and zoysia grass (*Zoysia* spp.) are difficult to differentiate morphologically (Al-Humaid and Motawei, 2004; Cai *et al.*, 2005). Therefore, analysis of genetic variability among species with DNA-based technologies is essential in the characterization of turfgrasses. DNA barcoding procedure can be used as a routine method for diversity assessment of plant species and identifying plants at the species level. These will be more informative in germplasm characterization. After that, correctly identified and characterized germplasms can be maintained as pure lines. It is helpful in continuous genetic improvements of turfgrass. The distribution of correctly identified turfgrass species makes the management and maintenance easy. The species-level identification is essential not only in turfgrass but also in other floricultural plants.

## CONCLUSIONS

Length and width of the leaf blade, leaf area, and the percentage of the ground cover were higher in *Axonopus* than that of *Cynodon* and *Zoysia*, whereas the culm length in any of the three species was not significantly different suiting them in different purposes. The dendrograms obtained from morphological analysis were clearly separated into three clusters. The dendrogram constructed by morphological data was again divided into sub-clusters, and eleven collections were separated individually, indicating that they are different from each other. Most of the time, there are no stable morphological traits that differentiate

closely related grass species. On the other hand, due to limited variation and environmental influences, morphological characteristics cannot provide a high level of precision in species identification.

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## Quantifying the Leaf Variegation In Red-Pigmented *Aglaonema* Cultivars Using Image Color Analysis

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### ABSTRACT

*Aglaonema* cultivars, the red-series in particular, has gained attention in the recent past with a high demand in the floriculture trade as a foliage ornamental plant. *Aglaonema* plants are valued based on their foliar variegation trait which is placed as the second most important consideration in the purchase decision at commercial scale. In quantifying the amount of variegated colour on leaves, a simple and efficient technique is required, especially at the export market. In this study, we attempted to develop a simple and effective method to quantify the amount of variegated colour on leaves. Image colour analysis was performed using thirteen red-pigmented *Aglaonema* cultivars. Using a digital camera, the images of the variegated leaves were imported into a computer. Pixel value of each colour within the selected leaf area was determined using MatLab software and respective RGB measurement graphs were generated for each sample. RGB histograms were built on the colour values 0-255 (x-axis) and relative numbers of pixels at each of the 255 colour value (y-axis). The dendrogram for the selected 13 newly introduced red pigmented *Aglaonema* cultivars was derived from the RGB peak colour values. All the cultivars used generally had red-pink and yellow patches on leaf blade. Three main clusters were observed at the similarity percentage of 66%. Leaf samples under each cluster show similar graph patterns in RGB measurement. In most of the samples, dark red color was observed and all the leaf samples indicated having dark green colour variegations. Blue colour-was not visual in the leaves. Image colour analysis qualifies as a valuable new tool for accurate, reproducible detailed and objective quantitative assessment for monitoring changes in colours and variegation patterns of plants like *Aglaonema*.

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## INTRODUCTION

The presence of discrete markings of various colors on an organ or an organism is referred to as variegation (Marcotrigiano *et al.*, 1997). Markings may be stripes, blotches, or streaks of white, cream, yellow, or other colors. Plants contain a wide variety of pigments such as carotenoids, chlorophylls, anthocyanins, and betalains. However, functions of color in plants are not yet fully understood as pigments may have physiological and/or biological functions within the plant. Variegation in plants is categorized as either cell lineage or noncell lineage types (Kirk *et al.*, 1987). Noncell lineage variegation occurs in many genera, and variegated patterns can be inherited in simple Mendelian fashion, such as in *Aglaonema* (Henny, 1983). *Aglaonema* has been a popular ornamental plant due to its attractive foliage with different combinations of leaf colors and low tolerance to light as an indoor plant.

Variegation is an important trait to ornamental plants. More than one third of commercially produced ornamental foliage plants are valued for their foliar variegation (Chen *et al.*, 2004), and consumers' preferences for plant characteristics placed foliar variegation as the second most important consideration in the purchase decision. In landscape design, variegated plants are often used as the center of attention or as a focal point in gardens.

Allocation of these pigments differ from species to species and are thought to be concordance with the phylogenetic relationship within the genus. Therefore, from the standpoint of phylogeny or taxonomy, coloration or color pattern recognition is one of the important factors to distinguish species. However, objective

handling of coloration to examine phenotypes or to study physiological or ecological implications of plants with color patterns includes difficulties because there is a considerable perception gap for visualization of color among people. Different methods, based on complex algorithms exist which are optimized for specific plant materials and purposes and are required specialized instruments.

Regardless of basic or applied research on foliar variegation, a technique that can simply quantify the amount of variegated color on leaves is required. Highly technical optical apparatuses, such as a digital image analyzer, have been used effectively (Smith *et al.*, 1988), but they are expensive and inconvenient with the need of high technical knowledge in using particular software. With the availability of digital cameras, scanners, and computer software, photographic images can be easily processed into digital form. Digital images are useful for color analysis because they are easy to record and process with little distortion. Quantification of variegated leaves through digital images was mentioned in recent publications (Chen *et al.*, 2004). The objective of this study was to test a simple method of quantification leaf variegation and identifying color allocation in red-pigmented *Aglaonema* plants. In this report, we describe a useful method to distinguish coloration and color pattern recognition of red-pigmented *Aglaonema* leaves with a computer-based software

## MATERIALS AND METHODS

Thirteen samples of cultivars of newly introduced red pigmented *Aglaonema* (Figure 1) were collected from a commercial nursery. Red, blue, green color

values of the leaves were analyzed using computer software (Mat Lab). The leaf was laid on the white color background and digital photograph was taken and used for color analysis to obtain line graphs (pixel count vs. color value) for each leaf image for red, blue and green values. Peak values of red, blue and green were obtained for each image and comparison between samples were done through cluster analysis. Dendrogram was derived through cluster analysis from the peak RGB color values of respective leaf samples using Minitab 17 statistical software.

**Figure 1.** Leaf samples of newly introduced red pigmented *Aglaonema* cultivars



Note: Ag 1 (A), Ag 2 (B), Ag 3 (C), Ag 4 (D), Ag 5 (E), Ag 6 (F), Ag 7 (G), Ag 8 (H), Ag 9 (I), Ag 10 (J), Ag 11 (K), Ag 12 (L), and Ag 13 (M)

## RESULTS AND DISCUSSION

MatLab software was used to analyze red, blue and green colours (RBG) of newly introduced red pigmented *Aglaonema* cultivars. The peak values of red, green, and blue color for respective leaf samples are indicated in the Table 1 and the graphs are presented from Figure 3-6.

**Table 1.** Recorded peak values and spread of RBG scale

Sample	Peak values		
	Red	Green	Blue
Ag 1(A)	35	45	13
Ag 2(B)	62	76	0
Ag 3(C)	142	83	0
Ag 4(D)	66	77	0
Ag 5(E)	151	66	0
Ag 6(F)	106	57	0
Ag 7(G)	32	46	0
Ag 8(H)	36	67	0
Ag 9(I)	46	62	0
Ag 10(J)	41	57	0
Ag 11(K)	134	57	0
Ag 12(L)	85	103	0
Ag 13(M)	44	70	0

The highest peak color values were observed in four of the selected samples, which indicates low color range. When the color values increase, the concentration of the particular color is low.

The information contained in a digital image includes the amount of red, green, and blue (RGB) light emitted for each pixel in the image. Although it may be intuitive to use the green levels of the RGB information to quantify the green color of an image, the intensity of red and blue will confound how green an image appears (Karcher *et al.*, 2003). All the colors are constructed through the combination of the Red (R), Green (G) and Blue (B) colors by the RGB color system. The red, green, and blue use 8 bit from each, which have integer values from 0-255. Zero (0, 0, 0) is equal to pure black and (255, 255, 255) represents white (Mercado-Luna, *et al.*, 2010). Color histogram represents the distribution of colors in an image in image analysis and the number of pixels that

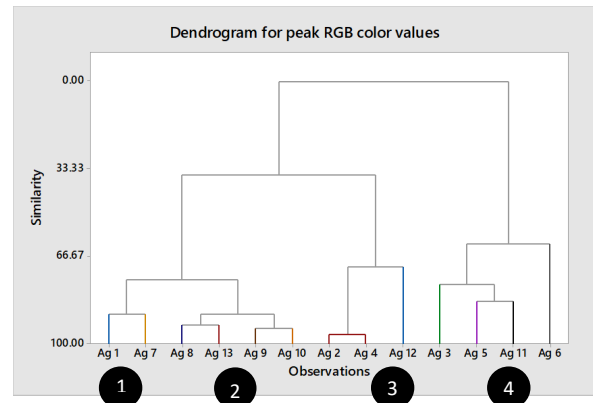
have colors in each of a fixed list of colors are represented. The RGB histograms were built on the color values 0-255 (x-axis) and relative numbers of pixels at each of the 255 color value (y-axis).

All the different colors and shades of colors in the RGB system are derived from different combination of red, green and blue. Especially in RGB histogram, dark colors are aligned to the left side of the x-axis and bright colors are aligned to the right side of the x-axis from the middle.

The *Aglaonema* plants, consists of multicolored foliage and selected red-pigmented cultivars were used for the experiment (Figure 1). All the cultivars used were generally having red-pink and yellow patches on leaf blade. Naturally, red, green, and yellow colors were visible from the *Aglaonema* leaves and blue color was not visible. In image color analysis relative proportions of the primary colors red, green, and blue colors were used to interpret the RGB color measurements of the leaves. The dendrogram for the selected 13 newly introduced red pigmented *Aglaonema* cultivars were derived from the RGB peak color values as shown in the Figure 2.

Three main clusters (1, 2, and 3) were observed at the similarity percentage of 66% and under first main cluster two sub clusters were observed. RGB measurement histograms are collectively displayed together for easiness of comparison which appeared in each cluster. Changes in spread and recorded maximum pixel count for each color are important to discuss the changes of color in *Aglaonema* leaves.

**Figure 2.** Dendrogram generated by the analysis of RGB peak color values



Leaf samples under each cluster show similar graph patterns in RGB measurement. Under clusters 1, 2, and 3 peak color value for red was observed to be more towards to the left side of the x-axis indicating dark red colors. For the leaf samples in cluster 4 had peak red color values more towards the right side of the x-axis indicating light red colors. In all the leaf samples except for the Ag 1 cultivar the respective peak color value for blue color was 0. For all the leaf samples, the peak color value for green color was more towards the right side of the x-axis indicating dark green colors on the leaf samples.

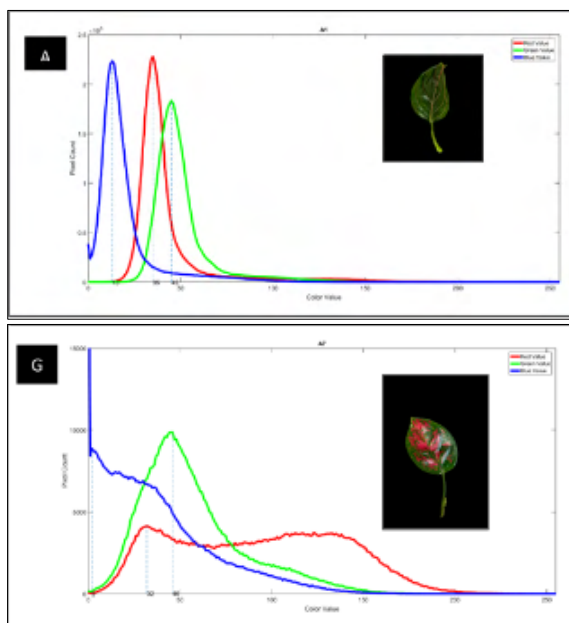
The measurements obtained for each coloration supports in phenotypic classification of *Aglaonema* cultivars. Based on the color patterns observed (Figure 1) and color measurements close phenotypic relationships were observed between cultivars within clusters.

As the interpretation of color differ individually when visual observations are made on naked-eye, taxonomical classification by colors becomes very difficult. Using the method of simply processing data in a digital image, omission of original data does not occur.

The used method of image color analysis allows data of a wide range of colors while digital image per pixel to be processed. The image processing was carried out using an inexpensive software MatLab where data analysis was done using Minitab 17 software where cluster analysis was performed in terms of statistical analysis of the obtained data.

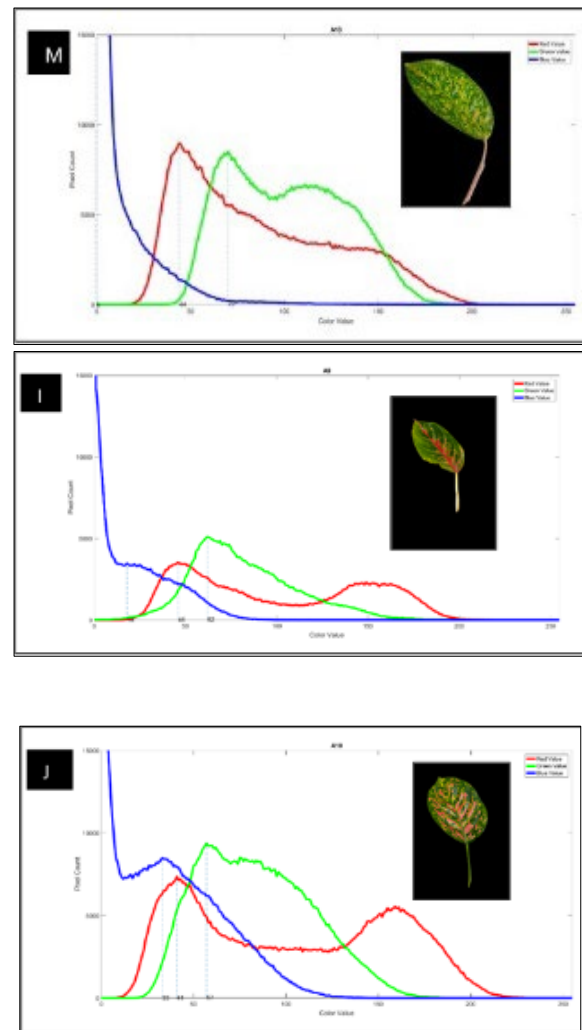
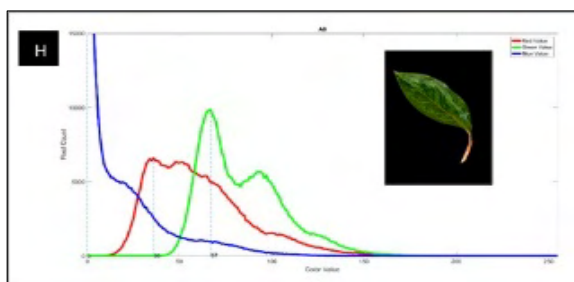
**Figure 3.** RGB Color variation of newly introduced red pigmented *Aglaonema* cultivars – Cluster 1

**Note:** Ag 1 (A), Ag 7 (G)



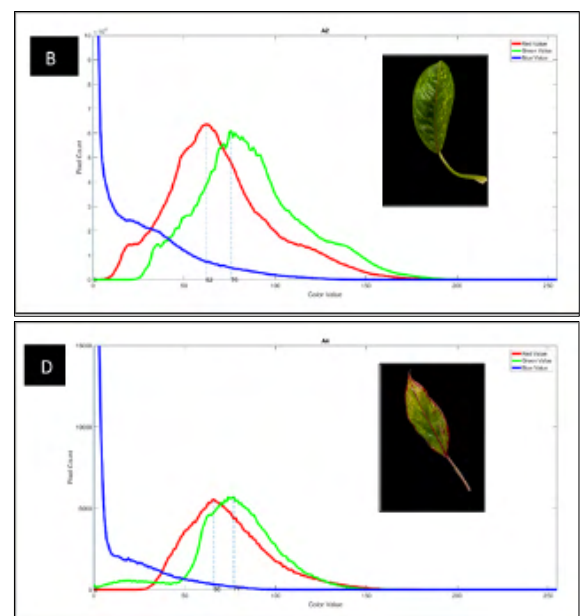
**Figure 4.** RGB color variations on newly introduced red-pigmented *Aglaonema* cultivars – Cluster 2

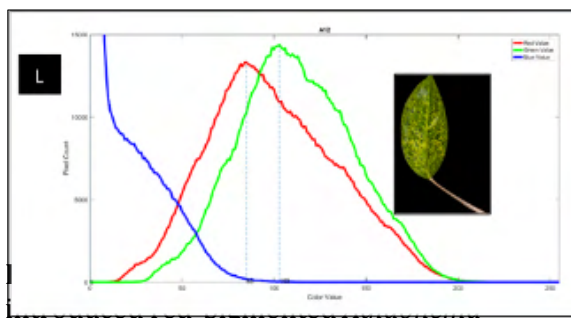
**Note:** Ag 8 (H), Ag 13 (M), Ag 9 (I), Ag 10 (J)



**Figure 5.** RGB color variations on newly introduced red-pigmented *Aglaonema* cultivars – Cluster 3

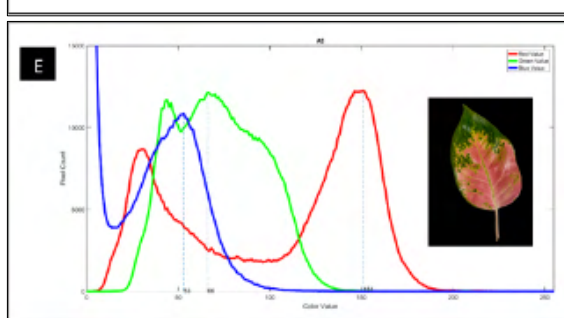
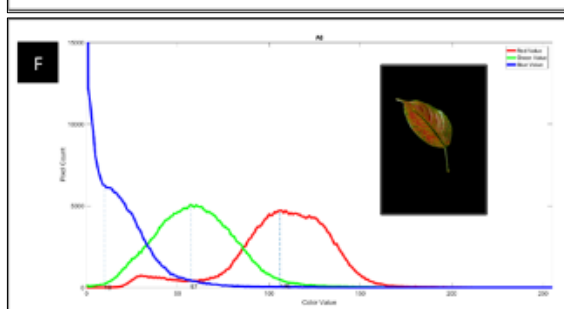
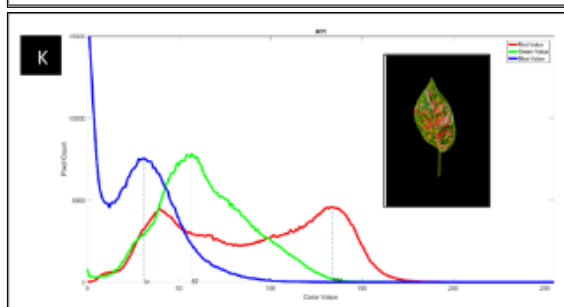
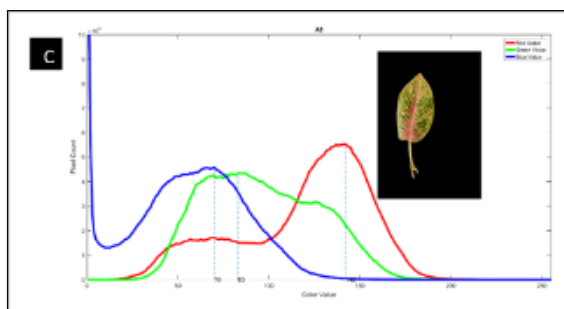
**Note:** Ag 2 (B), Ag 4 (D), Ag 12 (L)





**Figure 6.** RGB color variations on newly introduced red-pigmented *Aglaonema* cultivars – Cluster 4

**Note:** Ag 3 (C), Ag 5 (E), Ag 11 (K), Ag 6 (F)



This method facilitated simple conversion of two-dimensional images into one-dimensional color pattern sequences and graphical representation where quantitative histograms of color patterns were generated that are comparable to each other. Apart from taxonomic classification, this technique can further be used in assessing the foliage color in an objective way in exports to maintain the uniformity, in plant physiology studies to elucidate phenotypic adaptations in response irradiance gradient which affects the foliage color and in postharvest studies to assess the foliage quality.

## CONCLUSIONS

In this study, a simple and effective method for image color analysis was tested in identifying the variegation patterns in red-pigmented *Aglaonema* cultivars. The method of using digital image and an available non expensive software showed clear advantages with regard to objective, reliable, and convenient analysis of foliar color variegation. Problems faced in human bias color determination in identifying foliage plants based on their color patterns can be overcome through this technique where colors were determined through the software based on their wavelengths. Phenotypically close cultivars were identified based on the color gradients and concentration of each red, green, and blue color. Most of the cultivars contained dark red colors and dark green colors. Blue color was not detected in the cultivars and it was indicated in terms of blue color the color patterns were more towards the dark color range (black), giving dark appearance to the foliage. This method provides a useful tool for quantification of foliar variegation in phenotypic

classification of ornamental foliage and other plants.

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## Geo-graphical Distribution and Morphological Characterization of *Terminalia catappa* L. (Tropical Almond) in the Galle District, Sri Lanka

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### ABSTRACT

Morphological variations occur in phenotype-based on environmental conditions. This research aimed to study the variations in morphological characters of *Terminalia catappa* L. plants found in different geographical locations in Galle District. The data was collected from 70 individual plants and sampling sites were identified through the snowball sampling technique based on referrals named by the primary contacts. The study found that the *T. catappa* plants varied in height from 8.0 - 40.0 m with irregular or spreading canopy. Bark colour had four colours and the diameter at breast height varied from 10 - 57 cm. The immature leaves were light green in colour and covered with brown hairs. The leaves were obovate with mucronate or obtuse tips and auriculate or subcordate at the base. The inflorescence length varied from 6.0- 30.0 cm and flowers were white, greenish white or cream in colour and 0.5- 1.1 cm in length and 0.2- 0.6 cm in width. The fruit varied in length and in width. Fruits were ovoid to ovate in shape and rarely rounded, green when immature and yellow or bright red when ripe. The ripe fruit weight varied from 8-35.5 g. The seed weight varied from 0.4-1.5 g.

## INTRODUCTION

*Terminalia catappa* L. (tropical almond) belongs to the family Combretaceae and is locally known as “Kottamba”. It is widely distributed throughout coastal environments in the tropics. *Terminalia catappa* is a deciduous tree that grows in well-drained and well-aerated sandy soils. It is planted mainly for ornamental or shade purposes (Thomson and Evans, 2006). *Terminalia catappa* plants start bearing after 3 years of planting. The fruit is a drupe (Dassanayake *et al.*, 1980). The seed or the kernel has a milky taste and is high in proteins and lipids. It can be eaten either raw or after being processed. The kernel can be used to extract oil that resembles true almond oil (Gunasena and Asia, 2007). Therefore, the fruit is useful in pharmaceutical and chemical industries as well. The timber of this plant is used as an interior building material and in furniture production. Bark, leaves, fruits and roots can be used for making dyes and ink due to the presence of tannins. *Terminalia catappa* plant parts are used in folk medicine in India, Malaysia, Taiwan and the Philippines. The leaves are used for treating hepatitis and dermatitis due to the anti-oxidative, anti-inflammatory actions of the leaf extract. Bark is used for treating gastric fevers and dysentery (Anand *et al.*, 2015). Fruits have anti-diabetic properties and roots have antimicrobial properties.

Despite of its many uses, *T. catappa* remains an under-utilized species in Sri Lanka. Due to the nutritive value of the kernel and similarity in taste to almonds, *Terminalia catappa* has the potential to be developed as a valuable source of edible nuts. The improvement of more economically important nut characteristics of *T. catappa* L such as fruit/kernel size, ease of kernel cracking, fruit shape and color, etc. are neglected. Although this is a versatile crop, not grown on a plantation scale due to low popularity

among people than other nut crops. Even though substantial variation in morphological traits, particularly in fruit and nut characters, is observed among plants growing in different parts of the island, according to our knowledge, there has not been a scientific study of this variation. Plant phenotype is an interaction between genotype and environment and will display different forms when they adapt to the environment. The phenotypic variability of a genotype in different environments is known as phenotypic plasticity (Arteaga *et al.*, 2015, Gratani 2014). Such variation can be observed in leaf, flower, fruit, seed and other plant parts (Wang *et al.*, 2016). These traits are used in the identification of better accession from a species and for selective breeding purposes. Easily observable morphological descriptors which can be evaluated relatively cheaply are selected for characterization of morphological variation (Sultan, 2000). Morphological characterization of *T. catappa* L. accessions in different geographical locations based on leaf, flower, fruit, seed and plant traits can be useful to identify plant varieties with better characteristics useful to make popularity of *Terminalia catappa* L. plants among people. Thus, this study aimed to evaluate the geographical distribution and morphological variation of *T. catappa* plants sampled from the Galle district of Sri Lanka.

## MATERIALS AND METHODS

### Sampling Locations and Procedure

Locations of *T. catappa* were identified through the literature and by contacting government officials of the relevant departments (Wildlife Life Conservation, Department of Forest, and Department of Agriculture) and the public. Sampling sites were identified through the snowball

sampling technique based on referrals named by the primary contacts.

## Data collection

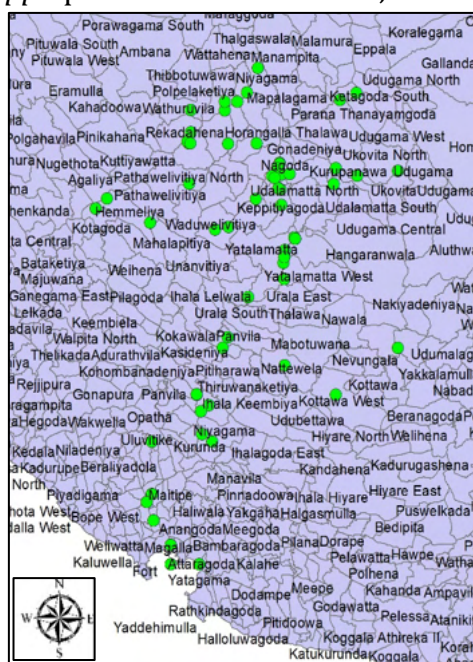
### Geographical Distribution of Plants

Latitude and longitude data of seventy individual plants were identified through a GPS tracker and mapped using Arc-GIS software.

### Morphological Characterization

Seventy fully matured plants/ accessions were identified for data collection. Qualitative parameters and quantitative parameters were used to collect the morphological data. Qualitative characterization was done by a panel of 20 members. Quantitative characterization was based on the average of 15 numerical measurements taken for one parameter per plant/accession. The qualitative and quantitative characters scored or measured are described below.

**Figure 1.** Geo-graphical distribution of *T. catappa* plants in Galle Districts, Sri Lanka



### Plant morphology

Two qualitative characters (bark colour and growth habit) and two quantitative

characters (plant height and diameter at breast height) were gathered as gross plant morphological characters.

**Leaf morphology** - Five qualitative characters (leaf colour, leaf arrangement, leaf apex, leaf base, and leaf shape) and three quantitative characters (leaf length, leaf width and petiole length) were collected as leaf morphological characters.

### Floral morphology

Two qualitative characters (arrangement of flowers in the inflorescence, colour of inflorescence) and three quantitative characters (length of inflorescence, length of flower and width of flower) were collected as floral morphological characters.

### Fruit morphology

Two qualitative characters (fruit colour and fruit shape) and four quantitative characters (fruit length, fruit width, fruit weight and fruit coat thickness) were gathered as fruit morphological characters.

### Seed morphology

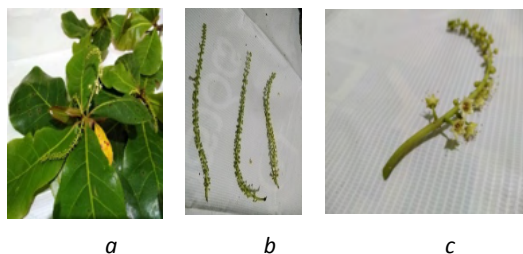
Two qualitative characters (seed colour, seed shape) and three quantitative characters (seed diameter, seed weight, seed coat thickness) were collected as seed morphological characters.

## RESULTS AND DISCUSSION

### Distribution of *T. catappa* plants in Galle District

*T. catappa* plants can be seen mainly on roadsides, home gardens, near water streams, bordering paddy lands and coastal areas. The plants were frequent in plain or undulated topography in these locations. Different geographical locations of *T. catappa* plants in Galle districts were shown in the map (Figure 1) given below.

**Figure 3.** *T. catappa* inflorescence (a- Inflorescences, b- inflorescence with varied length, c-close view of inflorescence)



### Morphological Characterization

*T. catappa* plants growing in the Galle District displayed variation in morphological characters including plant characters, leaf characters, flower characters, fruit characters and seeds characters as described below. The mean values for quantitative traits are given in Table 1.

**Table 1.** Values (mean and the range) for different quantitative characters of *T. catappa* plants

Character	Range	Mean $\pm$ SD
Length of Inflorescence	6.0-22.9 cm	14.8 cm $\pm$ 4.68
Length of flower	0.5-1.1 cm	0.9 cm $\pm$ 0.28
Width of flower	0.2- 0.6 cm	0.4 cm $\pm$ 0.14
Leaf length	18.0-40.7 cm	25.7 cm $\pm$ 5.69
Leaf Width	10.0-21.0 cm	15.0 cm $\pm$ 2.54
Petiole Length	1.0-2.5 cm	1.6 cm $\pm$ 0.42
Fruit Length	5.0-9.0 cm	6.4 cm $\pm$ 1.39
Fruit Width	3.5-5.0 cm	4.5 cm $\pm$ 0.56
Fresh Weight of Fruit	8.0-35.5 g	22.5 g $\pm$ 8.42
Fruit Coat Thickness	0.3-1.0 cm	0.5 cm $\pm$ 0.079
Seed Diameter	0.6-1.2 cm	0.9 cm $\pm$ 0.18
Seed Weight	0.4-1.5 g	0.8 g $\pm$ 0.30
Seed Coat thickness	0.7-1.5 cm	0.9 cm $\pm$ 0.23
Plant Height	8.0-40.0 m	24.9 m $\pm$ 10.21
Diameter at the breast height	10.0-57.0 cm	31.0 cm $\pm$ 12.28

### Plant morphology

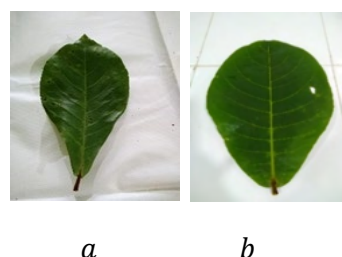
Tropical almond plants growing in the Galle District were monoecious. Mature

trees varied greatly in their size and shape, the height varying from 8.0-40.0 m with irregular or spreading canopy. The diameter at breast height ranged from 10-57 cm. Bark colours were identified as light brown, brown, gray, gray-black or black with some plants having occasional strip like appearance in the bark.

### Leaf Morphology

Leaves were generally obovate in shape but the width (10.0-21.0 cm) and length (18.0-40.7 cm) of the leaves varied greatly (Figure 2). Petiole length varied from 1.0-2.5 cm. Leaves were simple and arranged in spiral clusters, each cluster consisting of 10-15 leaves. The leaf tip was mucronate, ending in a short or somewhat long point or obtuse with blunt or rounded end. The leaf base was auriculate or subcordate. Brown pubescence appeared on the new leaves. Mature leaves had a shiny surface and were dark green or green in colour and turned red before falling and yellow to brown after falling. Trees defoliated twice a year.

**Figure 2.** Obovate shapes leaves of *T. catappa* with varied width and length (a- leaf with narrow width, b-leaf with broader width)



### Floral morphology

*T. catappa* flowers (Figure 3) were white, greenish white or cream in colour, small (length; 0.5-1.1 cm, width; 0.2- 0.6 cm). Flowers were arranged in a spike (6.0-22.9

cm) with 50-80 flowers in 4/5 flowers as clusters along the axis.

### Fruit morphology

The immature fruit was green with smooth skin and turned from yellow to bright red during maturation. The shape and the size of the fruit were diverse (Figure 4). The fruit was ovoid to ovate or rarely rounded in shape with length 5.0-9.0 cm, width 3.5-5.0 cm and laterally compressed. This drupe comprised of exocarp (skin), mesocarp, endocarp and seed. The thickness of the fruit coat varied from 0.3 -0.0 cm. The fruit weight of tropical almond varied considerably between 8-35.5 g.

**Figure 4.** *T. catappa* fruits (a- immature fruit bunches, b, c- ripen fruits)



### Seed and kernel morphology

The seed was white and generally ovoid to ovate in shape. The seed was covered with a 0.7-1.5 cm thick seed coat and made cream or yellow colour ovoid to ovate. Seed size (diameter: 0.6-1.2 cm) and weight (0.4-1.5 g) varied considerably.

### CONCLUSIONS

*T. catappa* plants grown in the Galle District in Sri Lanka have shown variation in morphological characters such as plant, leaf, flower, fruits and seed characters. The variation can be exploited to select plants

with characteristics that are popular among people and then improving those selected characteristics to thereby increase the market demand.

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## Evaluation of the Scenic Beauty of the Existing Landscape of Southern Expressway and Suggestions to Improve the Landscape Using GIS and Remote Sensing

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### ABSTRACT

The occurrence of landslides, frequent accidents and negative impacts on environmentally sensitive areas are some of the issues associated with the Southern Expressway in Sri Lanka. Most of these issues could be resolved through proper landscape designing along the highway. This study was intended to assess the existing landscape and land cover/use types of the Southern Expressway using GIS and remote sensing. Study area boundary of 1 km buffer zone along the expressway was demarcated and existing land cover/ use types and environmental sensitive areas were identified. Using "Landsat 8 imageries", a map was developed based on Normal Difference Vegetative Index (NDVI) values within the buffer zone. Landscape models were developed and a visual preference survey was conducted using a focus group of 30 people. Results revealed that the expressway is surrounded by environmentally sensitive areas, archaeological reserves, protected ancient monuments, landslide prone areas, hydrological areas, forest and wild life reserves. The greenness varied throughout the buffer zone. The visual preference survey revealed that the respondents preferred more natural landscape designs which fully or partially cover the residential areas and natural designs that fully screen the religious areas along the highway. Respondents mostly preferred to have landscape designs which express the importance of the area with clear interpretative labelling. Visual preference survey suggests that there is a need of area-specific landscape designs for the Southern Expressway and the importance of human perception-based methods in designing landscape.

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## INTRODUCTION

Highway is a linear landscape (Wang et al., 2013) with gentle curves, a little slope and wide lanes. People use highways in greater frequency with their busy life. Hence, landscape design in highway has gradually become one of the major elements of the roadside environment. There are several design objectives and key principles relating design and management of the roadside landscape such as safety of users, reduction of travel related stresses of drivers, harmonization of built environment with the natural ecosystem, ecologically soundness, minimal maintenance, cost effectiveness and added value to the built environment (Moffatt and Kohler 2008).

The scenic quality of landscaping is affected by physical features (e.g. topography, vegetation patterns, slope, building coverage, floor area ratio), and the observer's characteristics such as, motion, location, personal background, view angle, social characteristics, cultural background, past experience, daily routine and specific interests of individuals (Sung et al., 2001). Hence, the opinions of highway users should be considered to increase the scenic quality of highways. This is easily achievable through landscape design visualization via two-way communication between the designer and the actual users (Hadi et al., 2012). There are several computer-based visualizations such as plans, photomontages, 2D visualizations, 3D visualizations and real-time visualizations

that have been recognized for a long period in the decision-making process.

Southern highway is the first expressway in Sri Lanka stretched for 126 km between Kottawa to Godagama. Even though Southern highway provides many benefits such as reducing traffic, travel time from Colombo to Matara, delay costs, fuel and, attract private sector investors, expanding tourism around coastal belt, development of fisheries, agriculture and other industries the landscape design was very poor in terms of aesthetic value and safety requirements which leads for travel related stress, low attention to driving with lower effectiveness of driving speeds. The ecosystems consisting of wetlands and forest marshes along the highway are highly vulnerable to pollution. Moreover, sensitive areas like residents and religious places near the road especially suffer from air and sound pollutions and, vibrations.

All these issues can be addressed through proper investigation/ assessment of existing landscape and land use types with the participation of all stakeholders: planners, designers, constructors and consumers. This will lead to achieve a good use of land with minimum destruction to properties while keeping the natural terrain and existing scenic quality and will enhance the potential towards the ecotourism in the area (Cañas et al., 2009). Therefore, this study will be more beneficial not only for the existing expressways, but also construction and maintenance of future expressways .

## MATERIALS AND METHODS

The present study was conducted on the Southern Expressway (from Kottawa to Galanigama). The exiting land use, land cover types and important ecosystems types along the expressway up to 1 km buffer zone were identified by using the topographic maps (1: 50,000) developed by Survey Department of Sri Lanka in 1989, 1996, 1998, 1999, and 2001 and validated by visual interpretation techniques using Google Earth Software. After that, a map was developed using ArcGIS 10 mapping software for land cover/use types. The delineated map was overlaid on Google Earth after converting into KML (Keyhole Markup Language) file type.

The environmental sensitive areas were identified based on the areas declared as Environmental Protection Areas declared and mapped by Central Environment Authority (CEA) and the area maps are in the part 111 of the scheduled of the Gazette Extra Ordinary No. 772/22 of 24<sup>th</sup> June 1993 and subsequent amendments (EIA regulations), under the provision of the National Environmental Act.

Those identified areas were mapped by relevant departments such as; rivers, canals, streams, estuaries, water bodies and reservoirs were mapped by the Department of Survey; botanic gardens and sanctuaries were mapped by Department of Wild Life Conservation; heritage wilderness was mapped by the Forest Department; archaeological and historical reserves were mapped by the Department of Archaeology and erosion

prone areas were mapped by the Department of Agriculture.

The medium resolution (30 m) Landsat 8 OLI Satellite images which have 11 spectral bands were downloaded from the USGS (United State Geological Survey) Earth explorer website and processed in ERDAS imagine 2010 and ArcMap10 software. It was used to develop a map based on Normal Difference Vegetative Index (NDVI) values to get an idea about the vegetative proportions or distribution of greenness along the Southern expressway within 1 km buffer zone. The formula to calculate NDVI is shown below.

$$NDVI = \frac{(NIR - Red)}{(NIR + Red)}$$

Where RED is visible red reflectance, and NIR is near infrared reflectance. The wave length range of NIR band is (750-1300 nm), Red band is (600-700 nm), and Green band is (550 nm). The value of NDVI ranges from -1 to +1. The data was recorded in ERDAS Imagine software (Bhandari et al., 2012).

In this study, 430 photographs were taken from Kottawa to Kurudugahahetakma by using a SONY® digital camera with 18-70 angles and with a shutter speed of 100-1250 per second while traveling at a speed of 60-100 km/h along the Expressway. Viewpoint was located slightly off-centered of the road in the right lane and about 1.2 m above the pavement. Nine photographs were purposely selected including a bridge which was located over the road, paddy field, shoulder area, a plantation area, a landslide prone area, a

residential area and a temple area. They were edited by using Real time landscaping Architect® software and Microsoft office picture manager 2007 to make different landscaping models relevant to particular places.

Visual preference survey was done with 30 random people as direct communication showing edited photographs using Microsoft Power Point. According to the data of survey, perception of the public was evaluated and, found out the best options of landscape design models to implement. The Minitab 14 statistical software and Microsoft excel 2007 were used to analyze the collected data.

## RESULTS AND DISCUSSION

### Demarcating the study area boundary

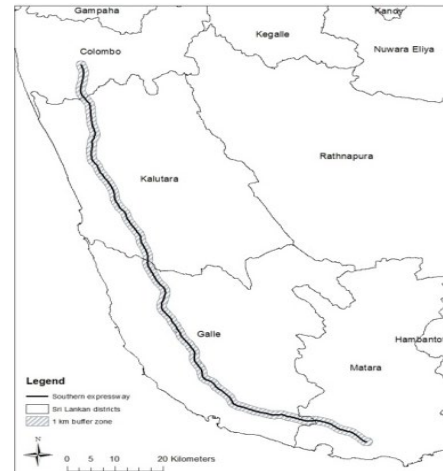
The main trace of southern expressway consists of 126 km and it lies across four districts (Colombo, Kalutara, Galle, and Matara) within the wet zone. The study area consisted of a 1 km buffer zone along the expressway (Figure 1).

### Identification of environmentally sensitive areas

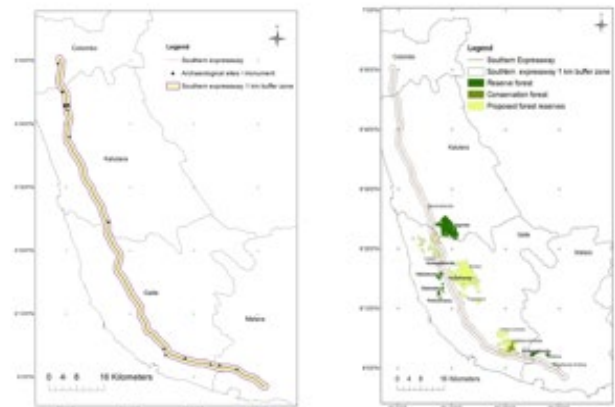
According to the Extra Ordinary Gazette (No.722/22) dated 1993/06/24 the environmentally sensitive sites and areas have been identified and mapped by responsible departments of Sri Lanka. As shown in the Figure 2, archaeological reserves, ancient or protected monuments/buildings (ancient temples, pagodas, fane, hermitages, and inscriptions) within/close to the 1 km

buffer zone along the expressway were identified.

**Figure 1.** Demarcated study area (1 km buffer zone along the Southern expressway).

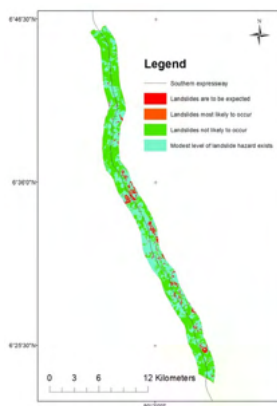


**Figure 2.** Location map of archaeological reserves, forest and wildlife ancient or protected reserves areas monuments/buildings within/close to the within/close to the buffer buffer zone.

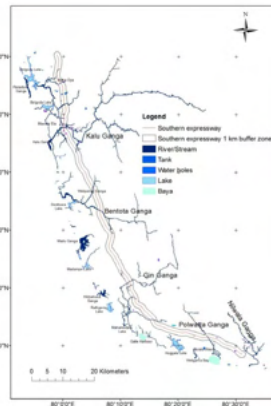


As shown in Figure 3, there were no forest and wild-life reserves area within the buffer zone in Colombo and Matara districts but, Kudagal kanda and Gallanda kuttiya reserved forests were very close to the buffer zone in Matara district. Southern expressway has gone very close to the Kananakanda forest reserve and a small part of Yagirala forest reserve which were included in the buffer zone in Kalutara district. The expressway has gone through both Uragaha and Kottawa kombala proposed forest reserves and a part of Yakkatuwa forest reserve was also included into the buffer zone in Galle district. According to the map developed by the National Building Research Organization (Figure 4), landslide prone areas within the buffer zone along the expressway could be identified only within the Kalutara district. Significant watersheds and several tributaries and minor streams such as Maha oya, Kalu ganga, Benthota ganga, Welipenna ganga, Gin ganga, Polwatta ganga (Figure 4), were crossed by Southern Expressway.

**Figure 4.** Map of landslide prone areas within 1 km buffer zone along the expressway



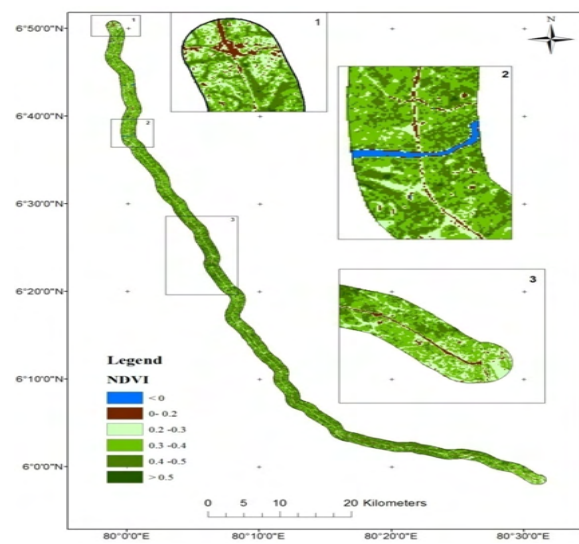
**Figure 5.** Map of hydrological areas within 1 km buffer zone along the expressway



As shown in the Figure 6, areas can be identified according to the density of

vegetation. Areas with zero NDVI value could be identified as water bodies and zero to 0.2 NDVI value could be identified as roads including Southern Expressway, built up areas and riversides. Areas with 0.2 to 0.3 NDVI value could be identified as home gardens, marsh lands and paddy fields while patches of rubber plantations, forest areas, and oil palm cultivations had NDVI values above 0.3.

**Figure 6.** NDVI map of southern expressway within 1 km buffer zone



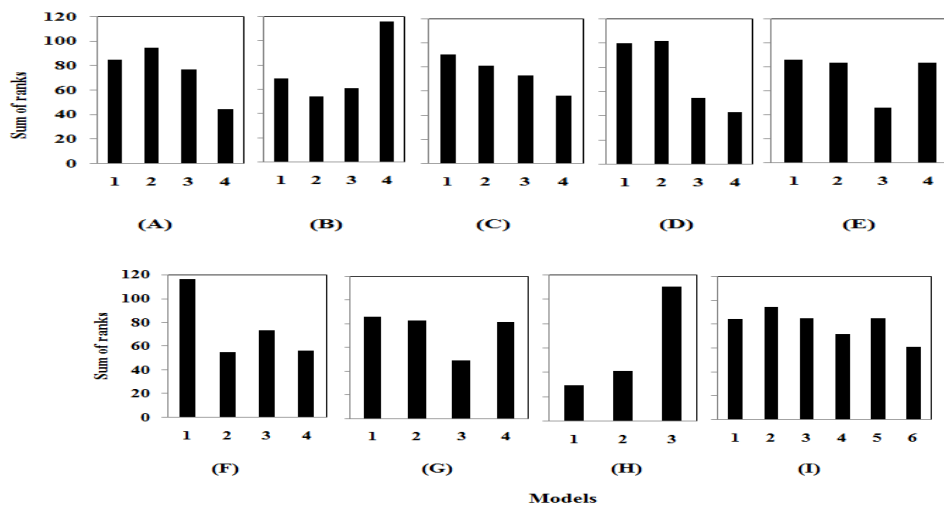
### Visual preference survey

According to the Friedman statistical analysis there were significant ( $P < 0.05$ ) differences among designed models. As shown in the Figure 7(A), second model with the concept of changing construction material of the bridge has got the lowest preference, while the highest preference was given for the bridge with planting flowering materials (Lowest sum of rank was given for the most preferred model). As shown in the Figure 7(B), second model

with screening the paddy field with natural trees was the most preferred while least preferred one was the fully covered paddy field by a concrete wall. As shown in the Figure 7(C), the fourth model with depicts dancing water fountain during the night along the roadside was the most preferred model and the least preferred one was the existing appearance without

artificial walls or natural trees or partially covering with hedge with vegetation than appearing residential areas while traveling. As Figure 7(F) shows, respondents preferred more on fully screening religious areas with natural trees and least preferred way was the existing appearance with more expose to the towards the road. As Figure 7(G)

**Figure 7: (A),** Landscape design model of front view of bridge which located over the road **(B)** Landscape design models for view of paddy field, **(C)** Landscape design models for besides of main Expressway during the night, **(D)** Landscape design models for shoulder area with steep topography and prone to landside, **(E)** Landscape design models for residential area, **(F)** Landscape design models for religious site, **(G)** Landscape design models to indicate the area which the passenger/ driver presently passing though, **(H)** Landscape design models with naming the site or showing the importance of the site using landscape elements, **(I)** Landscape design models for shoulder area.



any light. According to the analyzed results, as Figure 7(D) shows plants with retaining wall was the most preferred and second preferred way was the grass cover and existing appearance was preferred to covering it with only the concrete retaining wall. As Figure 7(E) shows, respondents preferred more on fully covering the residential areas with

shows, respondents preferred to have landscape designs along the roadside to express the clue on the area with using an artificial landscape element mostly and having a clue with natural landscape elements and notice the name of area directly with words was the second preferred way of respondents while least preferred way was the only notice the name of area directly with words. As

Figure 7(H) shows, respondents mostly preferred to have landscape designs which

express the importance of the area with labeling directly with words than appearing places as it is without any information. According to the Friedman statistical analysis there were no significant ( $P < 0.05$ ) differences among designed models for shoulder area (Figure 7(I)).

## CONCLUSIONS

In conclusion, proper landscape can be achieved through careful evaluating on existing land use/cover types and greenness of the area with the identification of environmental sensitive areas along the roadsides while considering human attitudes and preferences on different landscape elements and designs. This study helps enhancing the scenic beauty of the Southern expressway while making it sustainable. Additionally, this aids to convince the importance of landscape designing while adding the existing scenic beauty to the newly constructing expressways while making minimum impact on environment and certify maximum safety requirement. It is better to select plant species and propose guidelines for planning in roadside proposed which can be recommended specifically for expressways. Field practice guide even for small areas of the road landscape guideline for roadside planting should be developed.

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## Phytosociology and Mangrove Ecology in Trincomalee and Implications for Conservation

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### ABSTRACT

Mangrove forests are one of the intertidal wetlands dominating the tropical and subtropical coasts. They are keystone ecosystems providing pivotal ecological and economic services and have acknowledged roles in coastal productivity and connectivity. However, increasing natural and anthropogenic disturbances have imposed a question on their sustainability. Proactive mangrove conservation requires science-based inputs at local and regional levels. Considering above, the present study aimed to investigate the floristic structure, phytosociology, and the ecological linkage of floral assemblages in a mangrove forest in Trincomalee, Sri Lanka. Forest survey was done with 10m wide belt transects of different lengths at ten stations in the site (P1-P10). Mangroves along the transects were identified, enumerated, and measured diameter at breast height (DBH). Forest structure was assessed with a value index and niche width. Subsurface water samples were taken from the stations to measure environmental parameters (n=30). Floristic survey revealed a heterogeneous mixture of five mangrove species. Overstory was dominated by *Avicennia marina*, *Lumnitzera racemosa*, and *Rhizophora apiculata*. *R. apiculata* showed the highest niche width (9.77). The site revealed a Shannon index of 1.08, Simpson index of 0.38, and Pielou's evenness of 0.69. Cluster analysis classified the sites into two groups, which were then used to perform site-specific discriminant analysis of floral assemblages. Distance-based redundancy analysis (dbRDA) showed that salinity, dissolved oxygen, tidal amplitude are key factors controlling mangrove assemblages in the site. The data presented in the study would be fundamental in site-specific management and implementing conservatory actions.

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## INTRODUCTION

Mangrove forests are one of the intertidal wetlands dominating the tropical and subtropical coasts. They are keystone ecosystems providing pivotal ecological economic services and have acknowledged roles in coastal productivity and connectivity. These highly productive ecosystems provide many critical ecosystem goods and services. In addition to providing fish and wildlife habitat, mangrove forests reduce coastal erosion, provide seafood, improve water quality, supply forest products, support coastal food webs, minimize flooding impacts, and support high rates of carbon sequestration (Duke, 1992). Despite their tremendous societal, ecological and economical value, nearly all mangrove nations have experienced net losses in forest cover in recent decades, and remaining mangrove habitats are seldom pristine. Land-use changes, population increase, urbanization, and global climate change-driven sea level rise have affected the present status of the mangrove ecosystems; as they are highly vulnerable biomes (Alongi, 2015). However, given the amount of change that has occurred in the recent past and is expected in the near future, there is a pressing need to better anticipate mangrove management conservation to ensure their sustainability and prepare for the ecological consequences of global change (Alongi, 2008).

Presently, Sri Lanka has an extent of 197.16 km<sup>2</sup> of mangroves representing a linear coverage of 18.21% of the coastline. However, increasing natural and anthropogenic disturbances have imposed a question on their sustainability. Available literature proposes that north and north east coast holds the second largest mangrove forest in the island (Karunathilake, 2003), yet they are understudied in terms of diversity,

abundance and ecological functions. Proactive mangrove conservation and protective actions requires science-based inputs at local and regional levels (Sreelekshmi, et al., 2021). Unfortunately, prospective regional data in north and east is not abundantly available to implement mangrove monitoring and conservation activities. Considering all these facts, the present study aimed to investigate the floristic structure, phytosociology, and the ecological linkage of floral assemblages in a mangrove forest in Trincomalee, with respect to their geographical distribution and extent; and to propose a methodology to be adopted for their sustainable management.

## MATERIALS AND METHODS

### Study area

The site selected for the purpose of the study was Trincomalee and it is situated in the eastern coast of the Sri Lankan island. Trincomalee was chosen because of the abundance of mangroves in the respective area yet they have not been widely reported in past literature. It belongs to the dry zone of the country with its climate mostly affected by the Northeast monsoon. The landscape is surrounded by Tambalakam Bay and Trincomalee Bay in the adjoining (Figure 1). All the selected sites were naturally occurring mangroves and exposed to varying degrees of human disturbances including fisheries activities, land-use changes and pollution.

### Floristic survey

Floristic survey was carried out at 10 stations in the selected site (n=10; P1-P10) in late December 2019. The stations were selected primarily based on the mangrove floral density and accessibility.

### Species composition and nomenclature

The present study followed Pinto, 1986 for species identification and nomenclature.

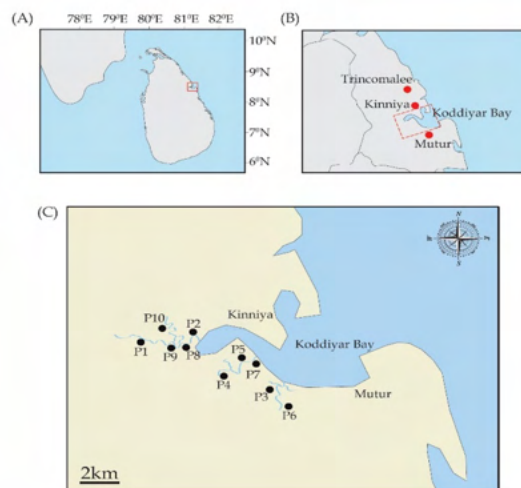
### Structural analysis

Fixed plot measurement was used for the characterization of the structural attributes of true mangroves based on the methods suggested by Snedaker, 1986. Mangrove floral vegetation was studied using 10m wide belt transects of varying lengths (depending on the mangrove density) in randomly selected points at the creek and inland areas of the tributaries. Quadrat method was used for the structural analysis of true mangrove flora. Transects were laid perpendicular to the High Tide Line (HTL); from the estuarine zone towards the landward margin. All the plots were fixed more than 5m away from adjacent plot to avoid spatial autocorrelation. Within each transect, quadrats (10m x 10m) were placed for the purpose of species identification. Each species in the quadrat were identified, enumerated and documented.

### Forest characteristics

Diameter at breast height (DBH) was recorded for overstory trees with DBH>5 cm in each subplot. Diameters were measure to the nearest 0.1 cm using the measuring tape. Dimeter measurements were adjusted to accommodate mangrove morphology as necessary; measurements were taken just above buttresses or the highest prop root, exactly 1.3 m from the ground (Kauffman & Donato, 2012).

**Figure 1.** (A) Map showing the study area, (B) location of Trincomalee and (C) sampling stations in the natural mangrove forests of Trincomalee, Sri Lanka



### Environmental parameters

Subsurface water samples (at least 3 at each point) were collected from the site at the points of the transects (n=30). The water temperature was recorded in the field using a standard degree centigrade thermometer. The water pH was measured with a digital pH probe (Voniry make, Model No. 8541957750), electric conductivity by a laboratory Eh meter (ECscan20 conductivity tester), dissolved oxygen with a digital DO meter (JPB-607A dissolved oxygen meter/Analyzer) and salinity by a portable refractometer (BIOBASE make, Model No. Bk-Pr32).

### Statistical analysis

Biodiversity of the mangrove stands were analyzed with various diversity indices including Shannon diversity ( $H'$ ), Pielou's evenness ( $J'$ ), Margalef species richness ( $d'$ ). Taxonomic diversity ( ) (Sreelekshmi, Nandan, Kaimal, Radhakrishnan, & Suresh, 2020) calculated to assess the taxonomical profile of the site. Apart from these indices niche width (Levins, 1968) and important

value index (IVI) (Nabi A, 2012) was also calculated.

Cluster analysis (CA) was performed based on the Bray-Curtis dissimilarity matrix. Multiple response permutation procedure was applied to check for significant differences between the clusters. Non-metric Multi-Dimensional Scaling (NMDS) was used to place the sampling stations in two-dimensional spaces based on the same similarity matrix used for CA to provide information on dominant species. The key environmental factors determining the pattern of mangrove assemblages were determined with a distance-based redundancy analysis (dbRDA). Representative relationships delineated by dbRDA were then tested using canonical analysis of principal coordinates (CAP), to place mangrove assemblages along the environmental gradient. Community structure was analyzed with PRIMER v6 (Clarke & Gorley, 2006) while other quantitative data were analyzed using SPSS 17.0.

## RESULTS AND DISCUSSION

### Floristic distribution and mangrove diversity

Species diversity is a measure of complexity in form and structure. Diversity can be correlated with different variables such as productivity, stability, maturity, predation pressure, evolutionary time and spatial heterogeneity. It is important for protection and conservation of natural vegetation which is increasingly threatened due to forest cutting for industrial and urban expansion (Sreelekshmi et al., 2021). The species composition of the natural mangrove stand in Trincomalee and the structural details from the present study are given in the Table 1. A sum of five mangrove species identified from five families.

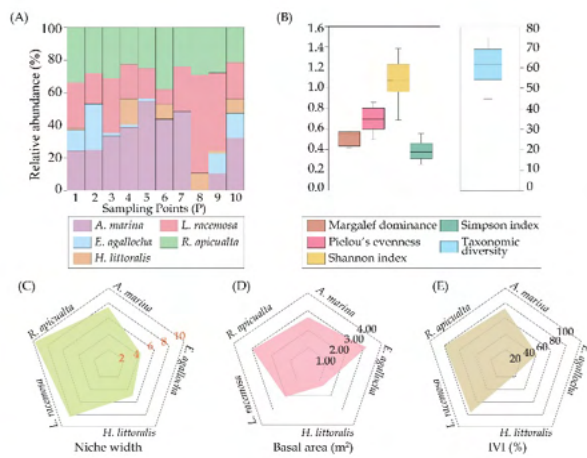
*Lumnitzera racemosa*, *Rhizophora apiculata* and *Avicennia marina* were found frequently throughout the study site (Figure 2A). The vegetation structure was mostly a composition of naturally old mangrove stand with trunk diameters ranging from 5.00 to 17.74 cm and with basal area ranging from 1.4252 to 2.6687 m<sup>2</sup> (Table 1). *A. marina* showed higher stocking density in the site (610 no. ha<sup>-1</sup>) followed by *L. racemosa* (515 no. ha<sup>-1</sup>).

Vegetation structure refers to the spatial stand extent, structure and composition of the vegetation in a forest community (Dahdouh-Guebas, et al., 2011). Overstory trees dominated the mangrove stocking in the Trincomalee area. The important value index (IVI) explains the dominance of a particular species on the study area (Nabi A, 2012) while niche width is used to understand the species' tolerance to a particular site (Sreelekshmi et al., 2021). *A. marina* and *R. apiculata* showed higher IVI values; 98.41% and 72.32%, respectively (Figure 2E). On the other hand, *R. apiculata* showed higher niche width (9.77) followed by *L. racemosa* (8.23) (Figure 2C). Of all the species, *Heritiera littoralis* showed the least stocking density (34 no. ha<sup>-1</sup>), and IVI (13.62%) but lowest niche width was shown by *Excoecaria agallocha* (2.38).

The site exhibited poor diversity of species and uneven distribution, overall (mean  $H' = 1.08$ ;  $J' = 0.70$ ;  $d' = 0.52$ ). Highest Shannon index and lowest Simpson index recorded in station 2, which also recorded higher number of individuals of all species. The site showed lower values of Pielou's evenness (0.49-0.86). This is primarily due to the lack of species variation in the mangrove stands. The overall taxonomic index 61.48. The diversity indices undeniably concluded that the natural mangrove stand in Trincomalee had low species diversity comparing to other

stands in the eastern region (Mathiventhan & Jayasingam, 2012)

**Figure 2.** Structural diversity and community ecology of the site surveyed. (A) Total species abundance (given as relative abundance (%)), (B) ecological quality represented by diversity indices, (C) Niche width, (E) basal area (m<sup>2</sup>), and Important Value Index (IVI %) of the mangrove species identified in Trincomalee



**Table 1.** List of true mangrove species identified in the Trincomalee mangrove forest, their scientific nomenclature, and their structural attributes

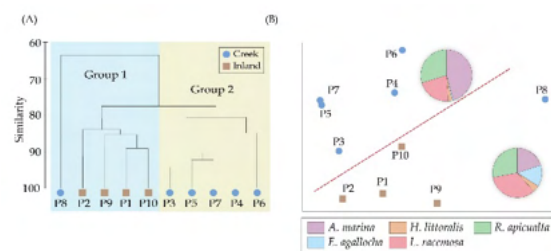
Family	Species (with taxonomic nomenclature)	Niche width	Density (no. ha <sup>-1</sup> )	Basal area (m <sup>2</sup> ha <sup>-1</sup> )	IVI (%)
Acanthaceae	<i>Avicennia marina</i> (Forssk.) Vierh.	7.75	610	3.2066	98.41
Euphorbiaceae	<i>Excoecaria agallocha</i> L.	2.38	125	3.2631	37.95
Malvaceae	<i>Heritiera littoralis</i> Dryand.	5.07	34	1.4252	13.62
Combretaceae	<i>Lumnitzera racemosa</i> Willd.	8.23	515	2.2740	77.7
Rhizophoraceae	<i>Rhizophora apiculata</i> Bl.	9.77	460	2.6687	72.32

### Spatial distribution of mangrove assemblages

The ordination of mangrove assemblages using CA and nMDS clearly showed that the vegetation patterns differ significantly between the creek and inland (ANOSIM = 0.760,  $p < 0.05$ ). The cluster results were primarily divided into two groups: Group 1 and 2 (Figure 3A). Group 1 comprised of

stations P1, P2, P8-P10 whereas the rest were included into Group 2. In general, terms Group 1 represented creek vegetation while Group 2 represented an inland vegetation structure.

**Figure 3.** Illustration of the mangrove community structure in the study site (A) Cluster analysis based on Bray-Curtis similarity (75%) and (B) Non-metric multidimensional scaling (nMDS) providing information of relative species abundance in clusters



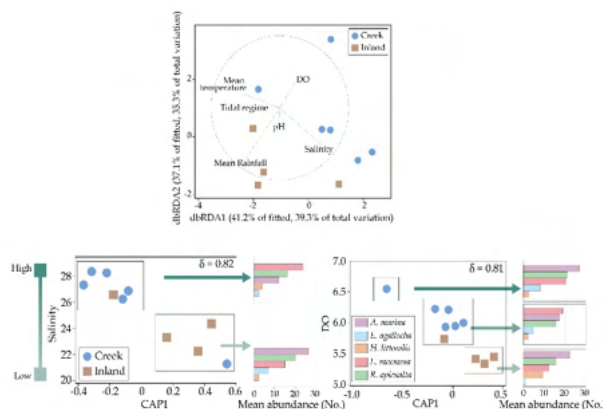
Although the diversity tends to remain the same between sampling points, richness and abundance of specific species vary widely between the two clusters. The nMDS performed based on the Bray-Curtis similarity to view the results of the cluster on a clearer perspective and as an outcome of species abundance (Figure 3B). The results showed that there is a clear distinction of the abundance of mangrove species in relation to zone preferences. While, *R. apiculata*, *L. racemosa* and *A. marina* seem to relatively equally occupy Group 1, *A. marina* dominated group 2. This can be attributed to their adaptability to specific ecological factors, especially salinity gradient. In the nMDS space, group 1 had a relatively wider distribution compared to that of group 2. This could be attributed to the ecological factors such as high water salinity and tidal wash off that drives the inland vegetation structure.

### Key factors influencing spatial patterns of mangrove assemblages

Of the many factors analyzed, DistLM showed that salinity, dissolved oxygen

(DO), tidal amplitude accounted for significant variations in mangrove assemblages across the sampling sites. Collectively these variables explained 56% of the total variability in mangrove assemblages. Thus, changes in the ecological status relevant to salinity and DO would change the vegetation structure, drastically. The dbRDA showed how the variability changes across the sites, with first and second axes showing 78.3% of the variability (41.2% and 37.1%, respectively) (Figure 4A). Of all the environmental factors, salinity, DO and rainfall were key factors controlling the mangrove assemblages, explaining the spatial distribution of species in the creek and inland regions.

**Figure 4.** (A) Distance based redundancy analysis (dbRDA) ordination based on environmental parameters and mangrove abundance. (B) Variation in mangrove assemblages along the canonical gradient in relation to salinity and DO; bar graph on the right indicated proportional abundance of mangrove taxa.



The mangrove assemblages were clearly distributed in relation to the environmental variables (Figure 4B). Salinity and DO clearly changed in relation to mangrove assemblages, with canonical correlations of 0.82 and 0.81, respectively. At lower salinity, *A.marina* was observed in high amounts, while *L. racemosa* seems to restrain higher salinity values. On the other hand, *Rapiculata*

seems to survive through the sites despite the salinity extremities. This attributes of change in species composition due to salinity variation indicates that the ability to adapt to low salinity levels across taxonomic groups (Morrisey et al., 2010). The inconsistent changes to the mangrove community in relation to environmental parameters might be attributed the greater influence of fresh water inflow and the salinity gradient (Alongi, 2008). This could also be attributed to their location in the water-land gradient i.e. creek or inland (Mitra, Sengupta, & Banerjee, 2011). The unique habitats and plant ecophysiological adaptations of mangrove forests give them a unique ecological complexity and differentiate them from any other terrestrial forest ecosystems in the same region. Mangrove species diversity is also influenced by change in physico-chemical properties of soil (Alongi & Mukhopadhyay, 2015).

The Trincomalee mangroves are presently vulnerable to various factors including human disturbances, tourism, pollution, industrialization, urbanization and coastal erosion. With increasing anthropogenic pressure, the mangrove could degrade in the near future. Action should be taken to conserve and protect the mangrove forests in a way to sustain their ecological stability and dynamics.

## CONCLUSIONS

The present study has identified a heterogeneous mixture of five true mangrove species in the Trincomalee marsh, dominated by *A. marina* and *L. racemosa*. Though the vegetation structure is poor and low in diversity, the mangroves do possess potential economical and ecosystem services. Moreover, the mangrove stand characteristics showed prominent significant relationships with the edaphic factors such as salinity, dissolved oxygen

and tidal amplitude. The data presented could be used as an effective tool in habitat preference for restoration programs. Hence, we emphasize the relevance of regular monitoring of the environmental parameters playing a significant role in the natural mangrove rejuvenation as well as various structural attributes, for adopting effective restoration and management methods of these dwindling ecosystems.

### Competing interests

The authors declare no conflicts of interest.

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## Biotive Molecules in Canadian Gooseberry and Blackcurrant

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### ABSTRACT

Wild berry varieties are widely distributed in Canada and are mainly used by the indigenous population as food. Gooseberries and blackcurrants are the two tart berries with a strong taste that are used to make preserves such as jams, jellies, and wines. Fruits such as berries provide significant health benefits because of bioactive compounds and their high antioxidant properties. Phenolic compounds and fatty acids are the predominant bioactive metabolites present in these berries. Recently, researchers are more interested in exploring the fruits such as berries for functional properties that benefit human health. However, research evidence related to the profiling of bioactive molecules in these wild berries such as Canadian gooseberry and blackcurrant is limited. These traditional wild berries may help to address the issues related to indigenous populations' food insecurity and chronic diseases. In this study, we assessed and compared the bioactive phenolic and fatty acid composition in these two berries using liquid and gas chromatography and mass spectrometry. The cyanidine glucoside, which is a polyphenolic anthocyanin present in blackcurrant is significantly higher compared to that in Canadian gooseberry. However, fatty acids such as oleic acid, linoleic, and alpha-linolenic acid, which are important in cardiovascular health, are present in both blackcurrant and gooseberry. Further characterization of these berries for antioxidant activity, bio-accessibility, and bioavailability studies will improve the value of these two types of wild berries to harness their full potential as a functional food.

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## INTRODUCTION

Maintaining health and disease prevention are major goals driving today's consumer food choices, and there is an ever increasing demand for "healthier" or "functional foods". By definition, functional foods are "foods or part of foods" that provide medicinal or health benefits beyond basic nutritional requirements (Adefegha 2018; Gul et al., 2016). Fruits such as berries are an abundant source of bioactive molecules providing health benefits because of their high antioxidant, vitamin, mineral, polyphenol, lipid, and fiber content (Gnanavinthan 2013). The continuing demand for "functional foods" leads to food processors in search of edible crops with high quality. For example, fruits that have a significant amount of bioactive compounds possess antioxidant, antimicrobial, anti-inflammatory, and anti-tumorigenic activities (Ono et al., 2020) and potentially have health promoting effects when consumed regularly.

The American Heart Association (AHA) recommends that adults eat four to five servings of fruit per day. However, a recent study showed that the higher prices of healthy food in rural and remote communities compared to urban centres, make healthy food "beyond the reach of many families" (Wright 2019). With the rising cost of healthy foods, it is important to identify healthy and functional foods from wild varieties that are easily accessible to rural and remote communities. In addition, it has been suggested that access to traditional food such as wild berries would help to address the disproportionately high rates of indigenous populations' food insecurity and chronic diseases (Wright 2019).

Out of 200 species of small, fleshy, wild berries currently found in Canada, native edible wild blackcurrants (*Ribes americanum*) are attractive true berries with a nice fall colored shrub (Figure 1A). About 14 species of currants are found in Canada belonging to the *Ribes* genus in the *Saxifragaceae* family. These berries are red or bluish or black in colour and the plants do not have thorns or prickles (Turner 2009). Another one is the Canadian gooseberry (*Ribes oxycanthoides* in *Grossulariaceae* Family), a wild variety (Figure 1B) that grows across the boreal region of Canada from

Hudson Bay to Alaska (Carey 1995). These plants have thorns or prickles on their stems and the berries are reddish to dark purple in colour. Many indigenous populations collect and store these berries as a food source. For example, the Ojibwa communities use these berries along with sweet corn and turn them into preserves such as jelly. Although some studies are available on Indian gooseberries (*Phyllanthus emblica*), documented research on Canadian gooseberries is scarce.

The health benefits of fruits are attributed to their phenolic compounds, which are secondary metabolites of plant metabolism. The bioactive phenolics in various berries include flavanoids (anthocyanins, flavonols and flavanols), condensed tannins, hydrolysed tannins, stilbenoids, phenolic acids and lignans (Manach et al., 2004). There is ample evidence to suggest an association of berry phenolics with health benefits. For example, epigallocatechin, epicatechin gallate, gallic acid, tannic acid, epicatechin gallate, geraniin, quercetin, and rutin have been reported to have anti-mutagenic

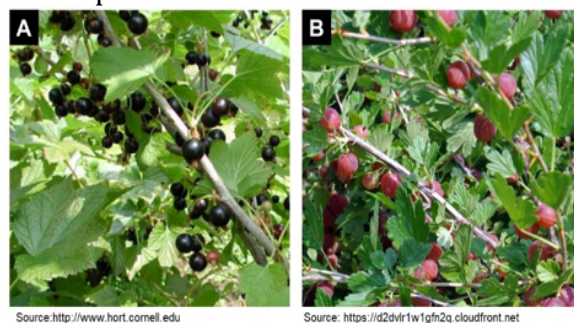
properties (Bhargava and Westfall, 1969; Kumar et al., 2018). In addition, many lipid groups in berries (unsaturated fatty acids, sterols, terpenoids and others) have also demonstrated high biological activity and potentially be important contributors in cardio-metabolic health. Berry seed oils are found to be concentrated with essential polyunsaturated fatty acids and other bioactive compounds including sterols and phenolic compounds and are known to possess cardio-protective functions in aged rats (Charnock et al., 1994 Jurgo ski, et al., 2018).

Parker et al., (2014) found that blackcurrant fruits contain two major anthocyanins, delphinidin and cyanidin. These two anthocyanins occurred as glucoside and rutinoside conjugates while other anthocyanins constituted a smaller fraction. The authors also noted the differences in anthocyanin contents between various cultivated blackcurrant varieties.

Blackcurrants are also considered a good source of lipids such as polyunsaturated fatty acids (Basegmez et al., 2017). Hence, further evaluation of not only cultivated varieties but also wild ones will help harness the full potential of these berry fruits that have promising health benefits. Investigating wild varieties also provides insights into unexplored germplasm for breeding purposes (Migicovsky and Myles, 2017).

In this study, we investigated the bioactive composition of Canadian gooseberry and blackcurrant with a primary focus on phenolics and fatty acids compounds.

**Figure 1.** Canadian black currant (wild variety) (A) and gooseberry (B) plants with ripened berries.



## MATERIALS AND METHODS

### Sample collection

*Ribes americanum* and *Ribes oxycanthoides* berry fruits were collected in their reddish purple colour stage from various locations including parks and landscapes in Winnipeg, in the province of Manitoba, Canada. Fruits were washed, freeze-dried and stored at -80°C within 24 hours until further analysis. A composite sample was prepared by grinding the freeze-dried sample and the ground material was used for the extraction of phenolic and fatty acid compounds.

### Sample extraction

**Phenolic compounds:** Metabolites from freeze-dried and homogenized samples were extracted using the methodology adopted from Hosseinian et al. (2007), Olas et al. (2018), and Rozalska et al. (2018). Briefly, sample material (2 g) was homogenized using a handheld homogenizer in a bath of 10 mL ethanol: water (80:20 v/v) in 50-mL centrifuge tubes. Then the extract was subjected to liquid-liquid extraction by addition of *n*-butanol and shaking the mixture vigorously. The mixture was dried by evaporating *n*-butanol and re-suspended in a solvent mixture of ethanol: water (80% v/v) and sonicated (1 h). Then the mixture was centrifuged (14000 rpm for 25 min) to separate the solvent and fruit material (pellet). The supernatant,

containing phenolic compounds, was separated, filtered, and evaporated to complete dryness, using a rotatory evaporator. The dried residue was resuspended in 2 mL ethanol: water (80:20 v/v). This constituted the polar fraction of phenolic compounds. The pellet from the earlier step of centrifugation, consisting of mainly non-polar metabolites was resuspended in ethanol, and dried using a rotatory evaporator. The residue was resuspended in a mixture of tert-butanol and water (non-polar fraction). Both polar and non-polar fractions together were fortified with labelled internal standards before analysis.

**Fatty acids:** Samples were extracted for fatty acids using a one-step extraction-methylation protocol adapted from (Carvalho et al., 2011, Vrinten et al., 2005) with some modifications. Briefly, fatty acids in freeze-dried and ground fruit material (200 mg) were esterified using methanolic-HCl (2 mL of 3 molar/L) by incubating at 85 °C for 90 min. Methylated fatty acids esters were extracted in two steps using hexane (2 mL in each step) under dark conditions. The hexane layer (top layer) was quantitatively transferred to a new disposable glass tube and evaporated to dryness using sample concentrator (Vacufuge Plus, Eppendorf AG, Hamburg, Germany). The dried extract was resuspended in hexane (1 mL) and vortexed before transferring into a GC vial for analysis.

### **Quantification of phenolic compounds**

Sample extracts were analyzed using high resolution mass spectrometer (Orbitrap ID-X Tribrid Mass Spectrometer, Thermo Fisher Scientific, Mississauga, Canada) in positive mode, coupled with ultra-high performance liquid chromatography (UHPLC-HRMS) (Vanquish, Thermo Fisher Scientific, Mississauga, Canada). Separation of analytes was achieved using a reverse-phase biphenyl column (particle

size 2.6  $\mu\text{m}$ , 100 x 2.1 mm, Kinetex, Phenomenex, USA) held at 35 °C. Gradient elution was achieved with 100% water (mobile phase A) and 100% acetonitrile (mobile phase B) both containing 0.1 % formic acid at a flow rate of 0.25 mL min<sup>-1</sup> with a runtime of 20 min. Extract was subsequently passed through heated electrospray ionization. An orbitrap acquisition method with full scan for m/z 150 to 800 at 120000 resolution followed intensity and data dependent MS<sup>2</sup> fragmentation at 30000 resolution was used. A stepped higher-energy C-trap dissociation collision energies at 15, 25, and 35 % were used to achieve fragmentation. Method detection and quantification limits ranged from 0.1 to 0.25 ng mL<sup>-1</sup> and 0.25 to 0.5 ng mL<sup>-1</sup>, respectively. Five point (0.1 to 200 ng mL<sup>-1</sup>) calibration curves were prepared using a mixture of pure analytical standards for quantification of analytes in the extracts. Identification and quantification of analytes were performed using TraceFinder (*Software version 4.1*, Thermo Fisher Scientific).

### **Quantification of fatty acids**

Fatty acid composition of the sample extracts was determined using gas chromatography (Bruker 436-GC (Bruker Daltonics, Germany) coupled with flame ionization detector as methyl esters of fatty acids (FAMES). Fatty acid methyl esters were separated on Rt-2560 capillary column (100 m x 250  $\mu\text{m}$  x 0.20  $\mu\text{m}$ ) (Restek, USA). Helium was used as the carrier gas with a flow rate of 0.8 mL min<sup>-1</sup>. The oven was programmed with an initial temperature of 100 °C for 4 min ramping up to 250 °C at a rate of 3°C min<sup>-1</sup> and held for 8 min. Identification of FAMES was carried out by comparing the retention times with those of analytical calibration standard mix (GLC Reference standard: 463, Nu-Chek-Prep Inc, MN, USA) and the results were calculated as a percentage of the calibration standard.

Statistical analysis: Experimental data were analyzed using PROC GLM in SAS (SAS Institute, Cary, NC, USA). The least significant difference ( $P < 0.05$ ) test was used to identify significant differences among treatment means.

## RESULTS AND DISCUSSION

### Phenolic composition

Concentration of various phenolic bioactive compounds in blackcurrant and gooseberry were determined semi-quantitatively using UHPLC-HRMS (Table 1). Black currents are known to have a high concentration of flavonoids, specifically anthocyanins which provide the fruits with their purple color (Archaina et al., 2018). These winter hardy berries are considered as a rich source of phytochemicals that are potent antioxidants, antimicrobials, and have anti-inflammatory properties (Nour et al., 2013).

In our study, we detected important bioactive polyphenolic compounds in both of these Canadian wild berry types. Although most of the phenolic compounds were detected in small quantities in these two berries, the cyanidine glucoside content was abundant in both, with significantly higher amounts in blackcurrant than gooseberry (Table 1).

It has been reported that cyanidine glucosides possess significant antioxidant, antidiabetic, anti-inflammatory, and cytoprotective effects against various oxidative stress-induced disorders enhancing health benefits in humans (Rahman et al., 2021).

**Table 1.** Concentrations of phenolic and anthocyanin compounds of selected blackcurrant and gooseberry fruit extracts (composite samples of each) quantified using high resolution mass spectrometry coupled with liquid chromatography.

Bioactive Compound	Black Currant ( $\mu\text{g/g}$ Dry wt.)	Gooseberry ( $\mu\text{g/g}$ Dry wt.)
<b><i>Cinnamic acid derivatives:</i></b>		
Caffeic Acid	< LOQ*	< LOQ
Ferulic Acid	< LOD#	1
Chlorogenic Acid	< LOD	< LOD
Sinapic acid	< LOD	1
<b><i>Benzoic acid derivatives:</i></b>		
Gallic acid	1	< LOD
<b><i>Flavone:</i></b>		
Vitexin	< LOD	< LOD
<b><i>Isoflavone:</i></b>		
Genistein	< LOD	< LOD
<b><i>Flavonols:</i></b>		
Kaempferol	< LOD	< LOD
Quercetin	3	1
Rutin	15	20
<b><i>Anthocyanins:</i></b>		
Cyanidine glucoside	832	150
Luteolin	< LOD	< LOD
Myricetin	< LOD	< LOD
Pelargonidin chloride	< LOD	< LOD
Petunidin 3-O-glucoside chloride	< LOD	ND\$

\* LOQ: Limit of quantification = 2.5 ng/mL in extract;

# LOD: Limit of detection = 1 ng/mL in extract;

\$ ND: Not detected;

### Fatty acid composition

Canadian wild berries are a good source of health promoting lipids especially the unsaturated fatty acids (Szakiel et al., 2012). The mono- and poly-unsaturated fatty acids in Canadian blackcurrant and gooseberry fruits include palmitoleic acid,

oleic acid, vaccenic acid, linoleic acid, linolenic acid, eicosatrienoic acid, and eicosapentaenoic acid (Table 2). Interestingly, blackcurrants have only a few types of saturated fatty acids compared to gooseberries. For example, arachidonic acid, docosanoic acid, and lignoceric acid were not detected in blackcurrant (Table 2). According to USA Food and Drug Administration report (2018), replacing saturated fat with similar amounts of unsaturated fats may reduce the risk of heart diseases. Therefore, wild blackcurrant will be a good source of unsaturated fatty acids.

**Table 2.** Fatty acid composition of selected blackcurrant and gooseberry extracts (composite samples of each) using gas chromatography coupled with flame ionization detector quantified as fatty acid methyl esters. Values represent mean of 3 samples  $\pm$  standard deviation).

Fatty Acid Composition	Blackcurrant (%)	Gooseberry (%)
<b>C16:0</b>	15.6 $\pm$ 1.7	11.2 $\pm$ 1.1
<b>C16:1</b>	2.9 $\pm$ 0.2	ND*
<b>C18:0</b>	1.4 $\pm$ 0.1	0.8 $\pm$ 0.1
<b>C18:1n9</b>	12.5 $\pm$ 1.9	8.6 $\pm$ 0.9
<b>C18:1n7c</b>	3.6 $\pm$ 0.4	0.8 $\pm$ 0.0
<b>C18:2n6</b>	18.2 $\pm$ 2.1	15.0 $\pm$ 1.6
<b>C18:3n3</b>	20.3 $\pm$ 1.1	1.1 $\pm$ 0.1
<b>C20:0</b>	ND	1.0 $\pm$ 0.1
<b>C20:5</b>	1.5 $\pm$ 0.1	2.8 $\pm$ 0.8
<b>C20:3n3</b>	1.0 $\pm$ 0.0	2.1 $\pm$ 0.4
<b>C22:0</b>	ND	0.9 $\pm$ 0.5
<b>C24:0</b>	ND	2.7 $\pm$ 0.7

\*ND: Not detected

C16:0 palmitic acid; C16:1 palmitoleic acid; C18:0 stearic acid; C18:1n9 oleic acid; C18:1n7c vaccenic acid; C18:2n6 linoleic acid; C18:3n3 linolenic acid; C20:0 arachidonic acid; C20:5 eicosapentaenoic acid; C20:3n3 eicosatrienoic acid; C22:0 Docosanoic acid; C24:0 lignoceric acid.

It would be useful to assess and compare both wild and commercially produced cultivars of blackcurrants and gooseberries for their bioactive composition. Most importantly, a comparative study between wild and cultivated varieties will help explore the untapped potential of wild berries in terms of health benefits to humans. Recent studies have shown a link between the consumption of fruits rich in polyphenolic compounds and lipids, with reduced incidence of chronic and degenerative diseases, such as cardiovascular disease, cancer and neurological disease (Ono et al., 2020). These studies may potentially support the use of Canadian wild berries as a good source of antioxidant bioactive compound that promote health benefits.

## CONCLUSIONS

Wild blackcurrants and gooseberries grown in Winnipeg, Manitoba, Canada could be very good sources of bioactive phenolics and fatty acids with potential health benefits. Comprehensive and broader characterization of bioactive molecules of these berries would benefit in understanding the relative bioactive composition changes and the influence of environmental conditions/geographic areas on bioactives. In addition, a comparison of the wild varieties with the cultivated ones would help harness the benefits by providing valuable information in the breeding process.

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## Characteristics of Fibre Extracted from Leaves of Banana (*Musa spp.*) Cultivar Ambun

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### ABSTRACT

Production processes are now shaping toward the concept of environmental-friendly and sustainable development. Waste biomass of various plants are widely utilized to extract natural fibers to be used in a diversified range of applications. Among these plants, banana carries a vast potential for extracting fibers from its pseudostem and leaves. In this study, fibers from leaves of banana cultivar Ambun (AAA) at harvesting stage were extracted by a decorticator machine. Fresh weight of the leaves (as mid ribs and leaf blades separately) used for extraction was measured. During fiber extraction, mid ribs of banana leaves were fed to the decorticator as they were, and parts of leaf blades were folded before feeding to the decorticator. After extraction, the fibers were hung up to air dry and the dry weight was measured. The yield of the fibers was influenced by the part of the banana leaf. Fiber extracted from mid ribs showed a significantly high amount of fiber compared to fiber extracted from leaf blades. The fiber quantity was 4.25 g of dry fiber per 100 g of fresh mid ribs whereas 0.88 g of dry fiber per 100 g of fresh leaf blades. The highest average tensile strength (breaking load of 1.34 N) was shown by the fiber separated from the mid ribs. Therefore, mid ribs can be suggested as the most economical part of the leaves of Ambun cultivar in extracting fibers due to its higher strength and quantity parameters for making use in fiber-based industries.

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## INTRODUCTION

Banana leaves (40 million tons, Mt/yr) rachis and pseudostems are few of the major agricultural residues and a key component of solid wastes around the world (Shah et al., 2005). Such waste provides obtainable sources of fibers, which helps to reduce synthetic fiber production. The properties of banana fiber such as good absorbance and high tensile strength make them usable in various industries (Pitimaneeyakul, n.d.). Different parts of banana trees provide different benefits, including fruits as food sources, leaves as food wrapping, and stems for fiber and paper pulp (Pitimaneeyakul, n.d.).

In a banana leaf, fibers are lignocellulosic in nature with a diameter of 5.6–11  $\mu$ m with an external wall thickness of 2.2  $\mu$ m consisting of helically arranged cellulose microfibrils in an amorphous matrix of lignin and hemicellulose (Gan et al., 2008; Mukhopadhyay et al., 2008). Banana leaf fibers consist of  $\beta$ -(1-4)-D glucose and the cellulose chains are arranged in crystalline microfibrils surrounded by non-cellulosic matrix (Zuluaga et al., 2007). The non-cellulosic matter consists of 25–30% protopectin, 1–2% insoluble pectin, 20–25% hemicellulose and 10–12% lignin, the rest being cellulose (Shah et al., 2005).

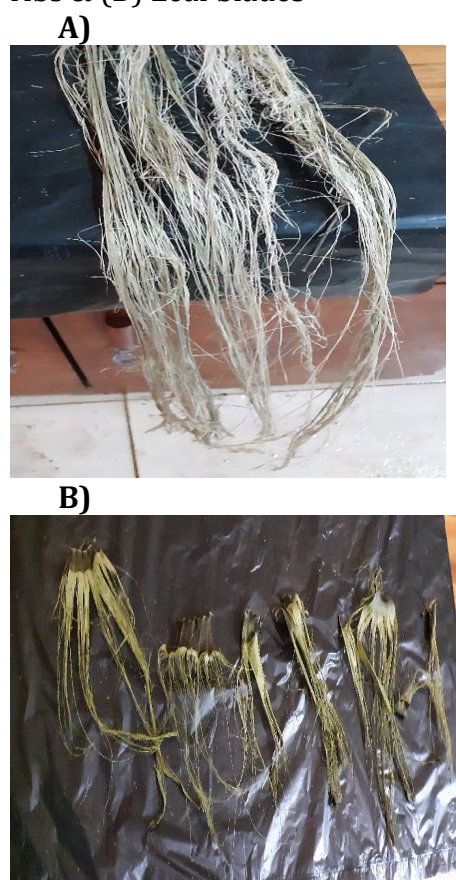
There is a lack of scientific data on variation of quality and quantity of banana fiber with different cultivars and different plant parts in different localities. Hence, the proposed study compares the amount of extractable fiber and the tensile strengths of two plant parts of a commonly grown banana variety in Sri Lanka. The extraction of fiber from the pseudostem is a common practice and leaves are used rarely for production of fibers. The yield of the fibers and tensile strength provide important hints regarding their utilization

in various products. In the present study, Ambun (AAA) was selected as the cultivar to extract fibers as this cultivar is extensively cultivated in Sri Lanka. The properties of fiber were studied quantitatively and qualitatively and a comparison study was done between the fibers extracted from different leaf parts; mid rib and leaf blades.

## MATERIALS AND METHODS

The banana leaves of the Ambun were collected from plants of harvesting stage from Intermediate Zone (IM1a) of Sri Lanka. Nine leaf samples were taken from 3 different locations. Banana leaves were separated for leaf blades and mid ribs. Fresh weight of the mid ribs and leaf blades used for extraction was measured. Mid ribs were cut to 1 m length pieces. Leaf blades were scraped, stacked, folded and rolled so that they would squeeze well. Then they were inserted between two blades called the squeezing roller and scraper roller of the fiber decorticator/raspador machine to extract the fibers. Manual combing was done to remove the excess pith from the fiber extracted from both leaf parts. Finally, fibers were allowed to dry in sunlight and dry weight measurements were taken. Fiber yield percentage was calculated by taking the grams of dry fiber per 100 grams of fresh mid ribs or fresh leaf blades. The mechanically extracted fibers were tested for the tensile strength using TA.XTplusC Texture Analyser with A/TG Grips using 5 kg load cell. Means were compared using Tukey test at  $p < 0.05$  probability.

**Figure 1.** Fibers extracted from (A) Mid ribs & (B) Leaf blades



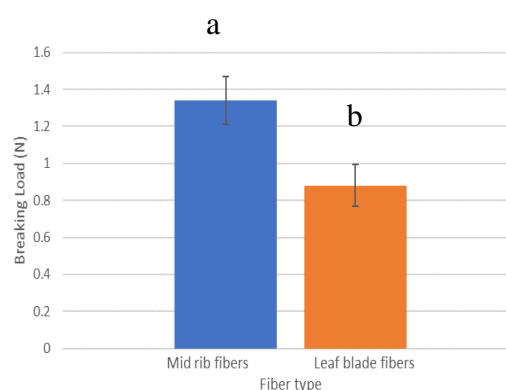
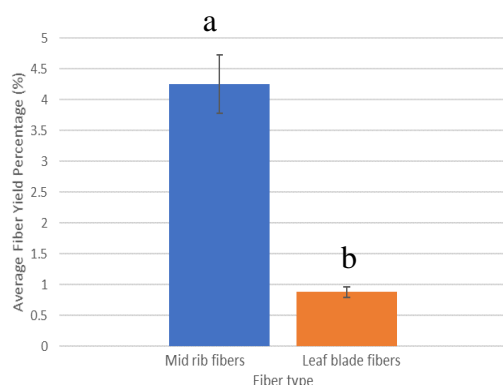
As depicted by Figure 2, the average fiber yield percentage was influenced by the leaf part. The average percentage of fiber yield was significantly different ( $p < 0.05$ ) between midribs and leaf blades. The higher average percentage of fiber yield (4.25%) was shown by the mid rib fibers of Ambun plants at harvesting stage

The highest average breaking load (1.34 N) was also shown by the mid rib fibers as shown by Figure 3. The main residual wastes of the banana crop are leaves and pseudostem; each composed of high amounts of lignocellulose. The lignocellulosic composition varies within the same plant cultivars and species, and according to the agroclimatic conditions (Manilal and Sony, 2011).

**Figure 3.** Average breaking load of fibers extracted from two plant parts of Ambun Cultivar; Means that do not share a same letter are significantly different. Error bars denote the standard error.

## RESULTS AND DISCUSSIONS

**Figure 2.** Average percentage of fiber yield from two plant parts of Ambun Cultivar Means that do not share a same letter are significantly different. Error bars denote the standard error.



When comparing the pseudostems and leaves, pseudostems show a better average percentage of fiber yield of 13.72 g of dry fiber per 100 g of fresh pseudostem sheaths for banana plants in harvesting stage (Priyadarshana et al., 2020). According to the present study, plant fibers of the same variety but of two parts of the leaf also showed different average percentages of fiber yield and different breaking loads. Therefore, it is

possible that the different lignocellulosic compositions in different parts of the same plant may have affected the different average percentages of fiber yield and different breaking loads

## CONCLUSIONS

The highest average tensile strength (breaking load) and the highest average percentage of fiber yield were recorded by the fibers extracted from mid ribs of Ambun plants at their harvesting stage. Therefore, mid ribs can be suggested as the most economical part of the leaves of the Ambun variety to extract fibers due to its higher quality and quantity parameters for making use in fiber-based industries. However, total fiber production measurements from different leaf parts of the banana plant under different conditions also need to be taken into consideration before making a solid recommendation.

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## Effect of Three Types of Biochar in Cocopeat Medium on Shoot Cutting Production of Chrysanthemum

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### ABSTRACT

Biochar is a popular growing media amendment that increases fertilizer and water use efficiency, nutrient retention and crop productivity in floricultural crops. In Sri Lanka, cocopeat is used as the major growing medium for most of the floricultural crops. Therefore, the objective of this study was to incorporate biochar as a potential media amendment to improve the performances of plants through the enhancement of media properties. The performance of Chrysanthemum (*Dendranthema grandiflora*) was tested in amended media, as Chrysanthemum shoot cuttings is one of the most important floricultural products exported from Sri Lanka. The experiment was conducted with four treatments: B1 - 80% Coir dust+ 20% paddy husk biochar (v/v); B2 - 80% Coir dust+ 20% coconut shell biochar (v/v); B3 - 80% Coir dust+ 20% pine wood biochar (v/v) and C - 100% Coir dust (control). Incorporation of biochar significantly ( $p < 0.05$ ) changes pH, electrical conductivity (EC) and water holding capacity (WHC) of the growing medium. Compared to the control, the time taken by Chrysanthemum shoots to reach standard size and quality did not show a significant ( $p > 0.05$ ) difference in B1 while B2 and B3 showed significant ( $p < 0.05$ ) differences. The number of shoots produced per plant three weeks after the first pinching and the post-harvest life and rooting performance was not significantly ( $p > 0.05$ ) different among treatments. The incorporation of biochar into the coir dust growing medium for Chrysanthemum showed promising results which need to be assessed using other substrates and different mixing ratios.

## INTRODUCTION

With the increasing concern on health and environmental impacts of growing media/ container substrates and their cost, alternative growing media are gaining popularity (Choi et al., 2018). Different plant-based substrates have been tested as alternative materials for horticultural crops (Choi et al., 2018). Out of them, biochar is one of the most common and widely used soil amendments that increases soil organic carbon, nutrient retention and crop productivity (Majumder et al., 2019).

Biochar is a product of burning plant materials such as grass, agricultural residues and forest residues (biomass) in a controlled specific process called pyrolysis (Choi et al. 2018). During the pyrolysis process, the physical and chemical properties of biomass are converted to highly porous, stable, carbon-rich material called as biochar. Due to its wide range of benefits, it is used in horticultural crop production (Nemati et al., 2015) and floriculture (Álvarez et al., 2017).

In Sri Lanka, several types of floricultural crops are cultivated with the aim of exporting. Most of the floricultural crop growers in Sri Lanka use only cocopeat as the growing medium. Therefore, the incorporation of a potential media amendment such as biochar may improve the performances of the plant through the enhancement of media properties such as fertilizer use efficiency and water use efficiency which are important for the quality of the product.

The impact of biochar on different floricultural crops has been evaluated previously (Choi et al. 2018). In this study, Chrysanthemum (*Dendranthema grandiflora*) was selected as the experimental plant because

Chrysanthemum shoot cutting is one of the most important floricultural products exported from Sri Lanka. Shoot yield, its quality and postharvest performances are the most important attributes of Chrysanthemum shoot cutting production.

Therefore, this study was conducted to evaluate the selected biochar types in cocopeat medium on yield and postharvest performance of Chrysanthemum shoot cuttings under tropical greenhouse conditions. Some of the selected properties of cocopeat medium amended with different biochar types were also evaluated.

## MATERIALS AND METHODS

### Location details

The experiment was conducted at the semi-automated greenhouse complex of Ceylon Foliage (Pvt) Ltd, Boralanda (6.84° N, 80.87° E) during the mid-July to October 2020. The experimental site belongs to the Up Country Intermediate Zone (IU3). The temperature of the area varies from 23 to 27 °C in the daytime from 13.5 to 17 °C in the night.

### Experimental details

Chrysanthemum (*Dendranthema grandiflorum*), variety 'Energy Splash' were used in this experiment. Chrysanthemum plants were raised in a nursery for three weeks and transferred to pots of 10 cm diameter. Ten pots were used in each treatment as replicates. Three treatments were used as follows,

Treatment 1: B1 - 80% coir dust + 20% paddy husk biochar (v/v)

Treatment 2: B2 - 80% coir dust + 20% coconut shell biochar (v/v)

Treatment 3: B3 - 80% coir dust + 20% pine wood biochar (v/v)

A 100% coir dust was used as the control (C). A completely randomized design (CRD) was used for the experiment in the semi- automated greenhouse. All other conditions except treatments were maintained as homogeneous as possible.

### **Biochar and media preparation**

Three types of biochar were prepared by pyrolyzing paddy husk, coconut shell and pine wood. The average particle size of biochar was 0.7 cm. Plant media was prepared by mixing biochar of 20% of the volume of pots (around 50 cm<sup>3</sup>) with coir dust.

### **Plant establishment and aftercare operations**

Chrysanthemum cuttings with 4 leaves and the apical bud (around 5 cm) were used for propagation. Plug trays were filled with standard coir dust and cuttings of the same size were established in plug trays. Then trays were kept in the misting room for rooting under high relative humidity and low light intensity. After one week, well-rooted cuttings were transferred to the hardening area. After 2 weeks of hardening, cuttings were transplanted in 10 cm diameter pots.

Plants were irrigated manually once a week. All the plants were fertigated equally with recommended fertilizers under recommended electrical conductivity (EC) levels.

### **Data collection**

The pH and EC levels of media were measured using standard methods. The water holding capacity (WHC) of the media was calculated using the following equation.

$$WHC = \frac{\text{irrigated water volume} - \text{leachate volume}}{\text{irrigated water volume}} \times 100$$

As plant data, the number of new shoots, quality shoots (standard size: 6-7 cm, 4-5 leaves with bud and without

malformations and pest and diseases) and leaf colour of new shoots after the first pinch were determined. The leaf color was compared with a standard quality shoot of the same variety. The time taken by shoots to reach the standard size (6-7 cm, 4-5 leaves with bud) was also measured.

Post-harvest life of shoots was taken after three weeks of the first pinch. One shoot from each replicate was harvested and kept in a cool room for 2 weeks. Then shoots were transplanted in plug trays according to the treatment and were kept in misting area. Then the length of post-harvest life (days) were determined.

Postharvest life: Shoots stored under cool temperature for 2 weeks were then planted in plug trays in cocopeat medium. The number of plants established was calculated as a percentage and it was considered as a measure of postharvest performance.

At the end of the experiment, plants were carefully uprooted, cleaned by washing using running water and air-dried. Roots were dried in an oven at a temperature of 60 °C until constant weight and the dry weight of roots were measured.

### **Data analysis**

The data were analyzed for one-way ANOVA procedure using SAS 9.0 statistical package at 95% probability level.

## **RESULTS AND DISCUSSION**

### **The pH and electrical conductivity of the medium**

The summary statistics of pH and electrical conductivity (EC) of the medium are shown in Table 1. When consider the average values throughout the study period, the significantly ( $p < 0.05$ ) highest pH value was reported from B2 (8.3). Two other treatments did not show a significant difference ( $p > 0.05$ ) with the

control. In EC, Treatments B1 and B2 have shown significantly ( $p < 0.05$ ) higher EC values compared to the control.

**Table 1.** Summary statistics of pH and electrical conductivity of the medium

Parameter	Treatment			
	B1*	B2*	B3*	C*
pH	7.8±0.2	8.3±0.1	8.0±0.2	7.8±0.2
EC	0.6±0.1	0.6±0.1	0.4±0.1	0.4±0.1

\* The values were rounded to the nearest decimal.

Devens et al. (2018) reported that the coconut shell biochar presented a high pH value of 8.41. This is because the cations of feedstock are largely in the biochar, where it concentrates due to the gradual loss of Carbon, Hydrogen and Oxygen during pyrolysis. Increment in temperature creates alkaline groups of cellulose which make high pH (Devens et al., 2018). Therefore, the comparatively higher pH in B2 is justified.

Moreover, Nemati et al. (2015) reported that the pH of substrates containing biochar was affected by the initial pH of the biochar sources. i.e. the higher the pH of substrate higher the pH of the biochar. According to the previous findings, Chrysanthemum thrives well in a wide range of pH (6-8). However, treatment 2 has exceeded the favourable pH range for chrysanthemum.

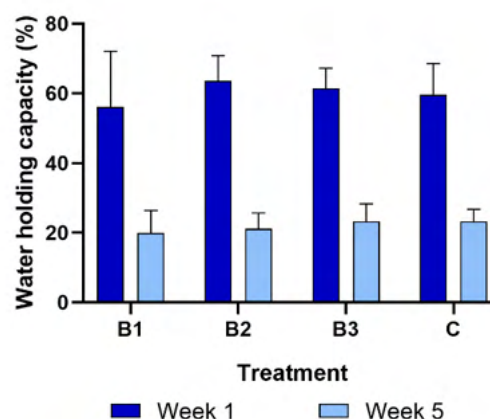
### Water Holding Capacity of the medium

In contrast to pH and EC, none of the treatments (WHC) shows a significant difference ( $p > 0.05$ ) with the control in terms of the water holding capacity. The possible cause is the less short-term (5 weeks) performance of biochar on water holding capacity compared with the long-term performance of biochar.

The WHC after week 1 was not significantly different ( $p > 0.05$ ) among

each other (Figure 1). The WHC values of week 1 ranged from 56.1% (B1) to 63.6% (B2). The WHC of control was 59.6% in week 1. Similar to week 1, the WHC after week 5 was also not significantly different ( $p > 0.05$ ) among each other (Figure 1).

**Figure 1.** The water holding capacity of treatments during weeks 1 and 5



A drastic reduction of WHC after at week 5 was observed in all treatments. The highest reduction of WHC compared to week 1 was from B2 (66.9%) while the lowest reduction was from the control (61.1%).

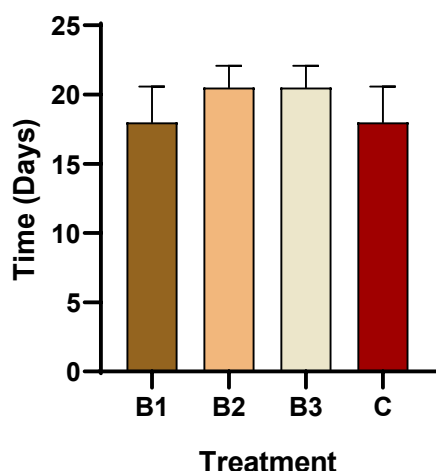
Complementary to the results, Farkas and Molnar (2020) reported the long-term positive effects of grain husk biochar. After one month, WHC had decreased significantly ( $p < 0.05$ ) at biochar application by 17% compared with control. Nevertheless, after 5 months, the WHC had increased by all treatments, the highest value reached at biochar application was by 9% compared with control.

### Time taken by shoots to reach the standard size and quality

The time taken by shoots to reach the standard size and quality was significantly ( $p < 0.05$ ) different among treatments (Figure 2). The treatment B1 did not show a significant difference ( $p > 0.05$ ) with the control while B2 and B3 have shown a

significant ( $p < 0.05$ ) difference with the control. The lowest time taken by shoots to reach the standard size and quality has recorded in both treatment B1 and the Control (18 days), which were not significantly different ( $p > 0.05$ ) among each other.

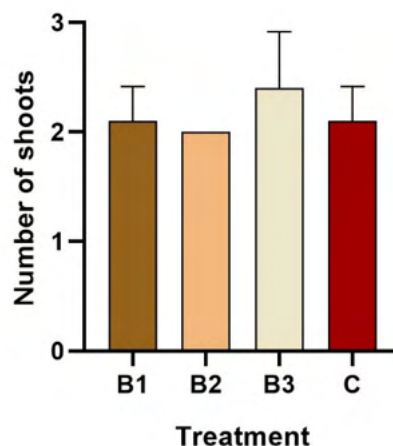
**Figure 2.** Variation of time taken by shoots to reach standard size among treatments.



#### Number of shoots produced per plant three weeks after the first pinching

The number of shoots produced per plant three weeks after the first pinching was not significantly different ( $p > 0.05$ ) among treatments. This is because mostly chrysanthemum produces two lateral shoots after the first pinch. Single pinching is done if two lateral shoots are desired whereas, double pinching is done for four laterals. Both pinching are required to encourage lateral growth.

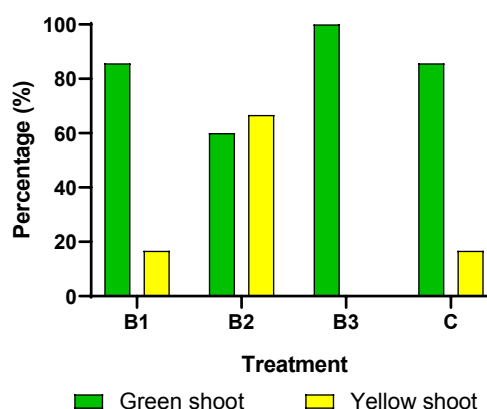
**Figure 3.** Variation of the number of new shoots produced per plant after the first pinching among treatments



#### Leaf colour of new shoots at the time of harvesting

An association between treatments and leaf colour of new shoots at the time of harvesting was evident (Figure 4). The highest association between treatments and green shoots has been observed in treatment B3 while the highest association between treatments and yellowed shoots was observed in treatment B2.

**Figure 4.** The association between treatments and leaf colour at the time of harvesting



The possible reason may be micronutrient deficiency due to the high pH in treatment B2 and high nitrogen use efficiency in treatment B3 due to amendment with pinewood biochar consist of well-arranged pores.

### Post-harvest life and rooting performance

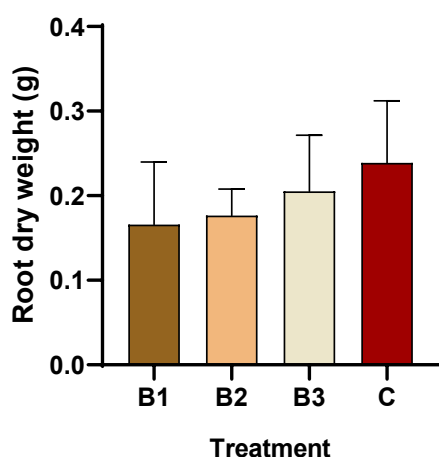
The post-harvest life and rooting performance did not show a significant difference ( $p > 0.05$ ) among treatments. The post-harvest life and rooting performance of all the treatments including the control reported a similar value. This is because the above feedstocks of biochar may have shown a neutral effect on the post-harvest life and rooting performance of Chrysanthemum.

Steiner and Harttung, (2014) reported that the growth of sunflower was similar in all growing media such as biochar, perlite, clay granules, sphagnum peat and peat mixed with biochar in 25%, 50% and 75% by volume. Further, there is a large potential for optimization such as a selection of particle size and feedstock for biochar production and growing media formulation for specific plant requirements (Steiner and Harttung, 2014).

### Root dry weight

The mean root dry weight did not show a significant difference ( $p > 0.05$ ) between treatments. However, the highest coefficient of variation (CV) of 0.44 was reported from B1 followed by B3 (0.32) and control (0.30).

**Figure 5.** Variation of root dry weight among different treatments



### CONCLUSIONS

Three types of biochar used in this study showed significant differences in pH and EC in the growing medium. Different growth performances were observed between treatments in terms of time taken by shoots to reach the standard size and quality, the number of shoots produced per plant three weeks after the first pinching, leaf colour of new shoots at the time of harvesting, post-harvest life and rooting performance and dry root weight. The incorporation of biochar into the coir dust growing medium for Chrysanthemum showed promising results which need to be assessed using other substrates and with different mixing ratios.

### ACKNOWLEDGEMENT

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## Analysing the Processing Ability of Cinnamon Stems Under Different Planting Systems

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### ABSTRACT

Cinnamon contributes largely to the country's economy, being one of the major agricultural export crops in Sri Lanka. But shortage of skilled cinnamon peelers is one of the major problems. Therefore, enhancement of the efficiency of processing procedure is crucial. Hence, the study was conducted to optimize the processing ability of common stems based on spatial pattern, type of planting material and harvesting interval to enhance the efficiency of cinnamon processing. Seedlings and vegetatively propagated plants (VP) of cinnamon; variety Sri Gemunu were planted under three spatial patterns as (A) 1.2×0.6 m with three plants per hill, (B) 1.2×0.4 m with two plants per hill and (C) 1.2×0.2 m with one plant per hill at the Faculty of Agriculture, University of Ruhuna. Stems were harvested in two planting intervals as 6 and 8 months. The study was conducted after four years from field establishment. Harvested cinnamon stems were processed with the support of a skilled cinnamon peeler. Scraping ability, rubbing ability, peeling ability and overall processing ability were recorded based on a scoring scale as, Bad-1, Normal-2, Good- 3 and Best- 4. The results revealed that, only the impact of planting material was significant ( $p < 0.05$ ) for Scraping ability, rubbing ability, peeling ability as well as overall processing ability of the cinnamon stems. Seedlings were observed to have better ability of processing than vegetatively propagated plants. Current findings can be used for further studies on efficiency enhancement of cinnamon processing.

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## INTRODUCTION

Cinnamon is the major agricultural export crop cultivated in Sri Lanka. Quills produced from the inner bark is the main product of cinnamon. Processed bark, in the form of quills making manually, is the product called Sri Lankan Cinnamon in trade. Making quills is a manual process, needing considerable skilled labor and also equal to 30 to 50% of the cost of production.

Steps are involved in procedure of cinnamon processing, which are scraping, rubbing and peeling. Removing of outer skin or the epidermal tissue layer from the inner bark is done during scraping. During the rubbing, inner bark is detached from the stem by rubbing with a brass rod. Finally, the bark is carefully removed from the stem by inserting the knife between the bark and the stem, paying attention not to break the bark and also to obtain maximum possible length of the bark, based on the erectness, maturity and the presence of nodes. All these processes are highly labor intensive and skilled peelers are essential for these processes. On average, a peeler can process about three kilograms of quills per day (Weerasinghe, 2011).

Shortage of skilled cinnamon peelers is one of the major problems in the Sri Lankan cinnamon industry. Though mechanization is the most promising solution, enhancement of the processing ability of cinnamon stem is equally important to increase the efficiency of cinnamon processing procedure.

Therefore, this study focused on evaluating the efficiency of scraping ability, rubbing ability, peeling ability and overall processing ability of cinnamon stems under different planting systems.

## MATERIALS AND METHODS

The study was conducted at the premises of the Faculty of Agriculture, University of Ruhuna, Sri Lanka. The area belongs to the low county wet zone (WL2) which receives more than 2,500 mm mean annual rainfall.

Healthy seedlings and vegetatively propagated plants of cinnamon variety Sri Gemunu were established according to three spatial patterns as (A) 1.2×0.6 m with three plants per hill, (B) 1.2×0.4 m with two plants per hill and (C) 1.2×0.2 m with one plant per hill.

All the plants were maintained according to the recommendations of the Department of Export Agriculture, Sri Lanka and after two years from the establishment, the first harvest was collected. Thereafter, the plants were harvested according to two harvesting intervals as 6 months and 8 months for two years.

The experiment to find out the impact of spatial pattern, harvesting interval and type of planting material on processing ability of cinnamon was conducted after 4 years of field establishment. Harvested cinnamon stems were processed with the support of a skilled cinnamon peeler. Scraping ability, rubbing ability, peeling ability and overall processing ability were recorded based on a scoring scale as, Bad-1, Normal-2, Good- 3 and Best- 4.

The study was conducted under three factorial split plot design with four replicates and data were statistically analyzed using appropriate statistical techniques.

## RESULTS AND DISCUSSION

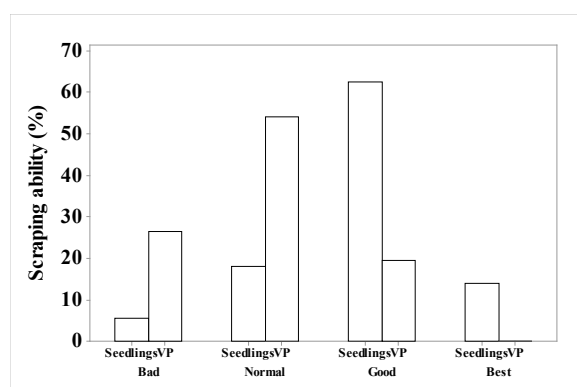
The impact of spatial pattern, type of planting material and spatial pattern were

evaluated for the efficiency of scraping, rubbing, peeling and overall processing. The results revealed that, only the impact of planting material was significant ( $P < 0.05$ ) for all cases.

### Scraping ability

According to the results, 62.5% stems of seedlings had a good scraping ability while 54.2% stems of vegetatively propagated plants had a normal scraping ability (Figure 1). At the same time, 13.9% stems of seedlings had the best scraping ability while no stems vegetatively propagated plants in that category.

**Figure 1.** Impact of planting material on the scraping ability of cinnamon stems



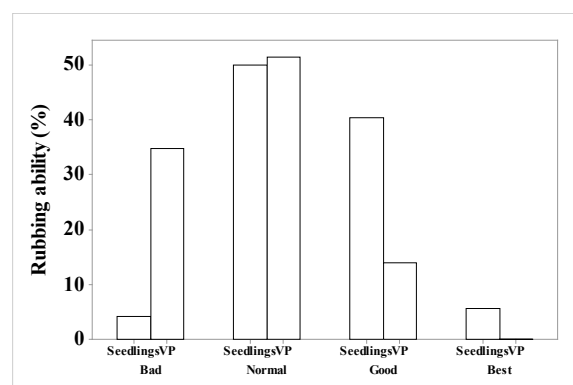
Physical properties of stems such as roughness, number of knots and straightness directly affect the scraping ability of cinnamon stems (Weerasinghe and Palliyaguru, 2008). Comparatively low straightness and high number of knots in vegetatively propagated plants related to the seedlings could be the reason for high scraping ability of seedlings than vegetatively propagated plants.

### Rubbing ability

When considering the rubbing ability of cinnamon stems, 40.3% stems of seedlings had a good ability while 50% stems of seedlings had a normal ability. Simultaneously, 51.5% stems of vegetatively propagated plants had a normal ability while 34.7% stems of vegetatively propagated

plants had a negative? Poor? ability (Figure 2). At the same time, 5.6% stems of seedlings had the best rubbing ability while no stems vegetatively propagated plants were in that category.

**Figure 2.** Impact of planting material on the rubbing ability of cinnamon stems



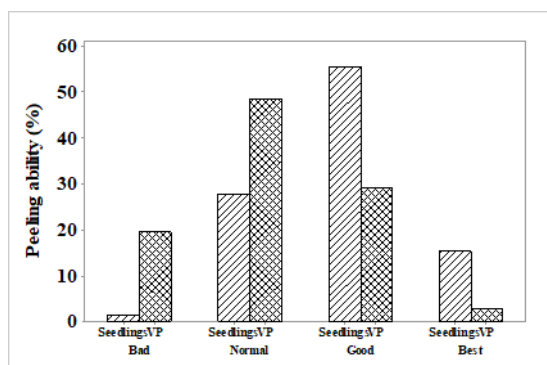
Season of the year is a major factor affecting the rubbing ability of cinnamon stems. Since the experiment was conducted within a same month, harvesting interval did not show any effect on the rubbing ability.

### Peeling ability

According to the results, 55.6% stems of seedlings had a good peeling ability while 48.6% stems of vegetatively propagated plants had a normal peeling ability (Figure 3). At the same time, 15.3% stems of seedlings had the best peeling ability while 19.4% stems of vegetatively propagated plants had a Bad peeling ability.

Peeling is the most skilled and time-consuming step in cinnamon processing which consumes 54.1% of total time requirement of the whole operation except for quills making (Pushpitha, 2006). Straight stems provide more room to detach longer bark segments during this step. Due to comparatively high straightness in stems of seedlings, the selling ability of seedlings become higher than vegetatively propagated plants.

**Figure 3.** Impact of planting material on the peeling ability of cinnamon stems

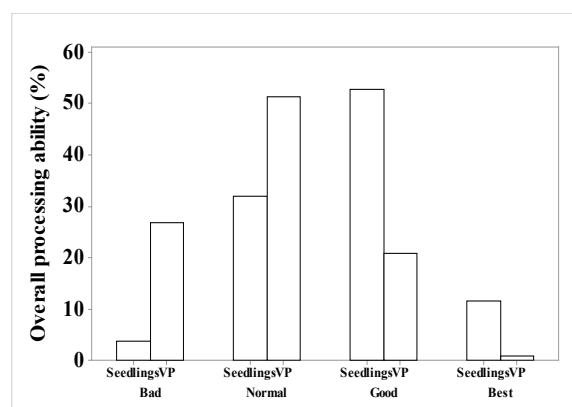


Peeling is the most skilled and time-consuming step of cinnamon processing which consumes 54.1% of total time requirement of the whole operation except for quills making (Pushpitha, 2006). Straight stems provide more room to detach longer bark segments during this step. Due to comparatively high straightness in stems of seedlings, peeling ability of seedlings become higher than vegetatively propagated plants.

### Overall processing ability

When considering the overall processing ability of cinnamon stems, 52.8% stems of seedlings had a good ability while 31.9% stems of seedlings had a normal ability. Simultaneously, 51.4% stems of vegetatively propagated plants had a normal ability while 26.9% stems of vegetatively propagated plants had a bad ability (Figure 4). At the same time, 11.8% stems of seedlings had the best overall processing ability while only 0.9% stems of vegetatively propagated plants were in that category.

**Figure 4.** Impact of planting material on the overall processing ability of cinnamon stems



As peeling is the most laborious step in cinnamon processing, the overall processing ability is mainly determined by the peeling ability of the stem. Hence, the peeling ability as well as scraping ability and rubbing ability were higher in seedlings, overall processing ability of seedlings was also higher than vegetatively propagated plants.

### CONCLUSIONS

The impact of spatial pattern, type of planting material and spatial pattern was evaluated for the efficiency of scraping, rubbing, peeling and overall processing and only the impact of planting material was significant for all cases. Seedlings observed to have better ability of processing than vegetatively propagated plants.

### ACKNOWLEDGEMENT

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## An Efficient Root Induction Protocol for Mass Propagation of *Jasminum sambac* L.: (Madurai Jasmine)

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### ABSTRACT

*Jasminum sambac* L is an ornamental plant that produces white flowers with a very pleasant fragrance, extensively used in perfumery and religious purposes. Flowers and flower buds are used for making garlands, bouquets, hair adornments and religious offerings. Moreover flower oil used in cosmetics industry and the plant has a medicinal value. Since this plant is poorly set seeds and not respond well to other vegetative propagation methods developing a reliable propagation method for commercial production is timely important. Hence the present study was conducted to find out an efficient method for vegetative propagation of *J. sambac* using different concentrations (5-25 ppm) of plant growth regulator; Indole Acetic Acid (IAA) and distilled water as control. Semi hard wood cuttings of *J. sambac* were used for propagation in a hydro-rooting system. The experiment was arranged as a Completely Randomized Design (CRD) with nine replicates. The highest number of roots was observed in 25 ppm IAA but 15 and 20 ppm IAA did not show significant difference from 25 ppm. In all IAA treated cuttings, root initiation was observed 2 weeks after immersing in the solution where it was taken 8 weeks to initiate roots in control. The 25 ppm IAA showed the highest root length which was significantly higher than that of all other concentrations. In conclusion, 15, 20 and 25 ppm IAA concentrations were effective in inducing roots and 25 ppm IAA was effective in obtaining highest root length in semi hard wood cutting of *J. sambac* within 2 weeks in a hydro rooting system.

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## INTRODUCTION

*Jasminum species* belongs to family Oliaceae native of tropical and subtropical regions and *Jasminum sambac* is an ornamental plant purposely used in perfumery industry and religious occasions. It produces very pleasant fragrant white flowers.

Flowers and buds of this plant are used for making garlands, bouquets, as hair adornments, welcome guests and for religious offerings. Jasmine oil extracted from the flowers used to produce high grade perfumes, cosmetics and flavoring mouth washes (Sabharwal *et al.*, 2013).

The leaves are given internally in decoction for fevers, diarrhea and used as a treatment for skin diseases (Shiva *et al.*, 2002; Umamaheswari *et al.*, 2007; Sun *et al.*, 2007). The flowers are used as an antispasmodic for calming and sedative infusion. Oil is regarded as antidepressant (Sun *et al.*, 2007; Wei and Shibamoto 2007). The decoction of the roots or infusion of the flowers used to treat for asthma. Roots and leaves are used to make an eye-lotion (LisBalchin *et al.*, 2002; Kulkarni and Shahida, 2004).

Commercial cultivation of *J. sambac* is rare due to poor seed setting and germination of seeds under natural conditions and death of many young seedlings. Therefore propagation from seed is unreliable (Gupta and Reddy, 2013). Since the seed propagation has many barriers the vegetative propagation is the only reproductive method. Vegetative propagation is achieved through ground layering and stem

cuttings, in general vegetative propagation is done through ground layering but it is not convenient for transportation purposes and success rate is also very low. Hormonal treatment of stem cuttings shows induction of high frequency multiplication. (Hartman *et al.*, 2011).

Therefore, this study was planned to develop an efficient and reliable vegetative propagation method using root inducing hormone IAA in different concentrations under hydro rooting system.

## MATERIALS AND METHODS

Semi hard wood cuttings (8 cm length) were taken from well grown mother plant of *J.sambac* under shade house conditions. Cuttings were cleaned and prepared for the study after removing few leaves from the base. After that cutting were dipped in a fungicide solution (0.6 mg/500 ml Captan) for 30 minutes. Then the cuttings were immersed in test tubes which include the solutions (T1-Distilled water (control), T2- 5 ppm IAA, T3- 10 ppm IAA, T4- 15 ppm IAA, T5- 20 ppm IAA, T6- 25 ppm IAA) separately as one cutting per one test tube by using cotton swab. Number of roots, root length and time taken to appear first root were recorded 2 weeks after establishment.

Experiment was arranged as a Completely Randomized Design (CRD) with nine replicates. Mean values were compared using Duncan Multiple Range Test (DMRT) at 0.05 probability level (SAS 9.1).

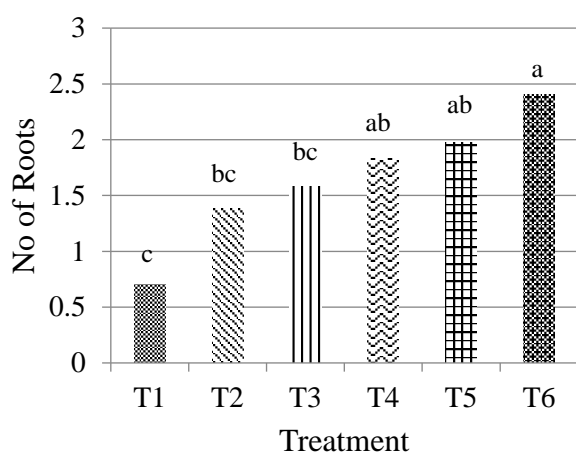
## RESULTS AND DISCUSSION

Root induction of *J. sambac* under hydro rooting conditions was carried out with

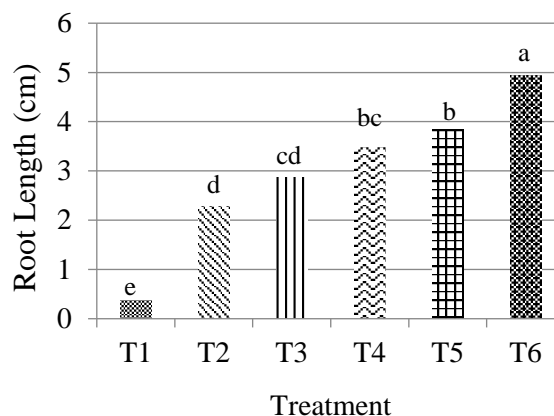
IAA as a root inducer. The highest number of roots were observed in T6 (25 ppm IAA) with 2 weeks after dipping in IAA solution and it was not significantly different from T5 (20 ppm IAA) and T4 (15 ppm IAA). These three treatments differed significantly from the control (Distilled water). The result showed that, the root formation of *J. sambac* in semi hard wood cuttings increased with the increasing concentration of IAA (Figure 1).

There was a significant effect of IAA concentration on the length of roots. The concentration of 25 ppm IAA resulted in the highest root length in the semi hard wood cuttings which was significantly higher than that of all other concentrations and control (Figure 2).

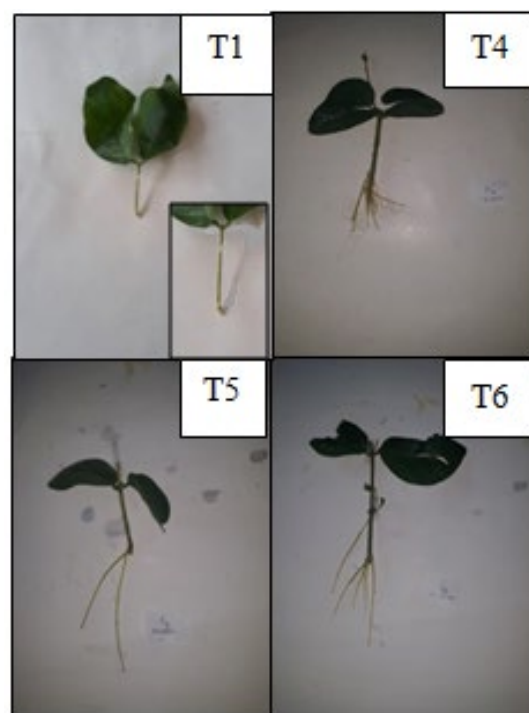
**Figure 1.** Effect of Indole Aecitic Acid (IAA) concentration on the formation of roots in *J. sambac* semi hard wood cuttings. The same letter above a bar indicates a non-significant difference at the 5% level according to ANOVA and Duncans' Multiple Range Test (DMRT)



**Figure 2.** Effect of Indole Aecitic Acid (IAA) concentration on the root length in *J. sambac* semi hard wood cuttings. The same letter above a bar indicates a non-significant difference at the 5% level according to ANOVA and Duncans' Multiple Range Test (DMRT).



**Figure 3.** Rooted semi hard wood cuttings of *J.sambac* after 8 weeks dipping in different IAA concentrations T1-Distilled water (control), T4- 15 ppm IAA, T5- 20 ppm IAA, T6- 25 ppm IAA



**Figure 4.** Cutting with developed roots and rooted cutting in a soil medium



Auxins stimulate the rooting of cuttings (Hartman *et al.*, 2011). Root initiation and less number of days taken for rooting in carnation cuttings were reported by using auxines (Singh *et al.*, 2006; Bharathy *et al.*, 2003) and in this study root initiation was observed within 2 weeks of immersion in IAA irrespective of the concentration. Root induction in control was observed in 8 weeks after immersion in the distilled water. There is a significant effect on the days taken for root induction by IAA when compared to control.

The higher number of roots and root length was observed when used 25 ppm IAA within 2 weeks. Auxins contributed to reduce the number of days take to root initiation in many ornamentals. IBA treated hard wood cuttings of mussaenda pink and hibiscus resulted the highest no of roots per cutting and root length (Bhatt *et al.*, 2012; Sharma, 2014; Majumder *et al.*, 2014). In consistent with the findings in this study higher number of roots, root length and less days taken for root initiation was observed in semi hard wood cuttings of *J.sambac* treated with IAA.

## CONCLUSIONS

The results of the present study clearly indicate that *Jasminum sambac* is amenable to vegetative propagation using plant growth regulators. IAA concentrations of 15 ppm, 20 ppm and 25 ppm are most suitable for increment of number of roots in semi hard wood cuttings within 2 weeks under hydro rooting conditions. Considering the root number and length IAA concentration of 25ppm was most suitable for obtaining rooted cuttings of *J.sambac*.

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## A Successful Surface Sterilization Technique for *in vitro* Establishment of *Dracaena sanderiana* Sander ex Mast. Nodal Explants

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### ABSTRACT

*Dracaena sanderiana* Sander ex Mast. is the number one cut foliage exported from Sri Lanka and it is also a popular potted plant. In order to promote dracaena cultivation, micropropagation techniques can be employed to produce high quality large number of clones as planting materials. However, severe microbial contaminations in the *in vitro* establishment stage mitigate the micropropagation application on this species. Therefore, this study was undertaken with the objective of using silver nitrate (AgNO<sub>3</sub>) to eliminate surface adhered microorganisms to obtain high amount of contamination free cultures at the *in vitro* establishment stage. Investigations also carried out to explore reusability of AgNO<sub>3</sub> after the first wash in surface sterilization. Apical parts of about 8 cm of *D. sanderiana* cv 'White' were used in this study. Silver nitrate solution in 200 mg/L and Clorox™ in 10% concentrations were used for the surface sterilization of the nodal explants. Results revealed that 200 mg/L AgNO<sub>3</sub> produced 90% and 10% Clorox produced 20% contamination free cultures after 8 weeks of establishment *in vitro*. Also, in the experiment of investigation of reusability of AgNO<sub>3</sub> it was observed that the second and third washings of AgNO<sub>3</sub> produced 80 and 70% non-contaminated cultures, respectively. Results of this study suggest that AgNO<sub>3</sub> is a highly effective low-cost non-toxic material which can be used in surface sterilization of *D. sanderiana* nodal explants. With this promising results it can be suggested that 200 mg/L AgNO<sub>3</sub> solution can be considered to replace toxic heavy metals such as mercuric chloride frequently used in Micropropagation.

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## INTRODUCTION

*Dracaena sanderiana* Sander ex Mast. is one of the well-known ornamental plants which belongs to the family Agavaceae. The plant is also known as lucky bamboo, Belgian evergreen, Ribbon dracaena or ribbon plant. It is grown in tropical and subtropical regions in the world. Some of the dracaena species have several medicinal properties and frequently used in curing diseases. *Dracaena mannini* contains Spiroconazole-A, an active saponin compound and *Dracaena arborea* showed antileishmanial, antimalarial, molluscicidal, fungicidal, and bacteriostatic activities (Okunji, et al., 1996) other than that, *Dracaena draco* produces several steroidal saponins, which showed cytostatic activity on Leukemia HL 60 cells (Mimaki, et al., 1999; Yokosuka, et al., 2000).

*D. sanderiana* ranks seventh among the top 10 potted plants in global trends in floriculture (Singh, 2000). It is also the number one cut foliage exported from Sri Lanka and contributes to earn foreign exchange in each year. Dracaena is propagated commercially by a vegetative method such as stem cuttings, top cuttings and division of suckers, however, it is a prolonged process to propagate many uniform plants to fulfill industrial demand. A large extent of plants is required to meet the increasing demand and therefore high quality planting materials can become a bottle neck. This hurdle can be overcome by applying micropropagation techniques to produce a large number of high quality clones in a short period.

One of the major problems in the tissue culture industry is the bacterial/fungal contaminations in the cultures especially in the *in vitro* establishment stage. The quality of mother plant, size of the explant

and human errors may lead to increased contaminations in cultured plant tissues. Furthermore, contaminations in cultures also arise due to the type of explant used, exogenous and endogenous microorganisms as well. To avoid this situation, explants must be sterilized before culturing. For this purpose different sterilization agents such as sodium hypochlorite (NaOCl), calcium hypochlorite (Ca(OCl)<sub>2</sub>), ethanol, mercuric chloride (HgCl<sub>2</sub>), hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>), benzalkonium chloride are used frequently for surface sterilization (Ahmadi et al., 2012; Kummer et al., 2013; Peiris et al., 2020; Silva et al., 2015).

Silver (Ag) is a well-known antimicrobial agent and widely used for various sterilization purposes and it can control plant pathogens more safely without any toxic effects on human and animal (Melaiye & Youngs, 2005). Silver Nitrate has shown superior effects in plant growth, improving both somatic embryogenesis (Kong & Yeung, 1995) organogenesis and micropropagation (Kotsias & Roussos, 2001). Until now, limited experiments have provided evidence of the suitability of AgNO<sub>3</sub> for controlling contaminations in *in vitro* explants (Ibrahim et al., 2011; Jo et al., 2009). Therefore, the present investigation was undertaken to determine the effects of AgNO<sub>3</sub> for surface sterilization of *Dracaena sanderiana* in micropropagation and reusability of AgNO<sub>3</sub> effectively after the first wash in surface sterilization.

## MATERIALS AND METHODS

This experiment focused on effectiveness of surface sterilization against fungal spp. *Fusarium* spp. identified from recent

publications and standard (Kumar et al., 2019) which severely damage *D. sanderiana* explant (Figure 1). About 8 cm cuttings of the top part of *D. sanderiana* cv 'White' nodes were collected from the plants growing in a protected house (Figure 2). The stems were brought into the tissue culture laboratory after removing all the leaves. They were prewashed with soap and water by gently rubbing with Dettol™ hand wash. These nodal stems were separated into single nodes to have approximately 1 cm segment. Then they were divided into two groups to include 20 nodes per group. Nodes in both groups were thoroughly washed again with tap water for 5 minutes and placed in a beaker with 400 mL deionized (DI) water with 1-2 drops of liquid soap and vigorously agitated for 30 minutes using an orbital shaker at 180 rpm, then soapy water was drained off and washed 3 times using DI water to remove excess soap from plant tissues. Finally, the following procedure was used to sterilize the plant nodes with AgNO<sub>3</sub> and Clorox solutions.

**Figure 1.** Nodes Contaminated from Fungal Species *Fusarium* Colonies



From the 20 nodal explants ten *Dracaena* nodes were washed in 100 mL of AgNO<sub>3</sub> (200 mg/L) solution for 30 minutes on a magnetic stirrer at 600 rpm). After 30 minutes, nodes were cultured (without washing with sterilized water) and tubes were placed inside the growth

room at 25 °C and illuminated 14 h/d with 1500 Lux provided by LED (Light emitting Diode) lamps. This was repeated with the next group of 10 nodes.

**Figure 2.** *Dracaena sanderiana* Sander ex Mast explant.



As the control, 10% Clorox was used for the remaining 20 nodal explants. Ten nodes each sterilized using 100 mL of 10% Clorox with 2 drops of liquid soap, for 15 mins. by agitating the mixture at 180 rpm on an orbital shaker. This washing mixture was decanted and the nodal explants were agitated again in 100 ml of fresh 10% Clorox for 15 minutes. Then the Clorox solution was decanted and nodal explants were thoroughly rinsed 3 times with sterilized water (autoclaved at 121 °C for 15 min.). Thereafter, the explant was cultured and placed in the same conditions as previously mentioned. This was also repeated for the 10 remaining nodes.

Murashige & Skoog agar medium (Murashige & Skoog, 1962) supplemented with 3% sugar, 1 mg/L benzyl amino purine (BAP), 5 L of fungicide (Folicur tebuconazole EW) was used. Medium pH was adjusted for 5.8. The medium was boiled for 2-3 minutes at 100 °C in a microwave oven to melt the agar. The culture tubes were sterilized using 5% Clorox solution, this sterilizing method known as CSUP technique (Peiris et al., 2012) and 5 ml of agar medium was poured to the tubes and capped. Similarly,

300 ml of media was prepared and poured into 60 tubes. The tubes were kept at room temperature (25 °C) to solidify the media. This medium was used to culture the nodal explants of both AgNO<sub>3</sub> and Clorox surface sterilization treatments. The experiment was repeated to investigate reusability of AgNO<sub>3</sub> (already used) and freshly prepared 10% Clorox in the same way as described earlier.

The number of cultures that survived from microbial contaminations was recorded weekly and final data was obtained at the 8<sup>th</sup> week from culture establishment.

### Statistical analysis

Each treatment was repeated twice and the experiment samples were arranged using complete randomized design. Chi-square ( $\chi^2$ ) test was used for AgNO<sub>3</sub> and Clorox treatments to determine whether treatment type is responsible or not for elimination of fungal growth inhibition at the sterilization.

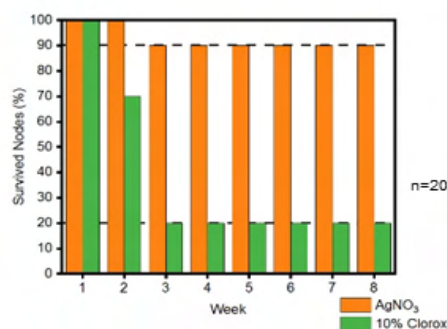
## RESULTS AND DISCUSSION

Silver is a promising antimicrobial agent which has been used in many disinfecting applications in the past 20 years. Therefore, silver becomes a characteristic chemical treatment for plant tissue culture applications as well. Applying Ag<sup>+</sup> as a sterilizing agent is a promising and effective concept in sterilizing plant nodes. We implement the above concept for *D. sanderiana* plant nodes used in this experiment. Figure 3 shows survival percentages of nodal explants in culture after sterilization from silver and Clorox treatments. Plant nodes sterilized from AgNO<sub>3</sub> provided 90% contamination-free cultures, whereas explants treated with Clorox produced 20% uncontaminated cultures after 8 weeks. Thus, suggesting application of Ag<sup>+</sup> method is much more effective than the conventional Clorox

treatment. The Ag<sup>+</sup> is the main element that interferes with fungal cells and causes damage to cell structure (Tomacheski et al., 2017). Other publications also show that Ag<sup>+</sup> has antifungal activity against various fungal species (Jo et al., 2009; Min et al., 2009). Our results also confirmed common fungal/bacterial species eliminated from plant node surface after applying Ag<sup>+</sup> treatment for 30 min.

The calculated  $\chi^2$  was 19.7, which is very much larger than 5%  $\chi^2$  value (3.84). Thus, suggest our alternate hypothesis of treatment is directly responsible for reduction of fungal contaminations is correct. According to the results of the contamination free cultures the effects of AgNO<sub>3</sub> are in the 10% Clorox at the level  $P < 0.001$ .

**Figure 3.** Survived Nodes Percentage after Sterilized from AgNO<sub>3</sub> & 10% Clorox solutions (sample size(n)= 20 nodes).



Furthermore, a magnetic stirrer was used to mix Ag<sup>+</sup> and nodes which is a very effective technique to homogenize the mixture. Also, Ag<sup>+</sup> migrate easily towards microbes exist on node surface and then penetrate fungus cell structure. However, there is no confirmed information on the pathway for sterilizing mechanism between microbial cell and Ag (Jo et al., 2009). Few hypotheses like cell wall damage, inhibit protein synthesis, ATP production and DNA/RNA inhibition are the most common mechanisms shown in

recent publications (Khezerlou et al., 2018). Our observations predict that  $\text{Ag}^+$  certainly inhibits fungus/bacteria cell growth in plant node surface due to the particular cell damage of the pathogens.

Silver ions denature proteins by binding to their thiol groups. Other than that  $\text{Ag}^+$  also prevent replication of DNA by its condensation and induces apoptosis in microbial cells (Pandian et al., 2010). Clorox is a well-known sterilizing agent which cannot prevent fungal activity and showed weakness of controlling microbial attacks. Thus,  $\text{Ag}^+$  is a promising sterilizing agent than Clorox (Tomacheski et al., 2017) disrupting metabolic activity and/or causes RNA and DNA alteration.

In this study, we used 20 mg of  $\text{AgNO}_3$  for the sterilizing process, hence cost for sterilization becomes very much lower which approximately is LKR 20 for all three washes, much less than the Clorox treatment which costs LKR 25-35 for one attempt. Moreover, reusing the same  $\text{AgNO}_3$  two times for sterilization reduced the cost without compromising the percentage of the uncontaminated cultures. Table 1 indicates results of the uncontaminated cultures after 8 weeks from the second and third wash as 80% and 70%, respectively. In comparison with Clorox 20, 30 and 40% of uncontaminated culture %  $\text{AgNO}_3$  gives still the higher performance than Clorox. Thus  $\text{Ag}^+$  becomes the best remediation for plant node sterilization than conventional Clorox,  $\text{H}_2\text{O}_2$  and mercuric chloride ( $\text{HgCl}_2$ ) (Min et al., 2009; Silva et al., 2015; Tomacheski et al., 2017). Mercuric Chloride gives very high percentages of uncontaminated plant cultures, however, it is a toxic heavy metal, a well-known poison for animals and plants (Senger et al., 2010) and with promising results obtained from  $\text{AgNO}_3$  in our study  $\text{HgCl}_2$  can be replaced by  $\text{AgNO}_3$ .

**Table 1.** Survival % of *Dracaena* nodes in reused  $\text{AgNO}_3$  after 8 week of culture establishment

Treatment	First Wash	Second Wash	Third Wash
200 ppm $\text{AgNO}_3$	90	90	80
10 % Clorox (fresh solution)	20	40	30

Sample size(n)= 20

**Figure 4.** Healthy Nodes with Newly Developed Shoots after 8 Weeks.



Figure 4 shows healthy nodes with shoots, suggesting no toxic effect with  $\text{Ag}^+$  at the sterilizing step (Min et al., 2009), which is another positive factor that can be considered in this sterilizing technique. After comparing  $\text{Ag}^+$  treatment with the Clorox method, we can suggest,  $\text{Ag}^+$  surface sterilization method is a more successful and efficient method to sterilize *D. sanderiana* nodal explants successfully to establish clonal propagation to produce planting materials.

## CONCLUSIONS

Silver as antimicrobial agent is a promising chemical treatment that enables inhibition of microbial growth in culturing plants. We used 200 mg/L  $\text{AgNO}_3$  solution to sterilize plant nodes and

obtain success percentage of 90% contamination free cultures after 8 weeks. In comparison, Clorox produced only 20% uncontaminated cultures at the same duration. Thus, suggesting antimicrobial activity in silver is a promising phenomenon that can be used to sterilize plant nodes. We utilized a very low amount (20 mg) of AgNO<sub>3</sub> to sterilize nodes, thus lowering the cost of plant production and reusability of the Ag solution and non-toxic effect are the positive factors that can be highlighted in this experiment whereas, Clorox is a one time used chemical in sterilization. Ultimately, we suggest that use of AgNO<sub>3</sub> in sterilization of explants is more effective than the conventional Clorox techniques in the plant tissue culture process.

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## Biomonitoring of $\text{HgCl}_2$ with *Dracaena sanderiana* under Two Different Irradiance Levels: Effects on the Photosynthetic Apparatus

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### ABSTRACT

Heavy metals such as Hg are phytotoxic. Interference of heavy metals with photosynthesis has been a topic of intensive research during the last few decades. Some plants can be used in biomonitoring and the remediation of such pollutants. It is important to assess the biomonitoring potential in ornamental plants as they do not enter into the food chain. This experiment was conducted to examine the effect of  $\text{HgCl}_2$  on the photosynthetic apparatus in *Dracaena sanderiana* to assess its potential to use in biomonitoring. *D. sanderiana* cuttings were subjected to heavy metal stress (100  $\mu\text{M}$   $\text{HgCl}_2$ ), along with control (distilled water) under two contrasting irradiance levels (High light-: 22,500 $\pm$ 2,000 lux and Low light-: 750 $\pm$ 200 lux). OJIP chlorophyll fluorescence measurements were conducted using a fluorometer (FluorPen, FP-110). The measurements were recorded four times a day (9 am, 12 noon, 3 and 6 pm) continuously for four days after imposing the treatments. Specific energy fluxes per reaction center, flux ratios and Performance Index (PI) were recorded. There was a significant reduction in PI, maximum quantum yield of primary photochemistry ( $P_o$ ) and quantum yield of electron transport ( $E_o$ ) with the time in  $\text{HgCl}_2$  treatment compared to the control. This indicates the negative effects of  $\text{Hg}^{+}$  on the photosystem II. However, the visual rating of the foliage quality was at a satisfactory level. Moreover, there was a significant increase/progress/growth in effective antenna size (ABS/RC) and maximum quantum yield of non-photochemical de-excitation ( $D_o$ ) in  $\text{HgCl}_2$  with time. Except in electron transport efficiency ( $\phi$ ), a clear unimodal circadian variation was observed in all OJIP parameters under high light condition. Photosynthetic apparatus of *D. sanderiana* is affected by the  $\text{Hg}^{+}$ . However, the plant was able to cope up with the heavy metal stress during the experimental period indicating that, it can successfully be employed in short-term biomonitoring of mercury. In the experiment, the temperature effect could not be eliminated, thus future experiments for studying that might be crucial.

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## INTRODUCTION

Mercury has been identified as the third most hazardous substance according to the Agency for Toxic Substances and Disease Registry (ATSDR) because of its toxicity, mobility, biopersistent and relatively long residence time in the environment (Sereshti et al., 2014). Heavy metals are discharged into the environment by both anthropogenic and natural sources, and eventually ending up in soils or surface waters. Contamination of natural and drinking waters with Hg can have a variety of detrimental impacts on human health and the environment.

Thus, controlling pollutants is a very critical task which has a complex procedure: sources and emissions must be identified; techniques must be developed that are sufficiently sensitive and low-cost to allow simultaneous measurement of multiple contaminants; risks must be assessed; critical emissions must be controlled, and economic factors must be taken into account (Wolterbeek, 2002).

Biomonitoring is a scientific technique which can be conducted to evaluate the environment, including human exposures to natural and synthetic chemicals, based on the analysis of tissue and fluid samples (Zhou et al., 2008).

Plants are ideal for accumulating trace elements from the atmosphere, soil and even from water bodies. Therefore, they have been utilized in a numerous monitoring studies, providing low-cost information about the environmental quality with the benefit of easy sampling. Several species have been used as bioindicators such as: lichens, agricultural crops, ornamental plants and some species of trees (Bargagli et al., 2003; Catinon et al., 2009). Because of the lack of developed root systems, mosses (Aceto et al., 2003) and lichens (Bergamaschi et al.,

2007) are more suitable to capture trace elements from rain and atmospheric particles by ion-exchange and chelation.

Utilization of plants for Phytoremediation has become a recent trend and it is a promising, environment-friendly method for large-scale clean-up of contaminated soil and water (Barocsi et al., 2003).

Chlorophyll fluorescence (ChlF) is one of the most popular rapid and non-invasive techniques used in plant stress physiology which can identify the status of photosynthetic apparatus in plants (Eeswaran et al (2012).

Thus, measurements of chlorophyll fluorescence are a very useful tool in evaluation of heavy metal ions influence due to its coupling effect on the photosynthetic electron transfer chain and to the further biochemical processes (Zurek et al., 2014). The present study was conducted to ascertain the possibility of using *Dracaena sanderiana* as a biomonitoring agent to remediate HgCl<sub>2</sub>. (different font size from the rest of paper)

## MATERIALS AND METHODS

This experiment was conducted in a glasshouse at the Department of Crop Science, Faculty of Agriculture, University of Peradeniya under two different environmental conditions; (i) high light intensity (22,500±2,000 lux; mean day temperature 40 °C; mean RH of 42%) and (ii) low light intensity (750±200 lux; mean day temperature 28 °C; mean RH of 53%). The healthy cuttings of *Dracaena sanderiana* with leaves in similar maturity stage were collected and cut ends were immediately immersed in water and kept under shade until separated into treatments. The cuttings were then subjected to 100 µM HgCl<sub>2</sub> (heavy metal

stress) and distilled water using treatment served as the control sample. The holding solutions (150 ml) were filled into clean glass bottles. *D. sanderiana* cuttings were recut while holding in water using disinfected sharp secateurs. The uniform cuttings were dipped in holding solutions separately. The treatments were laid out in a Completely Randomized Design (CRD) with two replicates per treatment. Each replicate consisted of two glass bottles (technical replicates) with three shoots (biological replicates). Two sets of all treatments were placed in the above mentioned two environments.

ChlF data were recorded using a portable fluorometer (FluorPen, FP-110). The measurements were recorded four times per day (9 am, 12 pm, 3 pm, and 6 pm) and the data collection was conducted continuously for four days commencing from the first day of treatment application. For ChlF data collection, a single leaf was chosen per treatment and three ChlF readings were collected from the three different places of the selected leaf throughout the experiment as replicates.

The leaf was exposed to a  $3000 \text{ molm}^{-2}\text{s}^{-1}$  saturating light pulse and ChlF was captured. Performance Index (PI), Specific energy fluxes (per RC) for absorption (ABS/RC), trapping ( $\text{TR}_0/\text{RC}$ ), electron transport ( $\text{ET}_0/\text{RC}$ ), and dissipation ( $\text{DI}_0/\text{RC}$ ) and Flux ratios or yields such as the maximum quantum yield of primary photochemistry ( $\Phi_{\text{Po}}$ ), electron transport probability ( $\Phi_{\text{o}}$ ), and the quantum yield of electron transport ( $\Phi_{\text{Eo}}$ ) were measured. The data were subjected to analysis of variance (ANOVA) for completely randomized design (CRD) using statistical analysis software (SAS, version 9.4, SAS Institute Inc., Cary, NC, USA). The significance of differences between the mean values was determined by Duncan's Multiple Range Test (DMRT) at  $p = 0.05$ .

Tests for homogeneity of variance were performed on all parameters and, where applicable, LSDs suitable for comparing means of three replicates were determined.

## RESULTS AND DISCUSSION

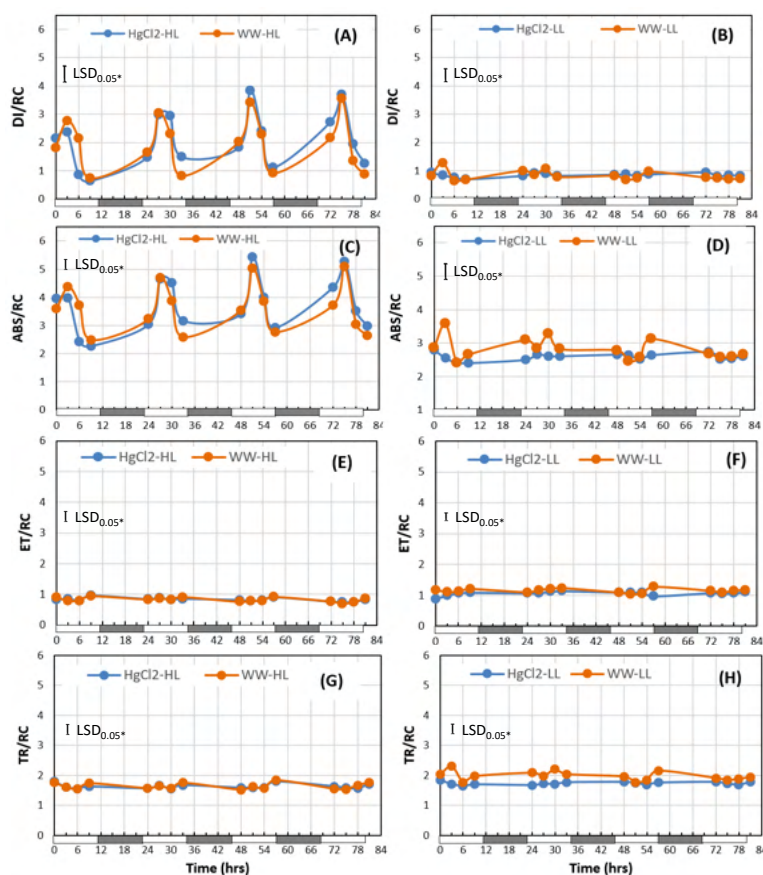
Except in the parameters of electron transport efficiency ( $\Phi_{\text{o}}$ ),  $\text{TR}/\text{RC}$  and  $\text{ET}/\text{RC}$  a clear unimodal circadian variation was observed in all other OJIP parameters under high light condition ( $22,500 \pm 2,000 \text{ lux}$ ) in the control sample. Even though the amplitude is not uniform, this circadian variation can also be recognized in  $\text{HgCl}_2$  treatment as well under high light condition (Fig. 1-3). But it is clear that these variations could not be observed under low light levels ( $750 \pm 200 \text{ lux}$ ).

This kind of circadian rhythms can be observed because of the crassulacean acid metabolism (CAM) pathway in *D. sanderiana* as a stress response under high light levels. Though the *D. sanderiana* is well known as a C3 plant, it can act as a facultative CAM species under non-optimal conditions such as under drought stress, salt stress, heavy metal stress and other stress situations, as observed for a few other plant species (Winter & Holtum, 2014)

### Specific energy fluxes

When the specific fluxes i.e. light absorption (ABS), energy trapping (TR), electron transport (ET) and heat dissipation (DI) per reaction center (RC) of the chlorophyll antenna complex are considered, a clear unimodal circadian variation was observed in the  $\text{DI}/\text{RC}$  and  $\text{ABS}/\text{RC}$  under high-light (HL - :  $22,500 \pm 2,000 \text{ lux}$ ) condition, irrespective of the presence or absence of  $\text{HgCl}_2$  (Fig. 1 A,B).

**Figure 1.** Specific energy fluxes for two different treatments of 100  $\mu\text{M}$   $\text{HgCl}_2$  and distilled water under high-light (HL-:  $22,500 \pm 2,000$  lux and low light (LL-:  $750 \pm 200$  lux) conditions. A) Heat dissipation per reaction centre (DI/RC) under HL, B) Heat dissipation per reaction centre (DI/RC) under LL, C) effective antenna size (ABS/RC) under HL, D) effective antenna size (ABS/RC) under LL, E) Electron transport per reaction centre (ET RC) under HL, F) Electron transport per reaction centre (ET RC) under LL, G) Trapping per reaction centre (TR RC) under HL, and H) Trapping per reaction centre (TR/RC) under LL.



The negative effects of  $\text{Hg}^{+2}$  ions on the photosynthetic apparatus were slightly evident 33 hrs after the treatment (Fig. 1 A,C) under HL, indicating that, ABS/RC and DI/RC are the only parameters in the specific fluxes in the chlorophyll fluorescence transient analysis that can be used in biomonitoring studies for Mercury. As the results revealed, a significant effect of 100  $\mu\text{M}$   $\text{HgCl}_2$  on the specific fluxes was not observed under low-light (LL -:  $750 \pm 200$  lux) conditions (Fig. 1 B, D, F, H). This implies that *D.*

*sanderiana* can survive under  $\text{Hg}^{+2}$  stress at least up to 100  $\mu\text{M}$  under LL without having any negative effects on the photosynthetic apparatus, while showing the ability of this species to use in phytoremediation studies.

Higher performance was observed during the mid-day indicating the presence of strong mechanisms in *D. sanderiana* to absorb light energy even during the stress conditions at mid-day. That proves *D. sanderiana* is having a better adaptation to

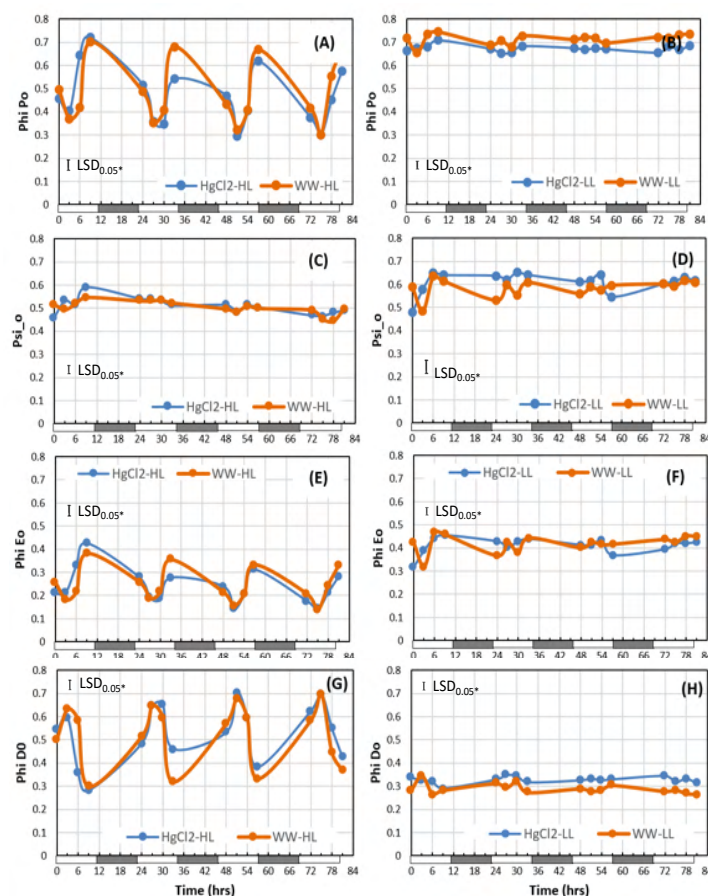
the stress conditions. By the visual observation of the experiment, it was noted that *D. sanderiana* has performed better even under these stress conditions with minimum wilting.

There are two probable causes for the observed increase in ABS/RC with time under  $Hg^{2+}$  stress levels. Inactivation of some PSII RCs, or an increase in the antenna size, assuming that the ABS/RC ratio is determined as the total quantity of photons absorbed by Chlorophyll molecules in all RCs divided by the total

number of active RCs ( van Heerden et al., 2007).

Thus, with the time, ABS/RC has increased as a result of modifying the photosynthetic pathways in order to adapt to the stress condition as a survival mechanism. That also provides sufficient evidence to the potential of *D. sanderiana* to use in the phytoremediation of heavy metal like Hg. Increment of heat dissipation with time can be explained as a survival mechanism to protect their chlorophyll pigments and reaction centers against higher amount of heat inside the chlorophyll molecules.

**Figure 2.** Flux ratios for two different treatments of 100 $\mu$ M  $HgCl_2$  and distilled water under high-light (HL:- 22,500 $\pm$ 2,000 lux and low light (LL:- 750 $\pm$ 200 lux) conditions. A) Maximum quantum yield of primary photochemistry II ( $\Phi_{Po}$ ) under HL and B) under LL, C) electron transport efficiency ( $\Phi_{Lo}$ ) under HL and D) under LL, E) quantum yield of electron transport ( $\Phi_{Eo}$ ) under HL and F) under LL, G) maximum



### Flux ratios

When the flux ratios or the efficiencies are considered, there a clear unimodal diurnal variation was observed in maximum quantum yield of primary photochemistry II (Po), quantum yield of electron transport (Eo) and in maximum quantum yield of non-photochemical de-excitation (Do) under HL condition as depicted in Figure 2 A, E and G. A significant effect HgCl<sub>2</sub> on the photosystem II of *D. sanderiana* was observed at the dusk (6.00 pm) throughout the study period, showing the HgCl<sub>2</sub> biomonitoring potential of this species.

As depicted in the Fig.2, in the maximum quantum yield of primary photochemistry II (Po or TR/ABS) and electron transport efficiency (Eo) showed a reduction with the time especially in the HgCl<sub>2</sub> treatment under high light levels. But contrary to those levels, there is an increase in the quantum yield of non-photochemical de-excitation.

That kind of reduction can be seen as a result of significant inhibition of the quantum yield of photosynthesis by Hg<sup>2+</sup> in *D.sandriana*. Since Po (PSII) is the product of qP and Fv<sub>0</sub> /Fm<sub>0</sub>, it was linked to declines in both the photochemical quenching coefficient (qP) and the efficiency of excitation energy captured by open PSII reaction centers (Fv<sub>0</sub> /Fm<sub>0</sub>) (Genty et al., 1989). A decrease in qP induced by Hg<sup>2+</sup> indicates a higher proportion of closed PSII reaction centers, i.e., an increase in the proportion of the reduced state of QA, which will almost certainly result in a decrease in the proportion of available excitation energy used for photochemistry (Genty et al., 1989; Dietz et al., 1985). (Havaux et al., 1991).

Because Hg<sup>+</sup> interacts on the reducing side of PS, the quantum yield of electron transport (Eo) has reduced with time (II). It may replace Cu<sup>2+</sup> in plastocyanin, disrupting the electron transport pathway between PS (II) and PS (I). Chun et al (1994) showed that whole photosynthetic oxygen evolving activity is inversely decreased with the increased concentration of HgCl<sub>2</sub> up to 100 µM.

A decrease in Fv/Fm<sub>0</sub> often results in an increase in non-photochemical quenching (qN). Laisk et al (1997) found a similar pattern because of the close linear relationship between the quantum yields of photochemical and non-photochemical quenching. Non-photochemical quenching increased proportionally in response to decreases in F/Fm (Laisk et al., 1997).

To some extent, the electron transport efficiency has demonstrated a steady change. Hg<sup>2+</sup> has the potential to significantly impair photosynthetic electron transport reactions in algae and higher plants (Krupa & Baszynski, 1995). Hg<sup>2+</sup> may reduce the photosystem's ability to dissipate excitation light energy via the photochemical route. According to several studies, Hg<sup>2+</sup> is involved in the breakdown of oxygen evolving complex (OEC) polypeptide composition (Bernier & Carpentier, 1995) and interfering with light harvesting complex II (Nahar & Tajmir-Riahi, 1995).

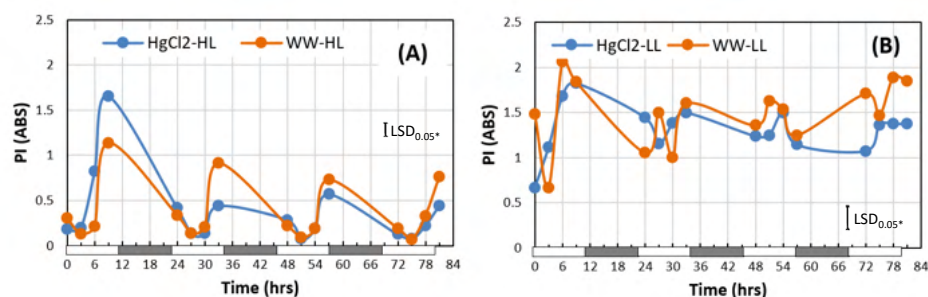
According to these findings, the efficiency of electron transport should be declined with time, but interestingly there were no such kind of observations in this study. That shows the capability of *D. sanderiana* to withstand against the distinct stress conditions showing strong survival mechanisms in the plant.

It proves the potential to use it in phytoremediation of Hg<sup>+</sup> for short time as

this research showed the results within small time duration. It might be better to extent the time period and study this in

advanced for further studies to recommend for long time.

**Figure 3.** Performance Index (PI) for two different treatments of 100 $\mu$ M HgCl<sub>2</sub> and distilled water under (A) high light (HL) - 22,500 $\pm$ 2,000 lux and (B) low light (LL) - 750 $\pm$ 200 lux conditions



### Overall performance of the Photosystem II

As shown in Figure 3, at any given time of the day, the overall performance of the Photosystem II (PS II) of *D. sanderiana* as denoted by the Performance Index [PI (ABS)] in low light (LL: - 750 $\pm$ 200 lux) is significantly higher ( $p<0.05$ ) than in high light (HL:- 22,500 $\pm$ 2,000 lux). Because in low light conditions the plants are not in a stressed condition like under high light levels. Nevertheless only under HL conditions, a circadian variation in PI was observed. The PI was significantly affected by the HgCl<sub>2</sub> under HL conditions 33 hours after imposing the treatment. A similar reduction was observed under the LL conditions as well. The PI (ABS) has dropped drastically after the first day of the establishment in HgCl<sub>2</sub> treatment.

The reduction in PI was observed because of the effect of mercury on photosynthesis in *D.sanderiana*. Mercury has an impact on photosynthesis by interfering with both the light and dark processes of photosynthesis (Bernier et al., 1993). Hg<sup>2+</sup> may reduce the photosystem's ability to dissipate excitation light energy

via the photochemical pathway. The size and the number of active photosynthetic centers in the chloroplast are damaged due to the contamination of Hg<sup>2+</sup> and thereby the photosynthetic efficiency of the plant and the efficiency of the photosynthetic apparatus are declined.

### CONCLUSIONS

This research revealed that *D.sanderiana* has the ability to endure higher stress levels, particularly for heavy metals such as Hg, as seen by chlorophyll fluorescence characteristics.

Fluorescence measurements of chlorophyll are useful for describing the state of the photosynthetic apparatus in plants. Under high light conditions, there was a strong unimodal diurnal fluctuation in all OJIP parameters except electron transport efficiency, TR RC and ET RC as a response to stress levels. This suggests that Hg<sup>2+</sup> has impacted negatively on photosystem II. The foliage quality, on the other hand, was rated as satisfactory. Furthermore, with time, the effective antenna size (ABS/RC) and maximum quantum yield of non-photochemical de-excitation (DIO) in HgCl<sub>2</sub> increased significantly, indicating *D.*

*sanderiana*'s ability to adapt to such stressors. However, the plant can withstand heavy metal stress, indicating that it can be used for short-term HgCl<sub>2</sub> biomonitoring. These findings are extremely important because it is an ornamental plant hence not accumulating in the food chain.

In this research only one concentration of HgCl<sub>2</sub> was selected which was studied before as a stress level. But for further studies, different Hg concentration levels can be experimented and examine the variations along with those stress levels. The time duration of this experiment was limited to some extent. Therefore, the extension of the research period may be an advanced objective in future studies.

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## Probing the Effect of Salicylic Acid on the Post-harvest Changes in *Cordyline fruticosa* Using OJIP Chlorophyll Fluorescence Transient Analysis

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### ABSTRACT

Use of proper postharvest treatment is vital to ensure a longer postharvest life in ornamental plant production including cut-foliage. Although Salicylic Acid (SA) is a promising postharvest treatment, to maintain postharvest quality of many cut foliage species, its direct impact on the photosynthetic process has debatable outcomes as reported by various researchers. In this study, we attempted to investigate the effect of SA on the post-harvest performance in cut foliage using OJIP analysis. Two concentrations of SA (100 and 300 mg/L) with a water-control were tested with cut-leaves of *Cordyline fruticosa* var Willy's gold at room temperature (25±2°C). OJIP parameters, i.e., specific energy fluxes (ABS/RC, TR/RC, ET/RC, and DI/RC), flux ratios (maximum quantum yield of primary photochemistry-  $P_o$ ), electron transport efficiency (  $\phi_o$ ), quantum yield of electron transport (  $\Phi_{Eo}$ ), and performance index (PI) were recorded every other day using a fluorometer (FluorPen FP). Leaf chlorophyll, anthocyanin contents were also determined using spectrophotometry. Data were analysed according to completely randomized design (CRD). The PI increased in both SA treatments up to the 7<sup>th</sup> day of treatment. SA at 300 mg/L had a significant effect on most of the OJIP parameters, specific fluxes in particular. SA treated leaves exhibited higher on the retention of chlorophyll. Except  $P_o$  all other flux ratios were significantly affected by the SA treatment indicating its impact on the photosynthetic apparatus but most probably in retarding the ethylene biosynthesis as reported elsewhere. SA extends the vase life of *Cordyline fruticosa* cut leaves. Moreover, there is an effect of SA on the photosynthetic machinery; net photosynthesis proved the OJIP results. The underlying mechanism warrants further studies.

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## INTRODUCTION

During early 1970s, the horticulture industry began to play a significant part in the export economy in Sri Lanka. This was the consequence of an endeavor to diversify the exporting commodities in order to gain additional sources of revenue and foreign exchange (Ranil *et al.*, 2016). From these floricultural commodities, ornamental foliage plants are vital in interior designing and hence a significant revenue can be generated both on the domestic and international markets (Malakar & Acharyya, 2019). *Cordyline fruticosa*, commonly known as “Hawaiian Ti plant” belonging to family Agavaceae, is a popular ornamental cut green in the Sri Lankan floriculture market. This ornamental consists of high decorative value due to its variety of colors in leaves and foliar patterns.

Temperature, relative humidity, ethylene, light, maturity stage, and purity of vase solution are the elements that affect vase life of cut foliage. Ethylene is a principal factor which affects the freshness of cut foliage in the several ageing processes. Therefore, the capacity to delay senescence or extend the vase life of cut flowers and foliage is critical. Experimentally prepared chemical solutions have proven to enhance the vase life of many cut flowers and foliage species by disrupting specific physiological processes (Gardening, 2013).

Salicylic acid (SA) is a crucial component of plant defense signaling networks in the acquisition of local and systemic resistance to several pathogens (Vos *et al.*, 2013). However, it mediates abiotic stress adaptation. SA plays an indirect or direct involvement in several physiological processes, including photosynthesis, as a stress-related signaling molecule (Poór *et al.*, 2019). SA is also known to have many beneficial effects both at preharvest and

postharvest levels, on several flower and foliate species.

The OJIP chlorophyll fluorescence technique has been rapidly developed and applied to plant physiology studies, which shows great potential to gain insights into the postharvest physiology of ornamental cut flower/foliage. This technique is useful to detect non-destructive measurements that enable for early detection of stress

**Figure 1.** Cut leaves of *Cordyline fruticosa* var “Willy’s Gold”

Photo Credit:

<http://www.greengoddess.lk/foliage-2/#>



conditions, during and soon after storage or transportation. In addition, it has high throughput in sample testing rate. This is an easy technique that can be applied for intact plants as well as for any plant part (Abbott, 1999). The OJIP technique can be used to explain the sequential flow of energy through PS II at the reaction center or a cross-section of a region that has been exposed to exciting light (Force *et al.*, 2003). Also, it is an information rich source about the photosynthetic apparatus that can be used to identify the post-harvest changes. The objective of the current study was to investigate the effect of SA on the post-harvest performance as well as the quality in cut foliage using OJIP analysis.

## MATERIALS AND METHODS

The experiment was conducted at the Research Laboratory, Department of Crop Science, Faculty of Agriculture, University of Peradeniya, Sri Lanka, under a relative humidity of  $90-95 \pm 2 \%$  and room temperature of  $25 \pm 2^\circ\text{C}$ .

### Plant materials and postharvest treatments

Healthy leaves at same maturity level were collected from *Cordyline fruticosa* var. "Willy's Gold". Three different holding treatments were used including control (distilled water),  $100 \text{ mg.L}^{-1}$  and  $300 \text{ mg.L}^{-1}$  salicylic acid which consisted of the pH values 6.97, 2.87 and 2.68 respectively. The individual leaves selected at the initial step were recut while holding in water using a disinfected sharp secateur. The uniform cut leaves were dipped in 150 mL of holding solutions (treatments) separately. While making these salicylic acid solutions, few drops of ethanol were added to dissolve salicylic acid and these solutions mainly consisted of distilled water, salicylic acid and ethanol. Materials were organized in a Completely Randomized Design (CRD) with 02 replicates per treatment.

### Measurements of chlorophyll fluorescence

Chlorophyll fluorescence (ChlF) data were recorded using a portable fluorometer (FluorPen, FP 100, Photon Systems Instruments Inc). The data were collected every other day commencing from the first day of treatment application throughout the vase life. Three ChlF data were collected from three different places of a single leaf that was chosen per treatment. During taking measurements, the cells were exposed to a 3000 molm<sup>-2</sup>s<sup>-1</sup> saturating light pulse. ChlF were captured at 10 s intervals across a period of 10 s to 1 s (Beneragama *et al.*, 2014). Each transient was analyzed using raw data

according to the OJIP-test (Strasser *et al.*, 2005). The major OJIP derived parameters were taken; specific energy fluxes (ABS/RC, TR/RC, ET/RC and DI/RC), flux ratios (maximum quantum yield of primary photochemistry-  $P_o$ ), electron transport efficiency and quantum yield of electron transport ( $E_o$ ), and performance index (PI) (Beneragama *et al.*, 2014) were recorded every other day.

### Leaf chlorophyll contents

Leaf chlorophyll a and b contents (milligrams of chlorophyll per gram of leaf tissue extracted) were measured on the first day and the last day of the experiment using 80% acetone extraction method. Absorbance was determined by spectrophotometry at 645 nm and 663 nm. (Witham, 1971).

### Leaf anthocyanin contents (LAC)

LAC (milligrams per liter) were assessed using UV/VIS spectroscopy method at the first day and the last day of the vase life. Here we considered the day which leaves could not be used for floral arrangements as the last day of the vase life according to visual appearance. Collected leaf samples were ground and extracted with potassium chloride (pH 1) and sodium acetate (pH 4.5) solvents. Absorbance was determined by spectrophotometry at 700 nm. The monomeric anthocyanin content of the samples was calculated according to Wrolstad(2001). During this time period this experiment was done only in a single time.

### Experiment design and data analysis

The experiments were laid out in a completely randomized design (CRD). The data were subjected to ANOVA in a completely randomized design (CRD) using statistical analysis software (SAS, version 9.4, SAS Institute Inc., Cary, NC, USA). The significance of differences between the mean values was determined

by Duncan's Multiple Range Test (DMRT) at  $p < 0.05$ .

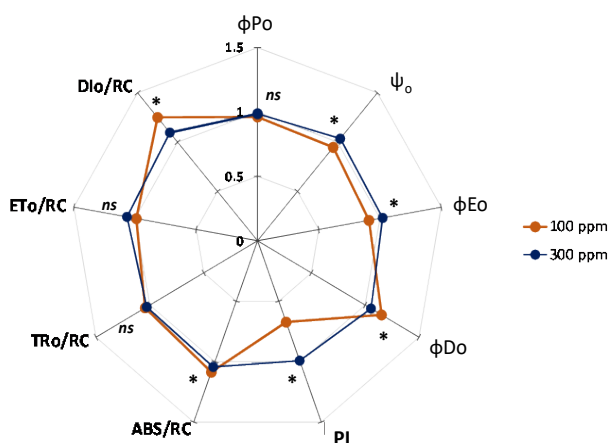
## RESULTS AND DISCUSSION

According to previous studies the quality of leaves was assessed using parameters such as leaf color, petiole condition, degree of glossiness, and overall appearance of each leaf when determining the vase life of cut greeneries (Samarajeewa & Wickramasinghe, n.d.), but in this study parameters based on OJIP analysis as well as pigment contents were evaluated.

### Specific Energy Fluxes, Flux Efficiencies, and Performance Index

At the end of the 15<sup>th</sup> day of the experiment, the values for specific energy fluxes, quantum efficiencies and the Performance Index in both salicylic acid (SA) treatments were normalized against the control treatment for easy comparison of the effect of SA (Figure 2). Among the four specific energy fluxes, the effective antenna size (ABS/RC) and heat dissipation per reaction center (Dio/RC) in the leaves treated with 100 ppm salicylic acid (SA) were found to be

**Figure 2.** Specific fluxes, flux ratios and performance indexes of *Cordyline fruticosa* var. "Willy's Gold" after 15 days of treatments. The values for the treatments (100 ppm and 300 ppm salicylic acid) have been normalized against the control (0 ppm salicylic acid). (ppm - parts per million=mg.L<sup>-1</sup>)



Asterisk mark at each parameter shows a significant difference ( $p < 0.05$ ); ns - non-significant.

ABS/RC - effective antenna size, TR/RC - Trapping per reaction center, ET/RC - Electron transport per reaction center, Dio/RC - Heat dissipation per reaction center,  $\phi Po$  - Maximum quantum yield of primary photochemistry,  $\psi_o$  - Electron transport efficiency,  $\phi Eo$  - Quantum yield of electron transport,  $\phi Do$  - Maximum quantum yield of non-photochemical de-excitation and PI - Performance significantly ( $p < 0.05$ ) higher compared to those in the leaves treated with 300 ppm SA. According to previous reports, SA inhibits the opening of stomata in epidermal layers thereby acting as an antitranspirant in leaves (Larqu  Saavedra, 1978, Fariduddin *et al.*, 2003).

SA is also known to inhibit the auxin oxidation, resulting in an increase in net photosynthesis in the leaves. (Fariduddin *et al.*, 2003) In the present study, the antitranspirant activity was evident in the leaves treated with 300 ppm SA whereas the 100 ppm SA concentration was found to be insufficient to serve the same purpose, thus making those leaves absorb more energy (ABS/RC). However, as *Cordyline fruticosa* was able to dissipate the excess energy absorbed by the antenna molecules, the leaves did not suffer from any energy loading. The SA levels did not have a significant effect on the other two specific energy fluxes, i.e. trapping per reaction center (TR/RC) and electron transport per reaction center (ET/RC). But these results were contradicted with the findings of Po r *et al.* (2019).

Among the flux efficiencies, except the maximum quantum yield of primary photochemistry ( $\phi Po$ ), all the other three efficiencies, i.e. electron transport efficiency ( $\psi_o$ ), quantum yield of electron transport ( $\phi Eo$ ) and maximum quantum yield of non-photochemical de-excitation ( $\phi Do$ ) displayed a significant difference

between the two SA concentrations used in the study (Fig. 2). It was apparent that the electron transport beyond the reaction centers (RC) was significantly enhanced by the SA at 300 ppm concentration. These observations agree with the findings that have been reported previously by Ghassemi-Golezani and Lotfi (2015).

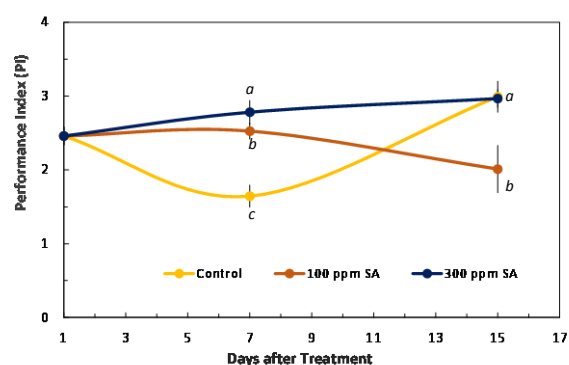
Even though concentrations of salicylic acid effect on OJIP parameters explains about the photosynthetic machinery, it couldn't be given evidence for the extending of vase life of *Cordyline fruticosa*. The effect of salicylic acid on the ethylene production as well as the retention of pigment molecules may be the cause for this. Hassan & Ali (2014) stated that ACC-oxidase activity (ACC, a precursor for ethylene biosynthesis) can be retarded by salicylic acid leading to extending the vase life of *Gladiolus* cut spike by retarding the senescence mediated by ethylene.

### Performance Index

The overall performance of the Photosystem II (PS-II) as denoted by the Performance Index (PI) in the chlorophyll fluorescence transient analysis, has been recorded on the 1<sup>st</sup>, 7<sup>th</sup> and 15<sup>th</sup> day of the treatments (Figure 3). By the 7<sup>th</sup> day, leaves treated with both SA treatments showed a significantly ( $P < 0.05$ ) higher performance in the PS-II compared to the control leaves. This is probably due to the well-documented effects of SA on improving the photosynthetic performance of leaves, mostly attributed to the increased Rubisco activity (Khodary, 2004). However, by the 15<sup>th</sup> day of the treatment, the PI of the leaves treated with 100 ppm SA was significantly ( $P < 0.05$ ) lower compared to that of 300 ppm SA treated leaves and the control leaves. It was observed that the holding solution with 100 ppm SA has been contaminated with microorganism (data not shown). Although SA is known to

inhibit microbial growth in holding solutions (Kazemi *et al*, 2012), the low concentration that we used in our experiment (i.e., 100 ppm) might have induced microbial growth by creating a slightly acidic environment for microbes. However, control treatment did not show any significant visual change in vase solution. At the end of the experiment, the control samples also reached a higher PI value similar to that of leaves treated with 300 ppm SA showing an adaptive response to low light conditions.

**Figure 3.** Performance index (PI) in *Cordyline fruticosa* var. "Willy's Gold" under different treatments (Control (0 ppm Salicylic Acid-SA), 100 ppm SA and 300 ppm SA). (ppm - parts per million= $\text{mg.L}^{-1}$ ) Different letters on 7<sup>th</sup> and 15<sup>th</sup> days of measurement indicates a significant difference as per the DMR test ( $p < 0.05$ ).



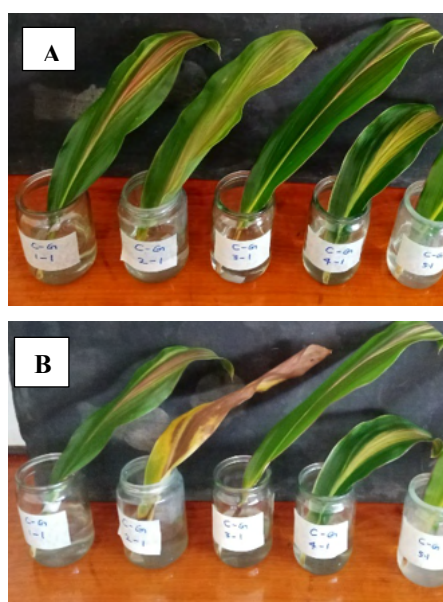
### Chlorophyll and Anthocyanin content

The chlorophyll content and the anthocyanin content were determined in all the leaf samples under different treatments on the 1<sup>st</sup> day and on the 15<sup>th</sup> day of the experiment (Table 1). The chlorophyll degradation was inevitable even in the presence of SA. However, there was a significantly higher retention of chlorophyll *a* content in the leaves treated with 300 ppm SA, whereas chlorophyll *b* was retained significantly by both SA treatments compared to control at the 15<sup>th</sup> day.

**Table 1:** Chlorophyll and Anthocyanin contents in *Cordyline fruticosa* var. “Willy’s Gold” under different treatments: Control (0 ppm Salicylic Acid-SA), 100 ppm SA and 300 ppm SA) (ppm - parts per million= $\text{mg.L}^{-1}$ ) at the first day and the last day of the experiment. Means  $\pm$  Standard deviation are shown (n=3). Means with the same letter are not significantly different ( $p < 0.05$ ).

	Initial	15 Days after treatment		
		Control	100 ppm SA	300 ppm SA
Chlorophyll <i>a</i> (mg/g)	$1.41 \pm 0.08^a$	$0.35 \pm 0.19^c$	$0.37 \pm 0.04^c$	$0.41 \pm 0.11^b$
Chlorophyll <i>b</i> (mg/g)	$0.32 \pm 0.26^a$	$0.20 \pm 0.08^c$	$0.24 \pm 0.04^b$	$0.22 \pm 0.07^b$
Anthocyanin (mg/L)	$135.8 \pm 35.2^b$	$54.7 \pm 31.3^c$	$491.3 \pm 124.5^a$	$424.9 \pm 93.5^a$

**Figure 4.** Visual appearance of control, 100ppm Salicylic acid and 300 ppm salicylic acid treated *Cordyline fruticosa* cut foliage respectively (A) 1<sup>st</sup> day of treatment application (B) 15<sup>th</sup> day of treatment



Zhao *et al.* (1995) have demonstrated that treatment with salicylic acid, increased pigments content in soybean plants. In addition, Sinha *et al.* (1993) reported that chlorophyll and carotenoid contents of maize leaves were increased upon treatment with SA. According to Agarwal *et al.*, (2005) ,SA reduces hydrogen peroxide (ROS; Reactive Oxygen Species) content in cells leading to an increased level of chlorophyll and carotenoid pigments. This indicates the favorable effect of SA through increased antioxidant enzyme activity and decreased oxidative stress in photosynthetic tissues.

In the present study, the postharvest chlorophyll retention has been increased by the application of SA. Moreover, the SA treatments, significantly increased the anthocyanin contents in *C. fruticosa* leaves by the 15<sup>th</sup> day, surprisingly even more than the contents measured at the 1<sup>st</sup> day of the experiment. Anthocyanin degradation is a common occurrence that has a negative impact on the quality of ornamental flowers and foliage, including roses (Luo *et al.*, 2017). As exogenous SA has been shown to stimulate the biosynthesis of anthocyanin pigments (Ram *et al.*, 2013), it is possible that SA treatment could delay the degradation of pigments in petals. As seen in model plants, increasing the concentration of phenolic compounds and anthocyanins may help to counteract senescence and prolong the lifespan of the flower (Cocetta *et al.*, 2018). Therefore, these reports support the observation related to SA induced anthocyanin levels in the present study.

## CONCLUSIONS

Based on this study it can be concluded that there is a significant effect of Salicylic acid on the performance of the photosynthetic apparatus of cut foliage *Cordyline fruticosa* proven by some of the OJIP parameters. Unless it is contaminated with microorganisms, 100 ppm salicylic acid treated leaves may also show a better performance. However, the extension of the vase life of the leaves may have

resulted most probably due to retardation of ethylene biosynthesis by SA treatments, as reported elsewhere. Therefore, the underlying mechanism of SA induced vase life extension warrants further investigation. Moreover, the ability of SA enhances the anthocyanin production for postharvest color retention in different variegated cut foliage.

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## The effect of different ethylene concentrations on different maturity stages on the postharvest quality of Cavendish banana (*Musa acuminata*) cultivar, 'Grande Naine'

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### ABSTRACT

Banana is one of the most cultivated fruit crops in Sri Lanka and 5% of total production is exported. Due to a lack of knowledge on harvesting maturity, artificial ripening and other postharvest technologies, 20% of the yield is lost during the post-harvest handling of banana. This study was conducted to examine the effect of application of different ethylene concentrations at different maturity stages on postharvest quality of Cavendish banana (*Musa acuminata*) cultivar 'Grande Naine' under tropical climate conditions. Mature bananas combs (hands) at twelve weeks, thirteen weeks and fourteen weeks after flowering were exposed to 0, 85 and 170 ppb of ethylene gas for 24 hours at 24 °C and under 75% RH. Different physicochemical properties were obtained and analyzed statistically. There was a significant interaction effect between the maturity stage and ethylene concentration on weight loss, TSS and pH at the table-ripe stage. The fruits lost weight steadily down to 8.5%, possibly because of the rapid rates of metabolism as well as water loss. Meanwhile, TSS increased from 4% to 20% and pH decreased gradually with the ripening of banana. The results revealed that the best stage of maturity for harvesting Cavendish bananas is at 11-12 weeks after flowering for improved physicochemical and sensory properties at the table ripe stage. Further, it can be concluded that the use of ethylene concentration of 85 ppb for ripening Cavendish banana instead of the higher concentrations that are commercially applied, would be cost-effective without decreasing the fruit quality.

## INTRODUCTION

Banana (*Musa* spp.) is considered the most significant fruit crop in Sri Lanka and cultivated in more than 50,000 ha land extent. It is reported to be cultivated 54% of the extent of fruits crops and results in 75,000 Mt of annual banana production. Of the total production of bananas in Sri Lanka, 5% is exported, and approximately 20% is lost due to postharvest losses (Wasala et al., 2014).

Banana can be harvested at a wide range of physiological maturity stages. Based on that, different physical and chemical indexes are developed to identify the correct maturity stage, such as the number of days after fruit set, fullness indices, the shape of transversely cut fruits and loss of chlorophyll in fruits (Amin et al., 2015). Generally climacteric fruits can be harvested after reaching the full maturation and before reaching the ripening stage. As a climacteric fruit, the banana is usually harvested at the pre-climacteric stage and for commercial purposes, the fruits are artificially ripened. Artificially ripening enables to minimize losses during transportations and to timely release of the product at the desired ripening stage.

Fruit ripening is the combination of physiological and biochemical processes leading to changes in pigments, sugar content, flavour, aroma and texture. Fruits harvested before maturity may not ripe adequately and may not reach the best quality (Amin et al., 2015). As a plant hormone, ethylene performs an important role during ripening by stimulating the development of colour, texture, aroma, and flavour and reduce the ripening variability. Ethephon, ethrel like ethylene releasing compounds are

used in commercial level banana value chain to induce the ripening process artificially (Malik et al., 2005).

Cavendish is a worldwide cultivated subgroup of bananas. In Sri Lanka, Cavendish is cultivated for the targeted export market. It is a pure triploid of *Musa acuminata* (AAA), and its popular cultivars include Grand Nine, Lactana, Patite Nine, Poyo and Williams. In local conditions, Cavendish banana harvests in a wide range of physiological ages (10-15 weeks after fruit setting) with the use of standard calliper. Even though the banana is harvested at different maturity stages, the same ethylene concentration (100-1000 ppm) is used in the ripening process due to the less knowledge about effective ethylene concentration for fruit ripening. The present study was conducted to examine the effect of different ethylene concentrations on different maturity stages on postharvest quality in Cavendish banana under tropical climatic condition in Sri Lankan condition with the objective of improving the quality of banana exports from Sri Lanka.

## MATERIALS AND METHODS

This study was carried out in the research lab, institute of postharvest Technology, Anuradhapura and Banana processing centre, CIC seed farm, Palwehera, Dambulla. Mature Cavendish banana (Grande Naine cultivar) bunches were harvested 11, 12 and 13 weeks after flowering (WAF) from the CIC banana plantation in Pelwehera. Bunches were 'de-handed' and the second and third hands from a proximal end of each bunch were selected for ethylene treatment. Each hand was

separated into clusters with seven fingers. For the three maturity stages, altogether 27 clusters were selected with 09 clusters for each maturity stage. All clusters were washed with chlorinated water to remove the latex and dirt. Then, the banana was washed with potassium aluminium sulphate (alum) (1% W/V). Banana clusters were allowed to drip dry and placed separately in carton boxes and stored in a cold room under 14 °C.

### **Experimental design and ethylene treatments**

The research was laid-out as two factor factorial completely randomized design (CRD) keeping maturity stage and concentration of ethylene as the factors and having altogether nine treatment combinations and three replicates. Two ml of ethephon (Thrill® - 480 g/L) dissolved in one liter of water was used to generate ethylene. Lime dissolved in water (100g/L) was used to keep the media alkaline and solutions were mixed. The 1<sup>st</sup> concentration 5 mL/cubic feet and 2<sup>nd</sup> concentration 10 mL/cubic feet of the prepared solution were applied to the ripening chambers separately. Clusters in each maturity stage (11, 12 and 13 WAF) were divided into three equal subgroups which contained 03 clusters each. Each subgroup was placed in 9 different plastic chambers with the same volume. The lids of chambers were closed and kept under 18 °C and 80% RH for 24 hrs. After 24 hrs, samples were transported to IPHT, Anuradhapura and kept at ambient temperature (26 ± 2 °C) and measurements were taken up to the table ripe stage.

11WAF E0-harvested at 11 weeks after flowering without ethylene treatment  
 11WAF E1-harvested at 11 weeks after flowering and treated with ethylene concentration 1

11WAF E2-harvested at 11 weeks after flowering and treated with ethylene concentration 2.

12WAF E0-harvested at 12 weeks after flowering and no ethylene

12WAF E1-harvested at 12 weeks after flowering and treated with ethylene concentration 1

12WAF E2-harvested at 12 weeks after flowering and treated with ethylene concentration 2

13WAF E0- harvested at 13 weeks after flowering and no ethylene

13WAF E0-harvested at 13 weeks after flowering and treated with ethylene concentration 1

13WAF E0- harvested at 14 weeks after flowering and treated with ethylene concentration 2

### **Evaluation of postharvest loss and fruit quality**

#### **Weight loss:**

$$\text{Weight loss} = \frac{\text{Initial weight} - \text{final weight}}{\text{Initial weight}} \times 100$$

#### **Total soluble solids (TSS):**

TSS was measured by using a handheld digital pocket refractometer (ALFA-ALTAGO HR -5).

#### **pH:**

pH of the juice was measured using a digital pH meter (model HI 2002, Australia).

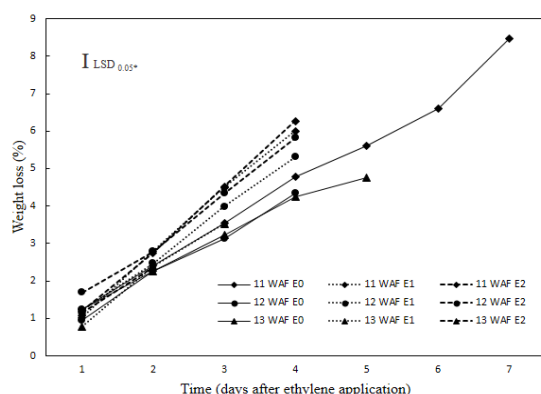
#### **Statistical analysis**

All parametric data were subjected to ANOVA using the SAS package. Treatments of significant parameters were compared at  $p < 0.05$  according to the Duncan multiple range test (DMRT). Non-parametric data and sensory properties were subjected to the Kruskal-Wallis test using Minitab. Treatments means were compared at  $p < 0.05$  according to multiple comparison procedures.

## RESULTS AND DISCUSSION

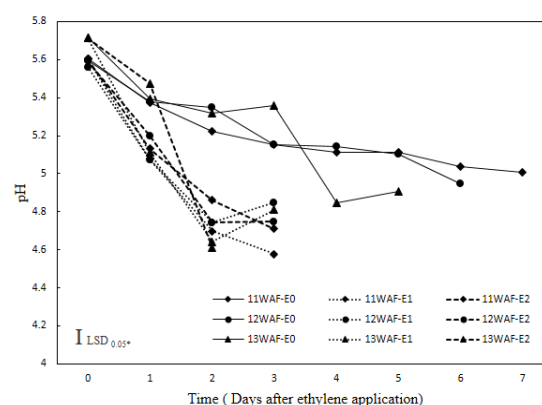
### Changes in cumulative weight loss

**Figure 1.** The relationship between time (Days after ethylene application) and percentage of cumulative weight loss of banana ripening under 9 different treatments. WAF- weeks after flowering, E0- 0 ppm ethylene, E1- 85 ppb ethylene, and E2- 170 ppb ethylene.



As shown in Figure 1, treatment 11WAF-E0 recorded a significantly higher weight loss compared to all other treatments which took 07 days to reach the table ripe stage while treatment 13WAF-E2 recorded the lowest weight loss which took only 2 days to reach the table ripen stage. Moreover, bananas that harvested 11 WAF were reported higher weight loss compared to the 12WAF and 13 WAF. Also, E0 treated bananas recorded a long period of ripening and higher weight loss compared to the E1 or E2 treated bananas. There were no significant differences between E1 and E2 under all three maturity stages. The weight loss of all the treatments was gradually increased with the time during the ripening process.

**Figure 2:** The relationship between time (from harvesting to table ripe stage) and pH of banana ripening under 9 different treatments. WAF- weeks after flowering, E0- 0 ppm ethylene, E1- 85 ppb ethylene and E2- 170 ppb ethylene



According to Siriboon and Banlusilp (2004), fruit ripening is a collection of biochemical reactions and starch converted into sugars. These reactions are required energy produced from respiration and excess energy released from tissues by the vaporization of water. Water loss is, first, a loss of marketable weight and then adversely affecting the appearance because of wilting and shriveling. The weight loss of fruits at each stage of ripening was positively correlated to the storage duration (Adi et al., 2019). Therefore, no ethylene treatments (E0) and low maturity fruits may cause to extend the ripening process (time taken to reach the table ripen stage) and results in high cumulative weight loss, compared to that of the other treatment combinations that employee ethylene application for fruit harvested at relatively matured stages.

### Changes in the pulp pH level

When the changes in pH levels are considered, the pH value of all the treatments gradually decreased with time (Figure 2). The pH of the banana pulp from treatment 11 WAF-E0 decreased from 5.6 to 5.0 during the ripening process and it has been recorded as the highest pH value at the table ripe stage. Pulp pH of treatment 13WAF-E0 decreased from 5.7 to 4.8 during the early four days of the ripening process and then increased to 4.9 at the

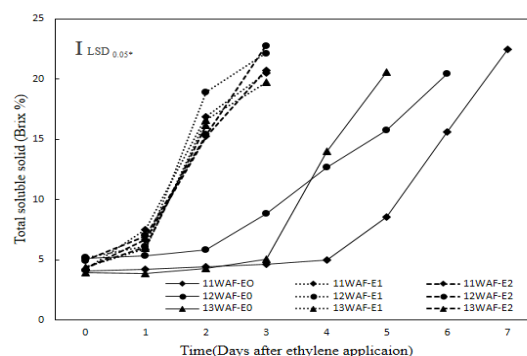
table ripe stage. Pulp pH values of E0 treated bananas and E1 treated bananas were not shown significant differences among the treatments at the table ripe stage but were significantly different from the E0 and E2 treated.

According to Hailu et al (2013), pH of the pulp of the green banana fruit ranged between 5 - 5.8 and pH of the pulp of ripened banana fruit ranged between 4.2 - 4.8. Generally, in bananas, the pulp shows an increase in acidity during ripening and the main organic acid present is malic, citric and oxalic. The pulp pH of cultivar Grand nine dropped sharply from an initial value of 5.80 at peel color stage 1 to peel color stage 2, then levelled off and increased slowly at a latter part of the ripening process (Dadzie and Orjeda, 1998). Ethylene treated bananas usually show a higher respiration rate and organic acid production compared to the those of the control treatment. That implies a rise in the organic acid production and a decline in pH during the banana ripening process (Belew et al., 2016). Both sugars and organic acids originate from photosynthetic assimilates. Therefore, the amount of assimilates that accumulates depends on the maturity stage and its effect on the organic acid production during ripening (Hailu et al., 2013).

### Total Soluble solids (TSS %)

When considering TSS%, among all treatment combinations, 11 WAF E0 recorded the highest value while 13 WAF E2 recorded the lowest value. There was a significant difference between the three maturity stages (Fig. 3). When considering ethylene concentration, no ethylene (E0) treatments were shown any significant difference compared to the ethylene treated bananas.

**Figure 3.** The relationship between time (from harvesting to table ripe stage) and pH of banana ripening under 9 different treatments. WAF- weeks after flowering, E0- 0 ppm ethylene, E1- 85 ppb ethylene and E2- 170 ppb ethylene



According to Maduwanthi and Marapana (2019), ethylene affects the rate of chemical changes during ripening however, it did not significantly affect the final levels of sugar and starch content in the ripe pulp. According to Adi et al., (2019) TSS is also positively correlated with the ripening duration taken to attain a specific ripening stage. Treatment 11WAF-E0 took 7 days to and treatment and 13 WAF-E2 took 2 days to reach the table ripen stage. It would be the reason for the highest TSS% in 11 WAF E0. When compared between 12 WAF and 13 WAF, the higher TSS was found in 12 WAF-E2.

According to Hailu et al. (2013), a amount of starch accumulation depends on the maturity stage. Therefore, 12 weeks' mature banana contains more starch than the 11 weeks' mature banana. The stage of maturity of banana fruit at harvest significantly influenced most of the activities of some enzymes. It could be another reason for the variation in TSS value in the different maturity stages.

Other than these physiochemical properties, a sensory evaluation was conducted to assess the organoleptic

properties of banana at table ripe stage and the treatment 12WAF-E1 reported as the best treatment and the next best treatment is 11WAF-E1. (Data not shown).

## CONCLUSIONS

A cumulative weight loss, pH changes and total soluble solid % showed a significant interaction effect between ethylene concentration and its/the maturity stage. It was found that it is better to harvest bananas at 11-12 weeks after flowering for attaining better physicochemical and sensory properties at the table ripe stage. The application of ethylene concentration of 85 ppb, irrespective of the maturity stage was found to be cost-efficient (without decreasing fruit quality).

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## Assessment of Drought Tolerance Ability of Selected Finger Millet Varieties in Sri Lanka

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### ABSTRACT

Finger millet (*Eleusine coracana* (L.) Gaertn. is a highly nutritious cereal crop widely cultivated in Sri Lanka. Drought is a major abiotic stress which leads to limit plant's growth and productivity. Two cultivated finger millet varieties (*Rawana* and *Oshada*) and three promising accessions (ACC: 7090, ACC: 7088, and ACC: 12415) were screened in a poly-house for drought tolerance using morpho-physiological traits and assessed using 5 selected Simple Sequence Repeat (SSR) markers (UGEP3, UGEP10, UGEP24, UGEP60, and UGEP78). Drought response was assessed using 9 morpho-physiological parameters. Through parallel analysis with control plants, it indicated that the variety *Oshada* performed effectively under drought stress compared to the other genotypes while *Rawana* indicated more sensitiveness to water withholding. DNA from each finger millet genotypes was amplified using selected SSR markers separately. Even though all five selected SSR markers exhibited comparatively higher polymorphism among the finger millet genotypes in previous studies, none of the markers showed the presence of polymorphism in the narrow genetic variation among the studied five genotypes. Interrelationships among the different agronomic traits measured were studied using Principal Component Analysis (PCA). PCA revealed that shoot dry weight (SDW), shoot fresh weight (SFW), shoot length (SL) and root dry weight (RDW) have contributed to the two principal components collectively. Hence, these traits can be effectively used in breeding programmes to generate variability. Furthermore, studies should be conducted with a greater number of SSR markers in order to have an in-depth assessment of genetic variability in the cultivated finger millet genotypes.

## INTRODUCTION

Finger millet (*Eleusine coracana* (L.) Gaertn) is an allotetraploid ( $2n = 4x = 36$ ) nutria cereal crop species of the family Poaceae, subfamily chloridoideae and is commonly known as “Kurakkan” or “Kurahan” in Sri Lanka (Wakista et al., 2017). It is an important food crop widely cultivated in the arid and semi-arid areas of the world, especially in East African and Asian countries including Sri Lanka. Finger millet has been cultivated in Sri Lanka from the ancient times and it is considered as the second staple food after rice in most of the rural areas (Dasanayake, 2017).

Finger millet is considered a very important crop due to several traits like resistance to pests and diseases, short growing season, productivity under hardy and drought conditions, high nutritious value, and excellent seed storage quality. They even have health beneficial effects for being, anti-diabetic, atherosclerogenic effects anti tumorigenic, antioxidant, and anti-microbial. The grain contains 70-76% of carbohydrates, 7-14% of crude protein, and is also inherently rich in methionine, iron, and calcium (Barbeau and Hilu, 1993). Increasing attention is paid in recent days to improve the productivity of finger millet due to its high nutritional content, its inherent capacity to tolerate several biotic and abiotic stresses, and adaptability to grow on marginal soils that have low fertility (Babu et al., 2007). Due to adaptation for semi-arid tropical climate, finger millet has been considered as a drought resistant crop. Genes that are involved in the C4 mechanism could be one of the reasons for its hardy nature under reduced moisture and hot environmental conditions. Finger millet contains C4 photosynthesis system, hence they prevent photorespiration. As

C4 plants can close their stomata for long periods, they can significantly reduce moisture loss through the leaves which in turn results in drought tolerance in finger millet (Wang et al., 2018).

In Sri Lanka, although some researchers have reported the genetic diversity of finger millet (Dasanayake, 2017), screening for drought tolerance of finger millet has not been yet revealed. As finger millet is considered the second staple food after rice and maize in Sri Lanka, more attention should be paid to this crop. This crop is grown widely by subsistence farmers and acts as a food security crop because of its high nutritional profile and excellent storage qualities (Dida et al., 2007). Therefore, it is important to identify the finger millet accessions which have excellent drought tolerance ability and eventually those can be used for breeding programmes to avoid the high yield losses due to long and extreme drought periods. Accordingly, the present study was conducted to assess the drought tolerance in two cultivated finger millet varieties and newly improved three accessions of finger millets.

## MATERIALS AND METHODS

### Experimental Site

The present study was conducted at the Biotechnology laboratory of the Faculty of Agriculture and Plantation Management, Wayamba University of Sri Lanka, Makandura from August to November 2020.

### Plant materials

To study the effect of drought stress on finger millet, seeds of two cultivated varieties (*Rawana* and *Oshada*) and three promising accessions (ACC: 7090, ACC:

7088, ACC: 12415) were obtained from Field Crops Research and Development Institute (FCRDI), Mahailuppallama, Sri Lanka.

### **Experimental set-up for drought screening**

Screening of selected genotypes for drought tolerance was conducted in a poly-house of the Department of Biotechnology, Faculty of Agriculture and Plantation Management, Wayamba University of Sri Lanka, Makandura, Sri Lanka from August to November 2020, where the average ambient temperature ranged from 23 °C and 30 °C.

The seeds of five finger millet genotypes were soaked overnight and sown in plastic pots containing silt loam soil: vermicompost in 1:1 ratio (10 seeds per pot). Drainage holes were provided at the bottom and the pots were arranged in a Completely Randomized Design (CRD) with four replicates. Standard agronomic practices recommended by the Department of Agriculture (DOA) were followed to raise the crops. Seedlings were thinned up to 3 plants per pot at 12 Days. After Sowing (DAS), control set up was also maintained with four replicates.

The plants were irrigated for 24 days after sowing by daily watering slightly above the soil saturation and thereafter, drought stress was imposed by withholding water. Drought-stressed plants were given 0.5 liters of water in weekly intervals until the plants reach the reproductive stage. Control set up was maintained with regular watering of 0.5 liters of water (Krishnamurthy et al., 2016).

### **Assessment of drought tolerance**

Drought tolerance of each genotype was assessed using drought-responsive nine morpho-physiological parameters *i.e.* chlorophyll content (CC) (SPAD units), shoot length (SL) (cm), root length (RL) (cm), shoot fresh weight (SFW) (g), shoot dry weight (SDW) (g), root fresh weight (RFW) (g), root dry weight (RDW) (g), the number of productive tillers/basal tiller number (BTN) and days to 50% flowering (DF50), at 58 days after imposing drought stress. Chlorophyll content was measured using a chlorophyll meter (SPAD-502 chlorophyll meter) which is a non-destructive method of measuring chlorophyll content. SPAD units generated from the chlorophyll meter are directly proportional to the chlorophyll content in a leaf (Ling *et al.*, 2011).

### **DNA extraction and quantification**

DNA was isolated from fresh 2-weeks old seedlings using the cetyl tri-methyl ammonium bromide (CTAB) method (Murray and Thompson, 1980). After extraction, the quality of extracted DNA was determined using 0.8% agarose gel.

### **SSR amplification**

Five finger millet SSR primers were selected for this study based on the previous studies (Babu et al., 2017; Dida et al., 2007) (Table 1). Polymerase Chain Reaction (PCR) was done in a total volume of 15 µl containing 20 µM of each forward and reverse primer, 1.5 µl of 10x PCR buffer containing 15mM MgCl<sub>2</sub>, 1.2 µl of 2.5 µM.

**Table 1.** Information on SSR primer sequences used in the study

S/N	Primer name	Primer sequence (5'-3')	SSR motif	product size (bp)	Chromosome number	A/T
1	UGEP3	F:CCACGAGGCCATACTGAATAG R:GATGGCCACTAGGGATGTTG	(CA)7N12(GA)15	206	NA	57° C
2	UGEP1 0	F:AAACGCGATGAATTTTAAGCTC R:CTATGTCTGTGTCCTATGTCG	(GA)19	400	8A	55° C
3	UGEP2 4	F:GCCTTTTGATTGTTCAACTCG R:CGTGATCCCTCTCCTCTCTG	(GA)26	183	3B	55° C
4	UGEP6 0	F:AGCTCTGCTTGGTGGAGAAG R:TTTTCTACTGGTGGGCGAAG	(GA)37	240	1B	55° C
5	UGEP7 8	F:AAGCAATCAACAAAGCCTTTTC R:TACAACGTCCAGGCAACAAG	(GA)14	244	2B	55° C

A/T- annealing temperature, NA- Not Available

dNTPs, 0.25 µl of *Taq* DNA polymerase (5 U/ µl), and 25-50 ng of template DNA (2.5ng/µl).

The PCR reactions were performed using Applied Biosystem (Model No. 9902, USA). Thermocycler was programmed for an initial denaturation of 5 min at 95 °C followed by 35 cycles of 1.0 min at 95°C, 30s at the corresponding annealing temperature of each primer, 1 min at 72 °C, and a final extension of 5 min at 72°C, and hold at 4 °C. The annealing temperature for primers was optimized using the temperature gradient method.

### Electrophoresis of amplified products

The PCR products were resolved on 3.5% agarose gels at 100 V. Gels were stained using ethidium bromide and visualized using the Gel Documentation system (BioRad). A 100 bp DNA ladder was used to compare the molecular weight of each amplified PCR product and finally polymorphic SSR markers among the tested varieties were selected.

### Data analysis

The relative value (RV) of each parameter compared to control was calculated as follows:

$$RV_{xA} = \frac{X_d}{X_{MC}} \quad (1)$$

Where, “X” is a respective parameter such as RL, SL, etc.,  $X_{MC}$  is the mean value of X parameter under control and  $X_d$  is the value under drought. The relative reduction percentage (RRP%) compared to control was also calculated using (2).

$$RRP\% = \frac{X_c - X_d}{X_c} * 100 \quad (2)$$

Relative measurements of each phenotypic parameter were statistically analyzed by one-way Analysis of Variance (ANOVA) using Minitab 17 version. Relative Means of each parameter were compared using Tukey's Test at 0.05% level of probability.

Principal Component Analysis (PCA) was performed for nine morpho-physiological traits using Minitab version 17 statistical software. Principal Components with Eigenvalues greater than 1 was considered for PCA analysis (Babu et al., 2017).

## RESULTS AND DISCUSSION

### Assessment of drought tolerance

Morphological characterization is important for identifying plant genotypes with desirable traits to employ directly as cultivars or trait donors to be used in crop improvement programs. Almost all the

measured growth and physiological parameters were significantly affected and the different finger millet genotypes responded differently to the drought treatment (Table 2).

Earliness in flowering is an important agronomic trait considered while breeding for high yielding varieties. Out of the five genotypes, ACC: 12415 (69 days) reached the flowering stage earlier than others under drought stress while the rest; ACC: 7088 (71 days), ACC: 7090 (71 days), *Oshada* (85 days) and *Rawana* (83 days) reached respectively to the flowering stage. However, compared to the respective control of each genotype, all the genotypes showed delaying of attaining to flowering stage (Table 2). According to relative values of DF50, ACC: 7090 showed the lowest value (1.09) indicating comparatively less effect of drought stress on reaching to flowering stage in ACC: 7090.

Statistical analysis revealed the significant differences of all tested drought-responsive morpho-physiological parameters except SL and BTN, among the cultivated finger millet genotypes exhibiting the variability of withstanding under drought stress (Table 2). Although all genotypes exhibited equal variation of SL under drought stress, ACC: 7090 comparatively recorded the highest relative mean value (0.72) for the SL. *Rawana* was recorded for having the highest relative reduction percentage (46%) (Table 2) indicating that it is SL is highly affected by the drought stress. *Oshada* was recorded for the highest value for RL (0.84), while ACC: 7088 showed the lowest (0.75) under drought. Others did not show any significant difference.

Although, BTN is not significantly different among genotypes, ACC: 12415 showed the highest mean relative value for the BTN (0.75) and the lowest relative reduction

(25%) under drought which directly affects the yield. ACC: 7090 recorded for having the highest RFW (0.66) under drought. With respect to the RDW, SFW and SDW, *Oshada* exhibited significantly high mean relative performances along with comparatively less relative reduction percentage of those parameters compared to other genotypes under drought stress (Table 2; Table 3).

ACC: 7088 recorded for having the highest CC (0.87) under drought stress, while ACC: 7090 and *Oshada* were recorded for the same CC (Table 2). According to the relative performance and relative reduction percentage of all tested drought responsive morpho-physiological parameters, higher drought tolerance was observed in genotype *Oshada* (Table 2; Table 3).

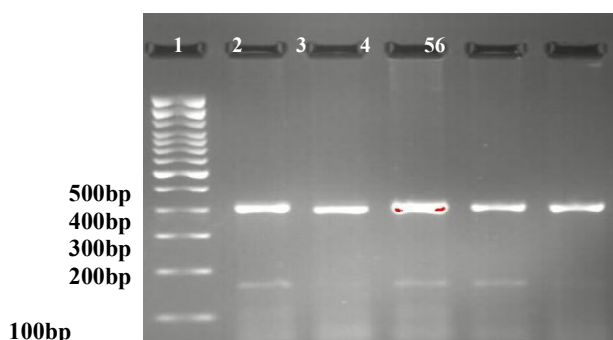
### Assessment of genetic diversity

DNA based molecular markers reveal a high level of polymorphism and they are considered powerful tools for the assessment of genetic variation, genetic relationships, and genetic potential within and among the different crop germplasm lines without environmental influences.

The genomic DNA of five finger millet genotypes were amplified separately using five selected genomic SSR primers which were spread across the chromosomes of the finger millet genome (Table 1). All five SSR primers amplified products across all the genotypes and were in the expected size range (Figure 1). Even though all five selected SSR markers exhibited comparatively higher polymorphism among the finger millet genotypes in previous studies (Babu et al., 2017; Ramakrishnan et al., 2016; Dida et al., 2007), none of them were polymorphic among the tested genotypes in this study indicating the presence of narrow genetic variance among the cultivated finger millets in Sri Lanka. However, further

studies should be conducted with a greater number of SSR markers in order to have in-depth assessment of genetic variability in the cultivated finger millet genotypes.

**Figure 1:** Amplification of five finger millet genotypes with the genomic SSR locus UGEP10 (400bp)



Lane1 - 100bp ladder, lane 2-ACC: 7090, lane3- ACC: 12415, lane 4 -Rawana, lane 5- Oshada, lane 6 – ACC: 7088

### Principal Component Analysis (PCA)

Interrelationships among the different agronomic traits measured, were studied using Principal Component Analysis. Allocation of different variables to their

principal component is a subjective approach and it was based on its principal component score. The first 3 principal components (PC) having Eigenvalues greater than 1 (PC1-3.0, PC2-2.1 and PC3-1.4), provided a reasonable summary of the data and explained 74.4% of the total variation. Loading plot of PC1-PC2, graphs the coefficients of each variable for the first component versus the coefficients for the second component (Figure 2). It shows how strongly each character influences a principal component. Out of the 3, the first Principal Component (PC1) was the most important which explained 33.6% of the total variance. In the loading plot SFW (0.567), SDW (0.523) have large loadings on component 1. So component 1 primarily measures the properties of the biomass of the shoot system of the crop. The PC2 explained an additional 24.3% of the total variance and attributed to positive loadings for SL (0.467) and RDW (0.487). PC3 explains the variance of 16.5% and contributed to a large loading for CC (0.665).

**Table 2.** Means of relative values of morpho-physiological parameters in cultivated finger millet genotypes under drought stress

V	SL	RL	BTN	RFW	RDW	SFW	SDW	DF50	CC
1	0.65±0.02 <sup>a</sup>	0.75±0.03 <sup>b</sup>	0.4±0.33 <sup>a</sup>	0.41±0.02 <sup>c</sup>	0.52±0.06 <sup>bc</sup>	0.54±0.02 <sup>b</sup>	0.53±0.04 <sup>b</sup>	1.41±0.01 <sup>a</sup>	0.87±0.03 <sup>a</sup>
2	0.59±0.02 <sup>a</sup>	0.8±0.01 <sup>a</sup>	0.75±0.3 <sup>a</sup>	0.43±0.03 <sup>c</sup>	0.54±0.11 <sup>bc</sup>	0.67±0.09 <sup>a</sup>	0.59±0.06 <sup>b</sup>	1.41±0.01 <sup>a</sup>	0.78±0.03 <sup>bc</sup>
3	0.72±0.18 <sup>a</sup>	0.81±0.03 <sup>a</sup>	0.29±0.3 <sup>a</sup>	0.66±0.03 <sup>a</sup>	0.64±0.12 <sup>b</sup>	0.31±0.03 <sup>c</sup>	0.30±0.04 <sup>c</sup>	1.09±0.01 <sup>d</sup>	0.83±0.02 <sup>ab</sup>
4	0.54±0.01 <sup>a</sup>	0.81±0.02 <sup>a</sup>	0.5±0.71 <sup>a</sup>	0.33±0.01 <sup>d</sup>	0.41±0.08 <sup>c</sup>	0.29±0.02 <sup>c</sup>	0.30±0.02 <sup>c</sup>	1.22±0.01 <sup>c</sup>	0.75±0.02 <sup>c</sup>
5	0.65±0.01 <sup>a</sup>	0.84±0.02 <sup>a</sup>	0.25±0.3 <sup>a</sup>	0.59±0.02 <sup>b</sup>	0.86±0.07 <sup>a</sup>	0.69±0.06 <sup>a</sup>	0.82±0.09 <sup>a</sup>	1.27±0.01 <sup>b</sup>	0.82±0.05 <sup>abc</sup>

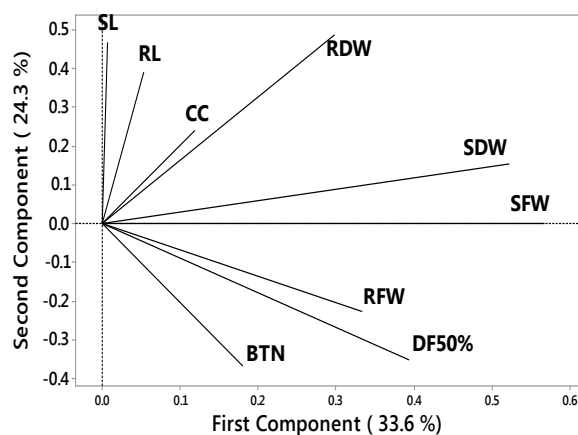
Data represented as means of the relative values ± SE. Mean values in a column superscripted by different letters are significantly different at  $P < 0.05$ . V- Variety, 1- ACC: 7088, 2- ACC: 12415, 3- ACC: 7090, 4- Rawana, 5- Oshada, SL- Shoot length, RL- Root Length, RFW- Root Fresh weight, RDW- Root Dry Weight, SFW- Shoot Fresh Weight, SDW- Shoot Dry Weight, BTN- Basal Tiller Number, DF50- Days to 50% Flowering, CC- Chlorophyll Content

**Table 3.** Relative reduction percentages of morpho-physiological parameters

V	SL%	RL%	BTN%	RFW%	RDW		SFW%	SDW%	CC%
					%				
1	34.71	24.95	58.33	59.01	48.05		46.56	46.78	13.17
2	40.36	19.32	25	56.73	44.04		32.73	40.82	21.45
3	37.09	18.56	75	33.90	34.58		69.61	69.61	16.78
4	46.64	19.19	50	66.99	58.84		70.76	69.52	24.93
5	35.21	15.44	79.17	40.39	14.06		31.19	17.89	18.07

V- Variety, 1- ACC: 7088, 2- ACC: 12415, 3- ACC: 7090, 4- Rawana, 5- Oshada, SL- Shoot length, RL- Root Length, RFW- Root Fresh weight, RDW- Root Dry Weight, SFW- Shoot Fresh Weight, SDW- Shoot Dry Weight, BTN- Basal Tiller Number, DF50- Days to 50% Flowering, CC- Chlorophyll Content

The variables in the first 2 principal components were more indicative of the drought stress as the variables within those principal components were extremely affected by terminal drought stress.

**Figure 2.** Loading plot of PC1-PC2 for five finger millet genotypes

RL-root length, RFW- root fresh weight, RDW-root dry weight, SL- shoot length, SFW- shoot fresh weight, SDW- shoot dry weight, BTN-basal tiller number, CC-chlorophyll content, DF50%-days to 50% flowering

## CONCLUSIONS

The present study revealed the significant variations in relative performances of the

droughtresponsive morpho-physiological parameters assessed within the cultivated finger millet genotypes. Accordingly, *Oshada* has exhibited higher drought tolerance compared to other finger millet genotypes in relation to the parameters; DF50, RL, RDW, SFW, and SDW indicating possibility of utilizing *Oshada* as a potential parental material in future breeding programmes for drought tolerance. According to the genetic diversity assessment, all the SSR markers used in this study were monomorphic among the genotypes. This may be due to the presence of narrow genetic variation in cultivated finger millet genotypes. However, further studies are required to be conducted with more number of SSR markers covering whole finger millet genome in order to reveal the in-depth genetic background in cultivated finger millet genotypes. Principal Component Analysis of this study revealed that SDW, SFW, SL and RDW were contributed to 1<sup>st</sup> two PCs collectively. Hence, these traits have contributed to the diversity of finger millet genotypes and those traits can be effectively used in breeding programmes to generate variability.

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**2021  
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## Contribution of Organic, Biodynamic, and Conventional Tea Farming Systems for the Clean Development Mechanism

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### ABSTRACT

Global warming is a significant problem in the world today and carbon sequestration in soil is used to reduce the greenhouse gases in the atmosphere. CO<sub>2</sub> is the primary gas that causes global warming. The study was conducted at the Tea Research Institute, Talawakelle. All treatments were arranged in RCB Design. CO<sub>2</sub> evolution rate of soil and roots was measured by using CO<sub>2</sub> flux chamber and in vitro method respectively. A Bioassay was conducted using Mung bean plants. Walkley and Black method and Kjeldhal method were used to analyze organic carbon content and nitrogen content. The CO<sub>2</sub> evolution rate of organic treatments was 58% and conventional plots showed 42%. The soil organic carbon was 8% and 3.14% in organic treatments and conventional treatment respectively. There was a 155% increment of soil organic carbon content in organic treatments compared to conventional treatments. Leaf organic carbon content showed as 57.7% in organic treatments whereas 38.7% was showed in conventional treatments. The highest root CO<sub>2</sub> evolution rate was observed in compost treatments followed by neem oil cake and tea waste and the least was observed in conventional treatments. In BIDORCON, the highest soil CO<sub>2</sub> evolution was observed in organic treatments, followed by biodynamic and the least was by conventional treatments. The soil and leaf organic carbon showed a similar pattern. These results indicated that organic farming supports the storage of excess carbon in the soil and plants which leads to a cleaner development mechanism.

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## INTRODUCTION

Organic farming as a production system favors maximum use of organic material (crop residues, animal excreta, legumes, on and off-farm organic wastes, growth regulators, bio pesticides etc.) and discourages the use of synthetically produced agro inputs, for maintaining soil productivity, fertility and pest management under conditions of sustainable natural resources and a healthy environment (Dahama, 1999). Sri Lanka pioneered organic tea (*Camellia sinensis* (L) O.Kuntze) production and marketing in the world. Organic tea was first undertaken in Sri Lanka in 1983, and in the year 2000 about 336MT of organic tea were produced in the country. There is a growing demand for high quality organically grown tea in international trade (Sivapalan, 2001). Sri Lanka caters to many strong international markets with organic teas. Yet the total extent under organic tea production is less than 1% of the total extent in the country. However organic teas fetch 3-4-fold prices of conventional teas (Mohotti, 2002).

The biodynamic systems approach is where the farm is viewed as a living entity in which each farm activity affects the others. It is a science of life forces, recognition of the basic principles at work in nature and an approach to agriculture, which takes these principles into account to bring about balance and healing.

The soil organic matter (SOM) provides substrates for soil microbial activity. In addition, SOM helps in establishing physical conditions and architecture of the soil to favor plant growth, comprising of organic debris, microorganisms including Bacteria, Actinomycetes, Fungi, Algae, Lichen

spores, and reproductive thali of Bryophytes, microscopic and macroscopic soil eating animals such as earth worms, termites etc. (Bezbaruah, 1999).

Atmospheric carbon dioxide levels, the major factor in the greenhouse effect, is now twice as high as they were during the last Ice Age. They have risen from 280 parts per million (ppm) to 365 ppm in the last two centuries alone and are now increasing at a rate of 1.3 ppm per year. The Clean Development Mechanism (CDM) is used to reduce the green gases in the atmosphere. CDM is one of the instruments created by the Kyoto Protocol to facilitate carbon trading. The CDM may be described as having several roles. It enables industrialized parties with emissions reductions commitments to efficiently reach their targets in an economically efficient way. Conventional chemical agriculture contributes to global warming because of emissions created by manufacturing fertilizers. Therefore, this study was planned to estimate the CO<sub>2</sub> emission in organic and conventional farming, in order to determine the possible contribution of organic and biodynamic farming to Clean Development Mechanism, and to provide preliminary information on the response of tea under elevated CO<sub>2</sub> levels in organic farming.

## METHODOLOGY

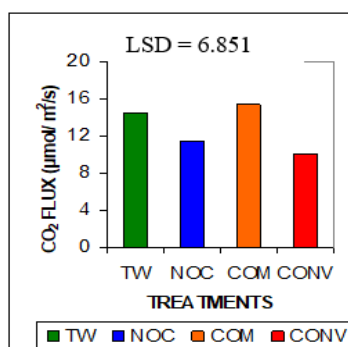
Experiments were conducted at the organic tea experimental plots of Field No.13 (TRIORCON (TRI Organic) trial) at St. Coombs Estate, Talawakelle. Experimental plots using tea waste neem oil cake and compost, at the rates given below are being maintained under organic standards stipulated by the IFOAM. The control plots (T4) are

being maintained as per TRI recommendation, for manuring and pest and disease management. The organic treatments per season are T1- 2 Kg/ per plant Tea waste (TW), T2- 500g/ per plant Neem oil cake (NOC), T3- 2Kg/ per plant Compost (COM), T4 – Conventional (CONV- Conventional). The treatments have been established in a Randomized Complete Block Design (RCBD) with four replicates. A preliminary study was also done in the biodynamic field (BIDORCON- Biodynamic & Organic) established at the TRI and the treatments were biodynamic organic and conventional. The CO<sub>2</sub> evolved by the soil of the treatments was measured by a 6400-09 soil CO<sub>2</sub> Flux Chamber. A bioassay was conducted using mung bean plants in both TRIORCON and BIDORCON fields to measure leaf N content and organic carbon content. Soil and leaf organic carbon (OC) were measured by the Walkley and Black method. Total leaf nitrogen content was determined by the Kjeldahl method.

## RESULTS AND DISCUSSIONS

The highest CO<sub>2</sub> evolution was observed in soil treated with compost followed by tea waste treated soil. The neem oil cake treated soil also had a lower CO<sub>2</sub> evolution and the control plot had the least CO<sub>2</sub> evolution rate. (Figure 1).

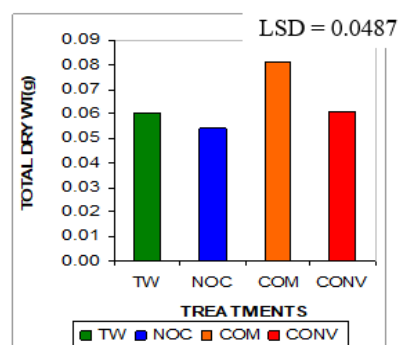
**Figure 1.** The relationship between CO<sub>2</sub> evolution rate and treatments measured by the CO<sub>2</sub> flux chamber in TRIORCON trial



The organic treatments had a total of 58% CO<sub>2</sub> evolution rate and conventional treatments had a total of 42% CO<sub>2</sub> evolution rate. Therefore, the organic treatments had 38% more CO<sub>2</sub> evolution than conventional treatments. The application of organic matter treatments induced a higher CO<sub>2</sub> evolution rate than conventional treatments which could be due to higher microbial activity in soil. Conventional treatments would have a lower rate of microbial activity due to application of herbicides and pesticides which create an unfavorable environment for microbial growth. The lower CO<sub>2</sub> evolution rate in the neem oil cake treatment could be due to the microbial suppressive nature of the product. Therefore, it will lead to lower microbial activity in the neem oil cake treated soil.

The dry weights of Mung bean plants did not vary significantly between the treatments. However, the highest weight was obtained in the compost treated plots. Plants grown in tea waste and conventionally treated plots had similar dry weights and the lowest was in the neem oil cake plots (Figure 2). This suggested that compost stimulated dry matter accumulation of Mung bean.

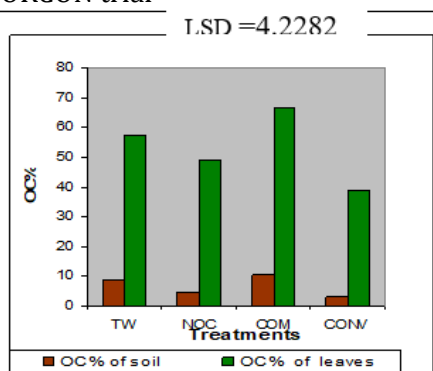
**Figure 2.** The relationship between plant dry weight of Mung bean and treatments in TRIORCON trial



The highest OC content of leaves was observed in the compost treated plants

followed by plants grown in tea waste applied plots which were significantly different from the control (Figure 3). The application of these organic components to soil could enhance the soil organic matter and this leads to enrichment of organic matter content in plants.

**Figure 3.** Relationship between leaf and soil OC% of Mung bean and treatments in TRIORCON trial

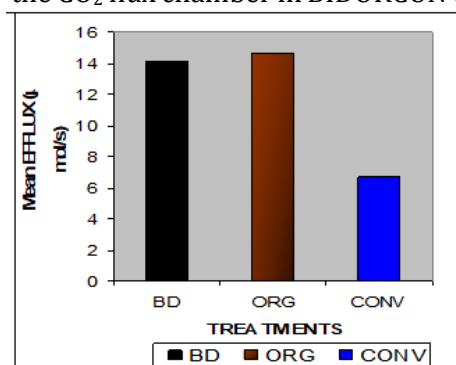


As in leaves the highest OC content of soil was found in compost treated soil, followed by tea waste, neem oil cake plots and the lowest value was obtained in the conventional plot. A mean of 8% OC was seen in organic treatments, and it was only 3% in conventional treatments. The increment of OC content of soil in organic treatments was 155% than in the conventional plots. The results indicated the significance of the application of organic matter to enhance the organic content in soil. Similar results obtained by Wang et al. (2016) reported higher soil CO<sub>2</sub> evolution in organic cultivation but higher C accumulation with no change in plant OC storage. Subramanian et al. (2013) showed a 43% higher above ground biomass and net gain of 10.26 t ha<sup>-1</sup> of soil OC in organic tea growing compared to the conventional system. Similarly, Xu et al. (2019) reported that C footprint estimation of five organic tea productions in China showed low

CO<sub>2</sub> emissions as 1.7 and 1.8 t CO<sub>2</sub> per ha.

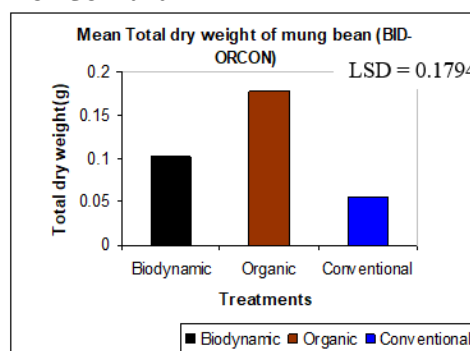
In BIDORCON the highest CO<sub>2</sub> evolution was observed in organic treated plots followed by the biodynamic plots. Conventional treatments applied plots had a lower CO<sub>2</sub> evolution rate when compared to the organic and biodynamic plots (Figure 4).

**Figure 4.** Relationship between CO<sub>2</sub> evolution rate and treatments measured by the CO<sub>2</sub> flux chamber in BIDORCON trial



The plants which were grown in organic treatments applied plots had the highest dry weight, followed by plants grown in biodynamic plots (Figure 5).

**Figure 5.** Relationship between plant dry weight of Mung bean and treatments in BIDORCON trial

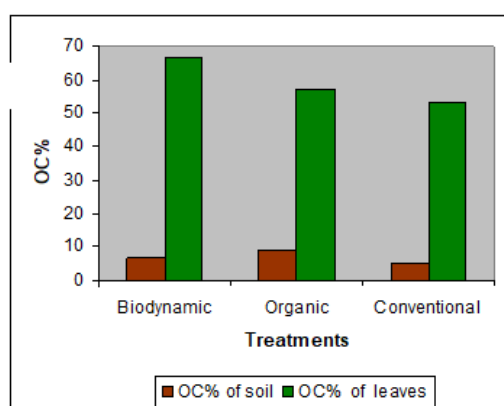


These plots contained ample amounts of nutrients as well as higher organic matter in soil which could enhance plant dry matter. On the other hand, the CO<sub>2</sub> evolution rates in the soils

were higher in these treatments which could stimulate photosynthesis rates. Plants grown in conventional treated plots had a significant low dry weight. Plants grown in biodynamic plots showed the better nodulation in roots. This indicates that biodynamic treatments enhance favorable microbial growth.

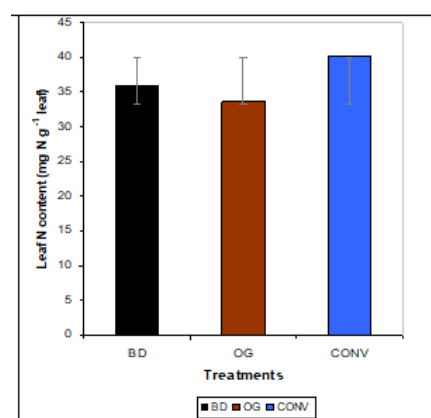
The highest leaf OC content was observed in plants grown in biodynamic plots, which was significantly higher than that of organic and conventional plots. Soil OC was highest in organic matter applied plots which was significantly higher than in the biodynamic and conventional plots. A higher amount of organic matter was added to these plots, and this would have led to the increase in OC content in soil (Figure 6). In organic and biodynamic plots, soil organic matter was significantly higher, and it indicates a greater carbon sequestration in these soils.

**Figure 6.** The relationship between leaf and soil OC% of Mung bean of Mung bean and treatments in BIDORCON trial



The leaf nitrogen content was higher in the conventional followed by the biodynamic and organic plots and was not statistically significant (Figure 7).

**Figure 7.** The relationship between the total nitrogen content of leaves and different treatments in BIDORCON trial



This could be due the availability of absorbable form of nutrients in conventional treatments compared to organic and biodynamic farming. Organic fertilizer release nutrients gradually to the soil for a longer period (Dahama, 1997). In TRICON trial, Leaf nitrogen content was higher in plants grown in compost plots, followed by those in tea waste and neem oil cake; the conventional treatments had the lowest leaf nitrogen content. Similar results were obtained in another study conducted in the TRICON trial, the higher N content was found in a flush of tea plants treated with tea waste and neem oil cake compared to compost and conventional treatments (Wekumbura *et al.*, 2010). In organic cultivation nutrients are readily available to plants due to higher populations of microbes in soil. This availability plays a major role in the decomposition of the organic matter and enhances the nutrient availability.

## CONCLUSIONS

By considering all these facts organic farming can increase carbon sequestration than CO<sub>2</sub> evolution by soil and the dry matter accumulation in plants. Therefore, organic farming can

be used as a tool in the Clean Development Mechanism. The findings of research conducted in other countries supported the findings of this research which shows that organic tea farming enhances the carbon sequestration. Conventional farming exacerbates the greenhouse effect by producing a net release of carbon into the atmosphere. Organic farming has a higher level of carbon storage in soil as well as in plant biomass. The higher number of leaves and leaf area leads to trap more carbon in this system than in the conventional system.

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# Education



## Role of Education Administrators in Implementing 21<sup>st</sup> Century Skills at National Colleges of Education.

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### ABSTRACT

The current changes taking place within the Sri Lankan education system focus more on integration of 21<sup>st</sup> century skills to the learning teaching approach. However, . majority of the teachers have no idea about 21<sup>st</sup> century skills and their integration to the curricular. This is research conducted to explore the role played by the education leaders to the curriculum of National Colleges of Education where pre-service teacher education is conducted. Two different questionnaires were administered for the Vice Presidents (Academic and Quality Assurance) and 50 lecturers of seven (7) National Colleges of Education where English medium courses are held. Also, semi-structured interviews for the Vice Presidents and lesson observations of (10) lecturers were conducted for data gathering. Data were analyzed both statistically and qualitatively. It was revealed in the process of data gathering that though the lecturers, prospective teachers and Vice Presidents possess a little knowledge about 21<sup>st</sup> century skills, integration of them in the curriculum has not been effectively done. The Vice Presidents lack strength and capacity of acting swiftly to achieve the expected targets in relation to the 21<sup>st</sup> century skills. A radical change to the role of Vice President is suggested to support 21<sup>st</sup> century skills. Capacity building and skill strengthening programs are suggested to help the Vice Presidents overcome their inability of making right decisions at the time of need. Further, it was suggested that the Teacher Educator service minute is revised so that more capable dynamic, young officers can come to these responsible positions.

## INTRODUCTION

Exploration for knowledge is the approach that would be used with 21<sup>st</sup> century skills in the learning teaching methodology of the new education reforms. In order to give practice of a particular skill to the learners, it is a prerequisite that the teachers are aware of such skills and capable of using techniques and strategies to develop those skills in the students. Nevertheless, a greater majority of teachers do not show any awareness about 21<sup>st</sup> century skills making integrating them to the learning teaching methodology a distant objective to achieve. (Uche, 2016) Since most of the in service teacher training programs are for comparatively short periods, they are not capable of catering to the need of making teachers in the system aware of 21<sup>st</sup> century skills. In that backdrop, the best approach should be to give this knowledge and skills to pre-service teachers. There are 19 National Colleges of Education (NCoEs) that educate around 4000 pre-service teachers annually for the Sri Lankan education system.

The authority who provides the opportunity and facilities for teacher educators, the training on 21<sup>st</sup> century skills is the Vice President (Academic and Quality Assurance), is the responsible authority for the professional development of teacher educators. It is the responsibility of the Vice President to turn the classrooms into 21<sup>st</sup> century classrooms with necessary equipment and support teacher educators to change their learning teaching approach to integrate 21<sup>st</sup> century skills. The doubt is whether the Vice presidents are fully aware of this responsibility and are they capable of performing the expected duty from them. Do they have the capacity to change a complete system to meet the

education challenges of a new century? With those questions, this research aims at critically analyzing the role of education leaders in charge of the academic section in introducing 21<sup>st</sup> century skills to the curriculum of NCoEs and find out how they can meet those demands.

### **What are 21<sup>st</sup> century skills?**

The demands for the skills and abilities of the workforce have been continuously changing during past two decades and this changing nature will affect today's school students who will step into the labor market in near future. Bell (2010) explains that at present, workers who join the job market are evaluated based on their skills such as communication, and collaboration, than their work performance. The partnership for 21<sup>st</sup> century skills (2008) posits major changes regarding what companies are expecting from their new employees and indicates that "advanced economies, innovative industries and firms, and high-growth jobs require more educated workers with the ability to respond flexibly to complex problems, communicate effectively, manage information, work in teams and produce new knowledge".

21<sup>st</sup> century skills are derived from the 21<sup>st</sup> century themes such as Global Awareness; Financial, Economic, Business and Entrepreneurial literacy; Civic Literacy and Health Literacy and are easily delivered through core subjects such as; Native Language/Reading, World Language(s) – English-, Arts, History, Mathematics, Science and Government/Civics. The Partnership for 21st-Century Skills, (2008) identifies 12 21<sup>st</sup> century skills under three categories as Learning Skills (4Cs), Literacy Skills and Life Skills.

### **Teacher education & 21<sup>st</sup> century skills**

Kim, Raza & Seidman (2009) in their findings of research conducted in Uganda, India and Ghana report to keep a wide range within the research for which they had selected secondary level in Uganda, primary level in India and pre-school in Ghana. Their argument is that the development of competencies known as 21st-century skills is gathering increasing attention as a means of improving teacher instructional quality. However, a key challenge in bringing about desired improvements lies in the lack of context-specific understanding of teaching practices and meaningful ways of supporting teacher professional development.

Classroom instructional quality (and its relationship to learning outcomes) serves as a device for educational transformation. However, there is much to be learned about what goes on inside classrooms, particularly in low- and middle-income countries. Though an abundance of observational tools exist, most have not undergone methodological development, and even fewer have been used in different contexts, cultures, and interventions (Bruns, 2011; Crouch, 2008).

Attention on how teaching practices and classroom procedures touch student learning outcomes and their psychosocial growth is rising. Instructional quality has proven to be more strongly connected with child learning of schools in both Western (Pianta et al., 2009) and developing countries (Chavan and Yoshikawa, 2013; Patrinos et al., 2013; Yoshikawa and Kabay, 2015). However, the breath of skills obligatory for quality student learning, and concurrently quality teaching demand for essential

competencies beyond literacy and numeracy, otherwise known as 21st-century skills.

### **Education leadership in 21<sup>st</sup> century skills**

Research worldwide on education leadership indicates that most of the leaders still do not go beyond the traditional role of financial control, division of labor and focus on rules and regulations. This is similar in both general and teacher education. A research conducted in Kenya shows that education leaders just proceed with the traditional role even in introducing 21<sup>st</sup> century skills. This is a series of case studies conducted with the aim of exploring the role of secondary school principals in Kenya. (Kaume, 2016)

Driscoll (2021) highlights the need for establishing strategies for driving change, going beyond the traditional training of leaders. Kools (2013) identifies leadership of change as the primary task for management. This involves management to set the direction, be accountable in putting learning at the center and keeping it there. Jones (2016) says that the leaders in the 21<sup>st</sup> century should be in tune with their teams and be ready to adjust with the time.

When research in the above areas was analyzed it was noticed that many researches were conducted in relation to the education leadership for 21<sup>st</sup> century skills in general education throughout the world. There is some research conducted in Sri Lanka also. Nevertheless, research that brought 21<sup>st</sup> century skills and education leadership together is limited. Only a very few could be seen in Sri Lanka. When research on education leaders' role in teacher education and 21<sup>st</sup> century skills is considered, only a few can be found in

the world and almost none in Sri Lanka. Therefore, this research intends to explore the role of education leaders in charge of the academic section of pre-service teacher education institutions in integrating 21<sup>st</sup> century skills with the following objectives.

- Find out how far the education leaders in charge of the academic section are aware of 21<sup>st</sup> century skills
- Find out the measures the education leaders in charge of the academic section have taken to integrate 21<sup>st</sup> century skills to the curriculum of National Colleges of Education
- Investigate the teacher educators' perception of the support given by the education leaders in charge of the academic section to implement 21<sup>st</sup> century skills in the curriculum of National Colleges of Education
- Explore the role education leaders in charge of the academic section can play in introducing 21<sup>st</sup> century skills to the curriculum of National Colleges of Education.

## **MATERIAL AND METHODS**

Since the research studied the role of a group of education administrators, most of the data gathered were qualitative data. Data included human behavior, expected personality traits application of strategies etc. Much of the data came in qualitative form. In addition to that, data that came as answers to some of the questions in questionnaires specially related to the lecturers' perception were quantitative data. Therefore, the research is a mixed method research with a major section producing qualitative data.

### **Population**

The target population of the research includes all Vice Presidents (Academic

and Quality Assurance) working in 19 National Colleges of Education in Sri Lanka and the teacher educators working in those colleges. The total number of teacher educators is about 750. So the population of the research includes Vice Presidents of 19 National Colleges of Education and 750 Teacher Educators.

### **Sample**

Since the research is conducted in English Language, National Colleges of Education where English medium courses are conducted were selected for the research. In number, there are seven (7) of them. Questionnaires were sent online to all seven (7) Vice Presidents (Academic & Quality Assurance). But, Vice Presidents working in three National Colleges of Education of Education where majority of the courses are English medium and one Tamil medium National College of Education and another Sinhala medium National College of Education where several English medium courses are conducted were selected for interviews. The teacher educator sample included 50 lecturers in the seven (7) National Colleges of Education for whom the questionnaire was administered and lessons of ten of those lecturers were observed.

Therefore, the data gathering instruments used in the research were;

- Questionnaires for vice presidents and lecturers
- Observation checklists for lesson observations and
- Semi-structured interview schedules

## **RESULTS AND DISCUSSIONS**

According to the data gathered through questionnaires and interviews it was revealed that the education leaders in charge of the academic section work with limited awareness of 21<sup>st</sup> century

skills. Owing to this limited knowledge most of them either have not still understood the necessity of integrating 21<sup>st</sup> century skills to the curriculum of NCoEs or find it difficult to do so because they do not see the importance of them. It is understood that they are busy with their administrative work and cannot find much time to follow workshops or further awareness sessions.

### **Integration of 21<sup>st</sup> century skills to the curriculum**

It is evident that the lecturers see the importance of integrating the 21<sup>st</sup> century skills to the curriculum of NCoEs. But, they seem to be in the misunderstanding that 21<sup>st</sup> century skills too should be included somewhere in the subject content of a particular syllabus so that they can teach the 21<sup>st</sup> century skills to the prospective teachers. It is true that an introduction about 21<sup>st</sup> century skills can be given to the prospective teachers by including some information about them in a subject syllabus. But, that knowledge will help neither the lectures nor the prospective teachers practice, develop or integrate 21<sup>st</sup> century skills in their teaching. Therefore, it is the duty of the authorities to make them aware that 21<sup>st</sup> century skills are not subject content that can be taught but they are practical skills that should be put into practice through the learning teaching approach.

The Curriculum of NCoEs is more than ten (10) years old and therefore needs quick revision. Nevertheless, there is enough scope within this curriculum for the teacher educators to integrate 21<sup>st</sup> century skills rather than waiting for the curriculum developers change the syllabi.

### **Awareness of education leaders in charge of the academic section on 21<sup>st</sup> Century Skills:**

When the questionnaire results were analyzed it was understood that more than 70% of the education leaders in charge of the academic section did not have a good understanding about what 21<sup>st</sup> century skills were. Among the vice presidents who had some awareness about them there were several who could not exactly name a few. The workshops organized by the education leaders with this little understanding about 21<sup>st</sup> century skills, proved to be ineffective of providing guidance to the teacher educators on how to integrate 21<sup>st</sup> century skills to the curriculum. Even with these drawbacks it was understood that more than 50% of the teacher educators had some awareness about 21<sup>st</sup> century skills which most of them had gained from workshops organized by outside institutions though the vice presidents claimed that they organized such programs within NCoEs. Although a greater majority of the teacher educators (95%) said that they integrated 21<sup>st</sup> century skills to their learning teaching approach, lesson observations proved this to be completely otherwise. The teacher educators too seem to have an internal awareness about this reality. This was proven when 85% of them requested for further awareness on 21<sup>st</sup> century skills.

### **Role of Vice President in integrating 21<sup>st</sup> century skills to the curriculum**

The teacher educators had complained that they faced many problems in trying to integrate 21<sup>st</sup> century skills to the curriculum of NCoEs. Though the education administrators claimed to have provided necessity facilities, they themselves admitted that there were financial and administrative problems that hindered and obstructed provision of facilities beyond stationeries and

technical support. They had not even thought about 21<sup>st</sup> century classrooms. Majority of the teacher educators accused the education administrators of being reluctant in decision making and taking prompt action at the time of the need. It was revealed that these experienced education leaders were not aware of the decision making capacity vested on them. The teacher educators do not believe that the vice presidents have capacity or enough knowledge to help them integrate 21<sup>st</sup> century skills to the curriculum of NCoEs.

## CONCLUSIONS

It was revealed that still professional development programs of the teacher educators are organized and conducted by outside institutions. In an era where even the schools conduct School Based Teacher Development programs, it is strongly believed that the NCoEs too can start their own institution based professional development programs. Therefore, a College Based Professional Development (CBPD) program is suggested for NCoEs. They should be financially empowered so that they can take the responsibility of their staff development and the responsibility should be given to the Vice President.

The teacher educators argue that the incapability and reluctance of decision making comes with the age of the Vice Presidents. Majority of them are on the verge of retirement and therefore, are reluctant to take radical decisions. As a solution for this, it is suggested that the service minute of teacher educator service is revised so that young, energetic, dynamic and more capable lecturers occupy these decision making roles.

As a final conclusion, it can be mentioned that 21<sup>st</sup> century skills are already there in the NCoEs. Some teacher educators

are already aware of them and that knowledge has been trickled down to some of the prospective teachers. Some of the Vice Presidents are also aware of them to a certain extent. The problem is that, not enough people are aware and not enough actions have been taken to integrate them into the curriculum. There are many defects in the role played by Vice Presidents (Academic & Quality Assurance) in general as well as in the process of integrating 21<sup>st</sup> century skills to the NCoE curriculum. Specially, their role of Quality Assurance has been overlooked by themselves. Therefore, either a revision to the role of the Vice President (Academic & Quality Assurance) or strong empowerment program to strengthen them in decision making is compulsory.

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## Study on the Social Factors Influencing on the Selection of A/L Stream in G.C.E A/L Examination: An exploratory study

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### ABSTRACT

G.C.E Advanced Level Examination completers can access both high-paid jobs and tertiary education opportunities, but many of them fail due to the wrong selection of subject stream. Aim of this study was to investigate the social factors influencing on the selection of A/L stream. The descriptive research design used to gather panel data from a sample of undergraduates of the university of Vocational Technology (n=50) who did their A/L's representing Art, Commerce, Mathematics, Science, and Technology stream. With the utilization of mixed methodology, research incorporated with qualitative data analysis through interviews as well as quantitative gathering through questionnaires. The personal based semi-structured interview was the main instrument of data collection instrument to get an inside into real-life experience regarding the social influential factors on the selection of A/L stream. Results mainly highlighted as social factors: student-related characteristics such as interest, priority, talent, skill G.C.E O/L exam results, job prospect and the social environmental factors such as parents, siblings, friends and peers, teachers while as institutional factors such as the intention of higher education impact on the decision significantly and positively. The study suggested that initiating seminars, awareness programs to enhance the value of knowledge, regarding the selection of A/L stream is essential in the school context.

## INTRODUCTION

In Sri Lanka, the G.C.E Advanced Level Examination is crucial because the Ministry of Higher Education chooses qualified candidates with good results for admission to universities and higher education establishments. Wickramasundara, Jagoda & Rathnayake study (2021), emphasized that The G.C.E Advanced Level examination is a highly competitive examination that is crucial in a student's pursuit of higher education and future employment. According to it has been previously reported based in Ministry of Education performance records, the number of pupils passing the G.C.E. Advanced Level examination has been steadily declining. In par with the aforementioned Nanayakkara (2019), has stated that “the Commissioner of Examination has demonstrated that around 80,000 students who sit for the G.C.E A/L Examination annually fail the examination due to the wrong selection of subject stream. Literature stresses that there is a strong value in wisely choosing the right subject stream for the G.C.E. A/L stream.

Although the Commissioner of Examination stressed, “Every profession is important to the country and students have various talents according to which the selection of subject stream has to be made” (Nanayakkara, 2019, para. Daily Mirror). A series of recent studies has indicated that according to University Grant Commission Sri Lanka (as cited in Perera & Pratheesh, 2018), found that Undergraduate education at state universities is free, but it is extremely competitive, limited, and standardized, with only 10.5 percent (less than 11,000) of those who sat the overall certificate examination (G.C.E A/L) and only 16 percent (less than 16,000) of students admitted.

Most early studies focused only to interpret the significance of choosing A/L streams in the G.C.E A/L examination, which opens avenues for higher education as well as for a future career. While most studies have focused on factors that influence higher education in the international and local contexts. However, the current issue of the study was not sufficiently explored, and therefore the purpose of this study is to identify the factors that influence the selection of A/L streams in G.C.E A/L Examination.

According to (Krezel & Krezel, 2017) emphasized that Social factors influencing students' choice of higher education classified into three broad categories: student-related characteristics, institutional factors, and Greater social environment (e.g. family & peers).

To comply with the previous study, the current study focused on to find out which social factors influence the selection of A/L streams. Based on these facts, the assumptions that arise in this context indeed involve.

This study would be the first exploratory study that will fill the gap of Sri Lankan context through the study on the social factors influencing on the selection of A/L stream in G.C.E A/L Examination. Therefore, the present study findings will be beneficial to improve students' attitudes toward their academics, teachers, parents, and other stakeholders of education for decision making as well as higher education institutions can use this information to enhance the quality of instructions.

### Research objective

To find out what social factors influence on the selection of A/L streams.

- What is the student-related characteristics relates with A/L stream?
- What are the institutional factors related with the intention of higher education?
- What are the social environment factors related with parents, siblings, teachers, friends, and peers?

## **MATERIALS AND METHODS**

### **Research design**

A research design is defined as a "blueprint for data collection, measurement, and analysis based on the research questions of a study (p.95). This study employed a descriptive survey research design. According to Sekaran and Bougie (2013), the objective of a descriptive study is to describe and is frequently used to collect data that describes the characteristics of people, events, or situations.

### **Sample and sampling technique**

As a representation of major A/L subject streams in G.C.E A/L examination (Mathematics, Science, Art, Commerce, Technology) sample comprised 50 undergraduates of University of Vocational Technology who completed their A/L's in Art, commerce, Mathematics, Science, and Technology streams. Researcher used stratified random sampling technique. Sample distribution among A/L subject streams followed; as art stream (14%) commerce stream (18%) and Mathematics stream (14%), Technology stream followed by (42%) and also science stream followed by (12%).

### **Methods of data collection**

Kaplan and Duchon acknowledged that "Mixed methods can lead to new insights and modes of analysis that are unlikely to arise if one method is applied alone" (as cited in Petter & Gallivan, 2004). Divergent

data from each method enable the researcher to construct more complicated, potentially innovative explanations for a phenomenon (Petter & Gallivan, 2004). With this inspiration, current study was conducted using mixed method approach as a qualitative method as a major instrumentation (Semi structured interview) and also incorporating quantitative method (Questionnaire). The number of people interviewed (n=10) was dependent on the saturation of the information, which was that there was no new information with the fifty interview. The questionnaire developed based on 5 point Likert scale to find out appropriate statement that best described the social factors greatly influenced on the selection of G.C.E A/L stream among participants (1-Strongly agree, 2-Agree, 3-Neutral, 4-Disagree, 5-Strongly disagree). Moreover, Participants were also asked to identified other factors which were not included in the questionnaire which they deemed important.

### **Data analysis**

The interviews conducted in Sinhala were translated into English and all the interviews were transcribed. Questionnaire data for this study were analyzed descriptively and interviews were analyzed using content analysis.

## **RESULTS AND DISCUSSION**

This section outlines the results of this study and qualitative and quantitative findings are presented alongside with relevant literature to support my argument. This social theme entails with three sub-themes.

## Student-related characteristics relates with A/L stream

**Table 1.** Percentage distribution of student related characteristics

Statements	1	2	3	4	5
Interest in related to the subject stream	16	24	32	28	00
Priority in related to the subject stream	08	32	28	32	00
G.C.E O/L Examination results	14	20	38	26	02
Job prospect	20	14	46	20	00
Subject that Related to Talent	06	18	48	28	00
Subject that related to skill	12	22	40	24	02

Participant 1: "I like chemistry a lot. I like that subject". The above statement highlights one of the major reasons why certain people selected certain A/L subjects. It further confirmed that interest in a related subject stream affects to a great extent in selecting the A/L stream. Besides, some researchers emphasize that middle school girls exhibit greater interest and enjoyment in math than their male peers (as cited in Rowan-Kenyon et al., 2012).

Priority in the relevant subject stream is another remarkable fact. Hence for the second statement as a piece of evidence, I would follow some of the interview responses.

Participant 4:

"I chose the technology stream because it's a new subject stream"

Participant 3:

"The reason that I am concerned is that I have already decided to pursue the Art as a Subject stream."

Participant 1:

"I think I chose it because I like science a lot. because I like science"

While several researchers have found high school grades to be stronger predictors of college academic achievement than any

other factors (as cited in Sheilynda Stewart et al., 2015). In this case, the spotlight falls into G.C.E O/L results. The following declarations of the interviewees stressed out that the G.C.E O/L results were another factor influencing their choice of the respective A/L streams.

Participant 7: "I did commerce for O/L and had a very good result. It was the main reason for my choosing A/L."

The next point of view strengthens the determinant of selection of A/L stream that related to job prospects.

Participant 9: "I wanted to become a bank manager, so I chose the "commerce stream".

The below response indicates that talent is considered as a determining factor in the selection of the A/L stream statement, as follows.

Participant 1:

"I like practical things as well as chemical reactions."

At one point above statement emphasized the coupling of subjects in respective A/L streams as well as stressed that the necessity of selecting talent-related subject streams.

The following participant response directly addressed the Subject that related to skill was concerned.

Participant 8:

"Since I was a child, I was good at art. Therefore, I chose three subjects with that subject".

## Institutional factors related with the intention of Higher education

**Table 2.** Percentage distribution of Institutional factors.

Statements	1	2	3	4	5
Entry qualification (%)	16	24	38	22	00

Some participants acknowledged that NVQ holders didn't influence by the A / L Subject stream while some agreed upon it as an additional qualification.

Participant 2:

"To do a diploma in agriculture, it was necessary to do bio science at A/L."

Although there were some participants' valued A/L stream selection as an entry qualification to a university.

Participant 5:

"Indeed, by the z-score obtained by Mathematics "

### **Social environment factors related with parents, siblings, teachers, friends and peers.**

**Table 3.** Percentage distribution social environment

<b>Statements</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
8.Educational background of parents					
• Graduate parents was a factor (%)	20	14	36	26	04
9. Parents socio economic status					
• Employed parents was a factor(%)	06	24	34	26	10
• Unemployed parents was a factor(%)	08	10	50	28	04
10. Parents view on vocational opportunity	12	24	36	26	02
11. siblings influence (%)	16	18	34	32	00
12.Teachers' influence (%)	18	24	32	26	00
13.Friends and peers influence(%)	10	20	48	20	02

It has been stated that parent's level of education and support provided to the student is also an important factor in increasing the achievement of students at Post-secondary level (as cited in Khurshid, 2014, p. 41). Therefore, it could be assumed that the inclusion of "Graduate parents" can be considered as a higher

level of parents educational level. Based on these facts, assumptions that arose in this context demonstrated with response to the questionnaire and interview responses but none of them mentioned directly in the interview.

Hart (as cited in Khurshid, 2014) conducted a study on effects of socio-economic status on students' achievement and concluded that learners who belong to lower socio- economic background perform often lower than the students belonging to higher socio-economic background, as they are unable to utilize all the facilities having by the learners of higher socio- economic background. In order to obtain parents' socio-economic status and its impact on the selection of the A/L stream, the questionnaire and interview were divided into two sections, as employed parents and unemployed parents. Some qualitative findings obtained are presented below.

participant 3: "My father gave a big impact". This statement strength the fact that having employed parents determined the subject stream".

The below mentioned statement can consider in both educational attainment of parents as well as parent's unemployment. It was seen that educational background and employment interchangeable in nature. Because the main reason of unemployment is caused by lack of education. But unemployment of parent was a factor that motive students toward achieving competitive examination like G.C.E A/L Examination.

Participant 08: "There is no pressure from the mother and father, they cannot even draw a line with a pencil."

As regards to the statement "Parents' views on occupational opportunities," questionnaire responses indicated that 12% strongly agreed and 24% agreed,

although none of them were mentioned in the interview as a deciding factor.

The below statement strength the fact that of siblings influence can be taken as a determinant factor (statement 11. Besides, it amplified, with respect to siblings' goals and achievements, it directly **and indirectly influenced the choice of** the A/L subject stream.

Participant 8 : "I followed my brother the way he won the art competition."

Study done by Hamre & Pianta concluded that teacher support appears to be a necessary condition for positive school behavior and achievement outcomes (as cited in Rowan-Kenyon et al., 2012, p. 4). Similarly, the impact of the teachers addressed in the questionnaire and the interview.

Participant 2 : "When I asked the teachers, they told me to do bioscience while considering my results."

Above statement highlights one of the major reason as to Why certain people selected certain A/L subjects. It further confirmed that Teacher advice played a major role in decision making process. It was further emphasized according to Abeygunawardena (2019) 'word of mouth' is remarkably important in students' decision making.

Furthermore, some respondents stated that the teacher's characteristics had a significant impact.

Participant 3: "When I was a child, I loved doing science because of a science teacher".

Apart from that friends and peers can be considered a social factor influence on the Selection of A/L stream that fact can further be indicated by the below segment. Participant 1 : "There was the influence of friends. When all the friends went to one, and when we went to another, we had to be alone." Above statement demonstrate

in details how friends and peers impact on deciding on A/L stream selection.

## CONCLUSIONS

This study proposes an understanding of the influences yielded by social factors on student selection of the A/L subject stream. Thus the goal of this study was to gain insight into what social factors influence on the selection of A/L stream in G.C.E A/L Examination. The findings obtained from both the questionnaire and the interview revealed that the choice of the A/L stream was driven at one point based on priority and interest, G.C.E O/L results. Another, believed to be the most important aspect, is job prospects. Another significant aspect discovered in the study was the influence of parents and siblings on A/L stream selection. Amongst the sample, it was evident that several participants had developed an acute understanding of their parents' unemployment and had taken it as a factor that had influenced and motivated their decision-making on such a competitive examination like the G.C.E A/L. Nonetheless, it was discovered that the level of education of the parents did not affect their decision. Moreover, results indicated that siblings' goals and achievements were directly and indirectly influenced by the choice of A/L subject stream.

Another important factor considered in the selection of the subject stream was the influence of teachers. With compared to the current situation, it was observed that teachers' advice affected the decision-making process of students. Another important factor considered in the selection of the subject stream was the influence of teachers and it was observed that teachers' advice affected the decision-making process of students. On the other hand, many participants in this study revealed that they received assistance

from their teachers before making the selection of the A/L stream. They also stated that before providing advice, the teachers considered students' subject matter knowledge and achievements. Whilst the current study only collects students' opinions on the influences, and it is equally important to consider the parents' and other perspectives to compare similarities and differences in judgment. In addition, further studies can be conducted focusing on a comprehensive survey of literature review analysis. Furthermore, this study emphasized the necessity of initiating seminars and awareness programs to enhance the value of knowledge regarding the selection of A/L streams, which is essential in school wise. In addition, as an implication, establishing career guidance and counseling centers in schools will benefit students because students will be able to get direct assistance with decision-making through teacher support. It may also assist students to make wise A/L stream choices based on current job market trends.

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## Impact of Social Media on AL Students' Academic Performance in International Schools

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### ABSTRACT

Social media has been a powerful source among students as an agent of socialization. It is hypothesized that there is a direct relationship between social media usage and the academic performance of students in schools. Hence, the main aim of this study is to investigate the impact of social media on AL students' academic performance in international schools. A quantitative research approach was used. The study involved a hundred year 12 students selected from five leading international schools from Colombo using the systematic sampling technique. A survey research design was executed, and a questionnaire was administered to collect the data. Descriptive statistics such as frequency counts, percentage and mean were used to analyze data. The findings of the study showed that apart from the benefits of using social media, most of the AL students spend more time on these sites for chatting, watching movies, and playing video games instead of focusing on their studies which have negatively affected their academic performance. The study also revealed that cyberbullying and privacy issues were the main problems caused by using social network sites for these individuals, which has not only affected their academic life but also their mental and physical health. Hence, it is necessary to approach adolescents to the use of social networks with ultimate responsibility.

## **INTRODUCTION**

Information and communication technology play an immense role in today's field of education, where students obtain information from various technological sources such as the internet, smartphones, digital cameras, video and text messages, social media, and so on. A rapid growth in the world of communication took place in the 1990s after the emergence of the internet. This led to the development of social networking sites (SNSs). Some of the most popular social media websites include Facebook, YouTube, WeChat, Instagram, WhatsApp, Snapchat, Tik Tok, and Viber. These sites have influenced all of us from education to entertainment which was a massive transformation in communication. On the other hand, academic performance, which is measured by the examination results, is one of the prime goals of a school. However, a direct relationship exists between social media usage and the academic performance of students in schools. As much as it has contributed in a positive way, it has caused many problems and disappointments to most of the students due to the overuse of social networking sites which they use for interaction purposes.

Some students in international schools even use mobile phones during school hours because bringing in mobile phones is not restricted in these schools. Hence, many students are now addicted to the online rave of the moment, with WhatsApp, Snapchat, Instagram so on, which has not only affected student's academic life but also has caused many other problems.

This study is vital to all the teachers, parents, students, student counselors, and school management. The study will help the teachers to know the influence that social media has on their students. They can assist, enlighten and create awareness to the students on the possible impact of social media, which has affected them. The study is of significance to parents because they will know the possible effects of these social media usage on their children. Therefore, they can be more vigilant and monitor their child more carefully than before. In addition, it will also help to understand the mental health condition of the child as well. It's essential to be aware of whether the child is going through stress or depression due to social networking sites. The study will benefit the students of the senior level to be aware that, apart from the social benefits of these social networking sites, using them more than necessary will pose possible dangers to their academics, behavior, and health. The study will also be relevant to the school management and educational counselors in assisting students in understanding the diversity of social media and in being aware of issues that teenagers face.

## **LITERATURE REVIEW**

The concept of social media has changed over time. Kaplan and Haenlein (2010) defined social media as a group of internet-based applications that is built on the ideological and technological foundations of Web 2.0 and allow the creation and exchange of user-generated content. Hence, these websites and applications are used as communication channels that are very popular among billions of people to share and discover content related to individuals, brands, information, entertainment, and so on. The first recognized social media

network began in 1997, and it was called 'Six Degrees'. This technology allowed people to upload profile pictures and make friends. Since then, up to date, there has been a tremendous improvement in social media in various forms. At present uncountable social networking sites exist, which have been developed for numerous purposes. Such as designed for the local community, specific purpose, or international use. Social media was classified into six different categories by Kaplan and Haenlein (2010). They are: collaborative projects (Wikipedia), blogs and microblogs (Twitter), content communities (YouTube), social networking sites (FB, WhatsApp, BB chat), virtual game World (world of warcraft), and the virtual second world (second life). Among all the above, social networking sites are considered the fastest-growing web application in the 21<sup>st</sup> century, and this rapid growth is being backed by technological evolution (Heyam, 2014).

As far as communication is concerned, humans have enormously benefited and continue to benefit from it, and its importance cannot be underestimated. At present, social media has taken a new dimension and has encouraged more participation through the introduction of smartphones that support social network applications. Mobile social media means when social media is used in combination with mobile devices. Internet usage on social media has rapidly increased among students. According to the views of Nielsen (2012), students continue to spend more time on social networking sites than any other. For example, the total time spent on social media across mobile devices increased by 37%, which is 121 billion minutes in July 2012 compared to 88 billion minutes in July 2011.

However, there are a number of positive effects of social media on students' academic life. Social media networks and several studies have asserted that social media have played an essential role on students in higher education. Williams (2008) also recognizes four significant advantages of social media usage by students in higher education. They are developing collaborative abilities, offering personalized course materials, improving learning motivation, and enhancing student relationships. Nevertheless, as an educational tool, social media has played an important role in recent times by connecting the students and the teachers in a more flexible learning environment. A flexible mode of learning expands the choice of what, when, and how people learn. It facilitates different styles of learning, including E-learning which is highly patronized across the globe. Undoubtedly, it generates students with new opportunities to engage in higher education forums while effectively getting connected to people who will facilitate in exchanging new ideas.

Some schools of thought state that social media is a nuisance to students' academic life. Kuppuswamy and Narayan (2010) argued that students spend more time on social networks for non-educational activities such as unnecessary chatting, which distracts their attention and concentration towards their studies. Besides, there are other findings that are contradictory to this claim. For instance, Junco et al. (2011) revealed that students benefit from chatting with peers, teachers, and external sources to acquire new knowledge. They also argued that students gained more vocabulary, improved their writing skills, and reduced their spelling mistakes through social media. However, according to some researchers, there are more

negative effects of social media on students than positive ones. There are many threats associated with social media. Some of them include fake accounts and theft, sexual abuse and harassment, inappropriate advertising so on.

On the same note, Sorav (2011) also mentioned some of the challenges associated with social networking are privacy concerns, cyberbullying, online harassment, and Facebook depression so on. Cyberbullying and privacy concerns are two main issues that have affected many teenagers' lives. According to Tynes (2007), cyberbullying is performed through digital media by an individual or a group that repeatedly communicates antagonistic or aggressive messages intended to impose harm or discomfort to others. Privacy concerns are also another issue that many people face in social networking. It is alarming the rate at which people post or share fake information on social media. It is not easy to verify what people say and post on social sites because it can be impersonated. Also, when some personal information is publicly displayed on some of these social networks, it's easy to take advantage and perpetrate all kinds of harassment.

According to the Digital report (2021), in Sri Lanka, there were 10.9 million internet users by January 2021. This number increased by 800 thousand (+7.9%) between 2020 and 2021. According to social media statistics, there were 7.9 million social media users in the country by January 2021. This is a + 23% increase between 2020 and 2021, which is around 1.5 million people.

By the beginning of this year, 36.8% of the total population were social media users in Sri Lanka. According to

Ratnayaka et al. (2017), social media has become pervasive, impacting the social and cultural fabric of our society that has changed the nature of social relationships. Facebook can be identified as a remarkable source of addiction because it's the most visited website in Sri Lanka. Today as a habit of using computers or smart devices, an average user browses Facebook for at least 30 minutes a day to get exposed to various information and updates. This has become an addiction for many who waste most of their valuable time on these kinds of social websites. Addiction is known to be harmful to human beings. Facebook addiction is no exception to this. Weerasundara (2014) argues that based on several suicides that were reported in Sri Lanka show sufficient evidence to believe that the reason for the deaths was the direct result of the victims' involvement with social media.

There has been much public discussion after that regarding this phenomenon. Suicides and other mental health problems precipitated or caused by social media are not only confined to Sri Lanka. It's a global issue especially, which can be seen among school-attending teenagers. Despite its apparent advantages in disseminating information and enhancing communication, social media can have a negative impact on mental health, which has been observed in recent years.

Besides, it's also observed that greater use or addiction to the internet has declined student's family time and communication with family members in the household. This has also caused a decline in the size of their social circle and has increased mental health issues such as anxiety, depression, and eating disorders.

The aim of this study is to investigate the impact of social media on AL students' academic performance in international schools. In reaching that aim, the following research questions were drawn to guide this study.

- How much time do AL students spend using social media?
- Does the nature of activities on social media cause problems to individuals?
- How has the use of social media influenced the academic performance of AL students?

## MATERIALS AND METHODS

The study was conducted based on a survey research design. This is the most fundamental tool for all quantitative research studies, which provides a numeric description of a fraction of a population. The target population in this research were the Year 12 students which were approximately 950 students from five leading international schools from Colombo. A hundred students were selected as the sample. Twenty students were chosen from each international school using the systematic sampling technique with the help of the Year 12 admission numbers. A self-developed questionnaire titled "Social Media and Academic Performance of AL Students Questionnaire" was used to get the desired information from the students. The questionnaire was divided into two sections (A and B). Section A was for the collection of information on the personal data of respondents, while Section B consisted of questions that elicited responses from the respondents related to the research objectives. The questionnaires were personally administered by the researcher to the students with the help of the Sectional Heads in the respective schools. Data were analyzed by using descriptive statistics such as frequency counts,

percentage and mean.

## RESULTS AND DISCUSSION

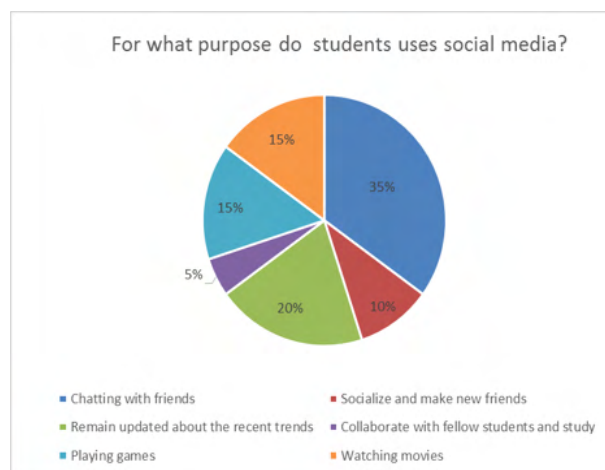
The findings first and foremost revealed that all students in international schools are well exposed to social media networks; all 100 respondents used more than three social media platforms on a daily basis. This is shown in table 1. The major social media platforms that the students use are WhatsApp (86%), Instagram (80%), and Snapchat (75%), respectively. YouTube and Google+ were ranked 4th and 5<sup>th</sup> positions by the students. The least used was Facebook which was only 15%. This shows that Facebook is becoming less popular among teenagers.

**Table 1.** Usage of social media networks

Social media network	Percentage
WhatsApp	86%
Instagram	80%
Snapchat	75%
YouTube	62%
Google	40%
Facebook	15%

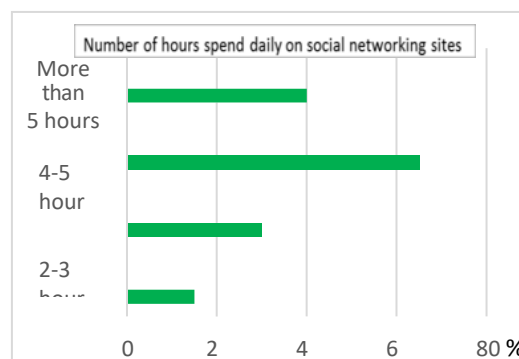
According to figure 1, the primary motives for using social networks for AL students are to chat with (35%) and socialize and make new friends (10%). They spend most of the time communicating with their friends and classmates regarding fashion, parties, food, music, peers, and personal issues. The prime purpose for 20% of students to use social media is to be updated about the recent trends. Some students are much updated on world issues such as political affairs, climate change, sports events, fashion, and music.

**Figure 1.** Distribution of students' uses social media



It is also shocking to see how 30% of the AL students waste their time watching movies and playing games on the verge of their exams. It also shows how they have not given priority to academic work. The findings also suggest that only 5% of the students use social media to collaborate with fellow students and study. This is a very miserable situation that can be identified among AL classes. However, students' usage of social media is not geared towards academics but rather to worthless things, which have really affected their academic life negatively. This clearly correlates with the number of hours they spend on social networking activities and their overall average exam marks. The respondents were asked to mention the number of hours they spend daily on social networking activities. The results were quite surprising. 65% of the respondents spend 4-5 hours daily. 15% spend less than one hour, 30% spend between 2 -3 hours, and 40% spend more than 5 hours. Figure 2 illustrates this. It is evident that the respondents do not study more often than they browse social media. They have been so addicted to this.

**Figure 2.** Distribution of time spend



Addiction to social networking sites (SNSs) by students shows a negative impact on their academic performance. This is visible by their average exam marks in the last term examination, which is shown in table 2.

**Table 2.** Average exam mark in the last term exam

Average exam marks	Percentage
Above 70	05%
61-70	10%
51-60	40%
41-50	30%
Below 40	15%

The students were asked to mention their overall average exam mark in the last term examination at school. The majority scored between 51- 60 marks which is only 40%. 30% and 15% of the students scored between 41 – 50 and below 40, respectively. Overall, 45% of the students have scored below 50 %, which is very disappointing. Spending more time on social network sites without focusing on academic work is the prime cause of this situation. Only 5% are top achievers who have been able to secure more than 70 marks in all their AL subjects and 10% between 61 – 70 marks. Students acknowledge the fact

that social media does provide a valuable platform for academic group work.

35% of the students agree on that point because they share lecture notes, PowerPoint presentations, and additional resources through social media sites. However, another 35% disagree on that point. A student who works independently and doesn't like to share resources falls under this category. Apart from social media affecting student's academic performance, there are a number of other issues that affect individuals. Cyberbullying was considered one of the severe problems that students face. This is a high percentage such as 40. Cyberbullying occurs through social network sites. This is when a person teases, threatens, or humiliates another person. This can happen in many ways, such as forwarding malicious messages to others, posting personal photos or information without the consent of others, tricking others into revealing private information, or spreading false rumours about someone. Although this is common on social media platforms like Facebook, Instagram, and WhatsApp, cyberbullying can also take place via e-mails, text messages, and chat rooms so on. Hence, technologies such as tablet computers and smartphones have made it possible for bullies to attack their victims online at any moment, no matter how far away the victim and the bully are from each other.

According to this study, students also face privacy issues which is 30%. Some of the significant privacy issues that can be considered nowadays are hacking someone else's account, impersonation, stalking and physical and mental harassment so on. Privacy threats do not happen only from strangers. Sometimes your close friends are involved in this.

Nevertheless, cyberbullying and privacy issues can be especially traumatic for students, which can cause them stress and depression. 20% of the students were facing this issue. As a result, it affects their academic performance due to low self-esteem, lack of self-confidence, fear, and guilt. In extreme cases, these incidents have even prompted some students to commit suicide. Overall, the research finds out that 80% of the students agree that social media has affected their academic performance negatively. Only 10% each disagreed, and neither agreed or disagreed. This is actually an alarming situation for the students, teachers, and parents. Using social media in an inappropriate way not only has caused problems to many students, but it has also affected their grades badly.

## **CONCLUSIONS AND RECOMMENDATIONS**

### **Conclusions**

According to the findings of the study, despite the benefits that students can gain from social media networks such as building relationships, sharing information, group discussions so on, there are many disadvantages of these networks which have caused severe consequences on the academic and personal lives of students.

Especially with the increasing number of cyberbullying and privacy issues, students have become potential victims. This has not only affected their academic life but also their mental and physical health. Therefore, it is necessary to approach adolescents to the use of social networks with ultimate responsibility. It's important not to forget about the negative consequences that excessive social infatuation could have.

## Recommendations

In line with the findings of this study, the following recommendations can be made.

- Students should be thoroughly educated on the influence of social media on their academic performance. They should make sure that they use these social networking sites judiciously to ensure that they do not become detrimental to their academics.
- Teachers should ensure students use social media sites as a tool to improve their academic performance. Conducting discussions, debates, PowerPoint presentations, research tasks on social media platforms will help students to inculcate the habit of using these sites in a more effective manner for their academic work.
- Introduction of a counseling unit to these schools. Many elite international schools do not have a counseling unit. This is a massive drawback. With the increasing number of students' issues, it is vital that the school management pay attention to this matter. It is essential to communicate, mentor, and guide the students before it becomes too late.

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## Issues and Challenges faced by Students from Single-Parent Households in Their Academic Performance at Senior Secondary Level.

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### ABSTRACT

An increase in single-Parent household is noticeable in the contemporary society. Academic performance of the students living in single-parent households is affected negatively at large. Therefore, this study aims to discover the issues and challenges that single-parented students face in their academic performance at the senior secondary level. A stratified random sampling method was used and the sample size was 100 senior secondary students from single-parent households from the Moratuwa Educational Division. Three self-developed questionnaires were administered to collect data. Secondary data was collected through test scores and school-based assessments. Descriptive statistics such as frequency counts, percentage and standard deviation were computed. The main conclusion of the study is that the issues and challenges that single-parented senior secondary students face have adverse effects on their academic performance. If these issues and challenges are addressed accurately and deliberately, the senior secondary students' academic performance can be improved. This study recommends that ground-level stakeholders like school administration, teachers, welfare societies, and educational counsellors pay their attention and help single-parents and their children to cope with their situations and enhance their academic performance.

## INTRODUCTION

Family is an agent of culture and socialisation and is the basic unit of human civilisation as it provides members to society. In a family, parents are the primary caregivers of children. When considering a child's optimal social and cognitive growth, the presence of the parents is essential. When the parents live in a family, the child is likely to receive the love, care, and concern needed to grow into a healthy human person (Ortese, 1998). When one of the parents is absent from a child's life, a void is formed because the child loses the support that would have come from that parent, as the father and mother play respective roles in the child's upbringing. A balanced and conducive family situation contributes not only to the social, physical, spiritual and psychological development of the children but also the children's educational performance.

Joseph (2009) stated that a single-parent household (referred to as SPH) has only a father or a mother and the children resulting from divorce, loss of one parent, never married, separation or desertion. SPHs is an ever-increasing phenomenon in contemporary societies. On 13<sup>th</sup> March 2019, Anna Nagy, head of the Single Parent Families' Foundation at United Nations, revealed that currently, there are 320 million single-parent families in the world (Wutz, 2019). Although the actual percentage is unknown, practical experience and newspaper reports revealed an increase in SPHs in Sri Lankan society. Jordal, Wijewardena and Olsson (2013) researched the topic of unmarried women's ways of facing single motherhood in Sri Lanka; it revealed that single motherhood is an increasingly global phenomenon. As SPHs continue to grow in numbers and become more

common, there has been a notable adverse effect on students' academia. Nyarko (2007) says that the children with experience of separation, divorce, or death of a parent do not perform well or achieve academically. However, the academic performance of the students is a prime concern in the teaching-learning process. Thus, schools prioritize the teaching-learning process by drawing all the possible resources to equip the teaching-learning process and facilitate the students to achieve better academic performance. Against this scenario, it is exciting to explore how the senior secondary students (Referred to as SSSs) from SPHs perform academically as they face many issues and challenges in their lives.

## LITERATURE REVIEW

It is accepted and believed that family relationships can provide a greater sense of meaning and purpose and social and tangible resources that benefit the well-being of children (Kawachi & Berkman, 2001). In the recent past, SPHs have gained the spotlight over the nuclear family, consisting of a father, mother, and children. SPHs emerge mainly due to parental separation or divorce, children born out of wedlock, and a parent's death. Children of such families face various disadvantages and challenges. For example, they are less likely to attend school; become school dropouts; show less academic performance and score lower marks, and so on (McLanahan & Schwartz, 2002). Therefore, the absence of a parent is seen as impacting the social cognitive growth of their children. Why SSSs? They are considered middle adolescence who are in a time transition.

The stage of adolescence can be understood as the phase between a child beginning to develop above ordinary childhood stage and becoming an adult. Children of the adolescent age group are highly energetic and active, as well as being very curious. Their attitudinal formation, the social cohesion of different types and levels which shape the educational attainment and perception of the adolescents for the future, will be determined by various factors such as parents, relatives, teachers and peers. In school education, senior secondary level occupies a unique position as one of the major government examinations; the G.C.E. O/ L Examination, which is very decisive in one's life, is being held. At this level, the students give much thought to their future academic and professional careers as well. Thus, this stage of life is very decisive and challenging. Hence, the students in this stage should be carefully guided and helped.

### **Theoretical perspective**

Through scientific research, it is being proved that the SPH situation directly affects the adolescents in the family. Several theories have been presented to describe the psychological significance of the relationship between parents and children and why they are strongly linked with well-being and educational achievement. This research is based on two prominent theories related to this regard.

### **Social learning theory**

This is one of the most influential theories of parent-child relationships. It is closely associated with the ideas and findings of Albert Bandura. Behavioural principles often used in social learning theory are widely used in parenting programmes for school-aged children. Social learning theory argues that the children's real-life experiences and exposures directly or indirectly shape their behaviour.

Children's strategies for dealing with emotions, managing conflict, and interacting with others are developed through experience. The primary source of these experiences is the parent-child and family relationship environment (O'Connor. et. al., 2013, p. 359).

The concept of Reciprocal Determinism developed by Bandura highlights that a person's behaviour is influenced by a person's individual factors and environment. Each could affect and be affected by the other. Therefore, children's individual factors like cognitive skills, attitudes and behaviour are influenced by the environment in which the parents are included. O'Connor et. al., (2013, p. 359) mention that the specific parenting behaviours targeted for assessment and treatment are positive attention, praise for the child's desirable behaviour, contingency of parental response, directions, clear instructions and limits on undesirable behaviour and criticism. Therefore, parenting involvements that improve the parenting dimensions mentioned above can improve children's positive behaviour while reducing negative behaviour. On average, children living with dual-parent households experience better educational, social, cognitive, and behavioural outcomes than children from SPHs (Brown, 2010). Consequently, it is obvious; children should experience both the parents and benefit from the distinctive roles played by father and mother to perform better in their academic achievements.

### **Attachment theory**

Attachment Theory was developed by John Bowlby (1969) and Mary Ainsworth (1979) and colleagues, was conceptualized as a model for understanding how experiences with the caregiver shape social and personality development in the child (Scott, Briskman, Woolgar, Humayun, & O'Connor, 2011). This theory is focused on the relationships

among people. Hence, attachment theory explains how the parent-child relationship emerges and influences subsequent development. Bowlby and other attachment theorists have developed a model of parent and child relationships from a broad theoretical base that includes cognitive, psychology and control systems. Therefore, based on the attachment to the parents, children's behaviour, psychological development, and achievements will be decided (O'Connor et. al., 2013, p. 359).

Students of senior secondary level who can be considered middle adolescents are experiencing a transitional period in their psychological, biological and social aspects. Scott, Briskman, Woolgar, Humayun, & O'Connor (2011) mention a particular challenge in adolescence because of the absence of conceptual-methodological work on what contributes to attachment processes in this age group and how attachment relates to adjustment. They come across opportunities in building new connections with peers and other social groups. However, if parental affection is not dominant, then there is a tendency for them to make strong attachments with other social groups, negatively affecting their academic achievements. Therefore, parent-child relationships built during infancy and childhood should continue with much more vigour and spirit during this stage of children's lives and has become very challenging, especially in SPHs. In addition, Scott, Briskman, Woolgar, Humayun, & O'Connor (2011) say that in adolescence, it is likely that a warm, involved parenting style will be associated with security and an angry style with insecurity.

Thus, social scientists in general, and psychologists in particular, principally agree that parent-child relationships play a vital role in shaping children's

development and adjustments in life. Professor Joyce L. Epstein highlights that parental involvement is a significant factor in a child's education (Anyakoha, 2016, p. 838). Epstein's Theory of Family Deflect Model, which anchors family on the Family Deficit Model in Hunter & Donahoo (2003), also sees two-parent family as the ideal family structure and SPH deviant from the model family. This Family Deficit Model upholds that SPHs negatively impact children since such families are not nuclear in structure. Furthermore, the structure plays down the effects of economic and other background factors on learners' academic attainment (Hunter & Donahoo, 2003).

Despite such negative impacts, some scholars hold a different stance. Abbott (2012) holds the view that single parenting can contribute to a child's academic performance just like in a two-parent family provided that the single parent is well equipped to handle the challenges that are present due to the absence of the other parent (Okaka, 2016, p. 1). Supporting this view, Anyakoha (2016, p. 838) affirms that Epstein's Risk and Protective Factor Model does not regard single-parent families as irregular because the foundation for the model is that all families have both strengths and weaknesses. Besides these findings, many other researchers still believe that the issues and challenges that single-parented students face; affect students' academic performance more negatively than positively.

Schultz (2006) believes that higher levels of emotional, social and academic problems are recorded among children from unstable households than from the other types of families with both mother and father. Furthermore, the study reveals that the children living with their married parents do significantly better than children from single-parent households

regarding educational achievement. Usdansky & Parker (2011) indicates that a single-parent family directly influences the academic achievements of adolescents in the family. Abudu and Moses revealed through their study that most students from SPHs experience low parental involvement in their academic activities, negatively affecting their academic performance (Abudu & Moses, 2013). Moore and Valladares (2009) have found a mix of poverty and single parenthood was further explained to poorly and negatively affect the educational attainment level of affected children. The parental distress with less supervision found among SPHs brings about persistent tension capable of affecting both children's social and educational attainment (Moore & Valladares, 2009).

After critically analysing the existing literature, it is evident that there are issues and challenges that SPHs' students face in their academic performance at the senior secondary level. However, available literature shows that no sufficient research is being conducted into this matter in the Sri Lankan context. Thus, it is a timely need to investigate and find solutions to this research problem and create enthusiasm in the research field for further investigation in this regard.

This study is beneficial in guiding all the stakeholders in education when focusing on single-parented students' academic achievement at the senior secondary level. Furthermore, it gives them insights to fulfil their duties and responsibilities without failing to find solutions to this current issue in the field of education in Sri Lanka. Finally, this study will contribute to the existing body of knowledge on the academic performance of adolescents who come from SPHs.

### **Objectives**

This study aims to discover the issues and challenges that SPHs' students face in their academic performance at the senior

secondary level. The following objectives guided the study.

- To identify the issues and challenges that the SPHs' students face in their academic performance at the senior secondary level.
- To examine the causes for the identified issues and challenges and their effects on SPHs' students' academic performance at the senior secondary level.
- To explore the possible solutions to address the identified issues and challenges and improve the academic performance of the SSSs in SPHs.

### **MATERIALS AND METHODS**

The survey research design was employed to conduct the study as it is the most fundamental research tool for all quantitative research studies that can provide a numeric description of a fraction of the population. The target population in this study was the SSSs (Grades 10 & 11) who come from SPHs, their single-parents and grades 10 and 11 class teachers from the Moratuwa Educational Division. In this study, Moratuwa Educational Division was selected through a non-probability sampling technique. A stratified random sampling method was used to determine the schools proportionately from different types of schools, which can be considered as different strata. In the Moratuwa Educational Division, there are thirty schools. The schools with no secondary schools and Tamil medium schools were not included in the sample. So, the total population comprises of twenty-seven schools. These schools could be categorised into three different types; National Schools (1AB), Provincial Schools (1C, type 2 and type 3) and Semi-Government Schools. Ten schools out of twenty-seven schools were selected using a stratified sampling technique. A hundred single-parented SSSs, fifty single-parents

and fifty class teachers from the senior secondary level in Moratuwa Educational Division were selected as the sample by using a convenience sampling technique. The participation of single-parented SSSs, their single-parents and class teachers in the study was based on their readiness and willingness. The primary data was collected from questionnaires, while the secondary data was extracted from the test scores and school-based assessment reports. Three self-developed questionnaire items were employed to collect relevant quantitative data from the SSSs in SPHs, their single-parents and the class teachers who consented to participate in this research study. These questionnaires were divided into two sections. Section A contained the respondents' demographic data, and section B had the questions that prompted the responses from the respondents concerning the objectives of the research study. These questionnaires were given to all hundred SSSs (fifty students from each grade) from SPHs, fifty single parents and fifty teachers from ten schools. The researcher administered the questionnaires to the sample selected with the help of principals and sectional heads in the respective schools. Descriptive statistical measures such as frequency counts, percentage and standard deviation were used in analysing data.

## RESULTS AND DISCUSSION

According to the results, most of the SSSs from SPHs experience low parental involvement in their academic activities for many reasons. The class teachers, too, have notified the lack of parental participation concerning the matters of the schools. 24% of single-parents rarely attended parent-teacher meetings, and 38% never attended. Attending talent shows, activities and programmes of the students have a low percentage (38%). In addition, most of the single parents show

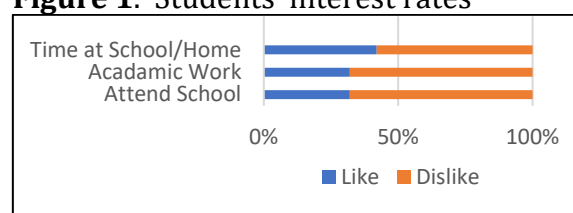
inadequate constant supervision of students' academic progress (72%) and less interest in teacher-parent communication (73%). The causes for these issues are shown in table 01.

**Table 1.** Causes with percentages

Causes	Percentage
Lack of Finance	88%
Lack of Help in Homework	72%
Stressful Responsibilities	92%
No External Help at Home	82%
Informal Employment	38%
Stigmatisation	62%
Other	78%

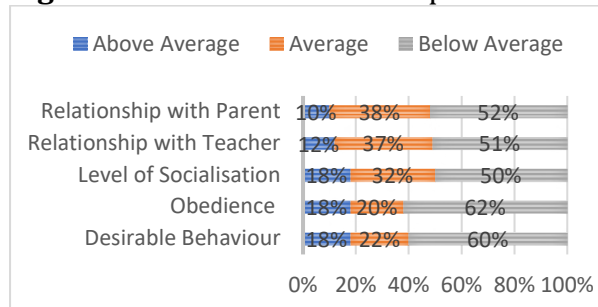
It is also alarming to notice that many students would like to be away from the school and home. The questionnaire for teachers revealed 62% of students' attendance is below the average. This is mainly due to the poor relationships and less attention from single-parents and class teachers. Figure 01 shows students' interest in doing academic work and attending school.

**Figure 1.** Students' interest rates



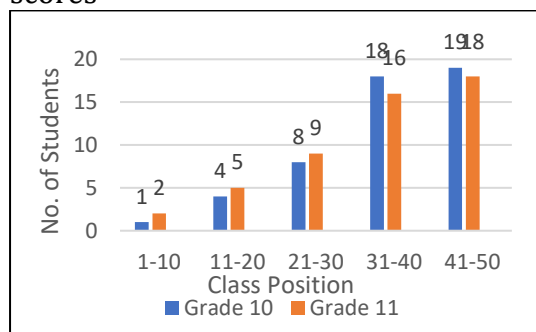
A considerable number of students (78%) have issues with their behaviour and face challenges in building better relationships with parents, peers, and single parents. These students feel that they are being neglected, not welcomed and not cared for. Due to the effects of behavioural issues and challenges in relationships, these students have become victims of social vices and unhealthy relationships.

**Figure 2.** Students' relationship status.



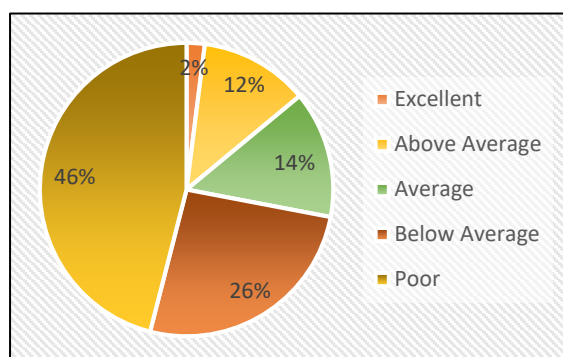
The evidence mentioned above and many other factors have proved that the issues and challenges that SPHs' students face have adverse effects on their academic performance at the senior secondary level. Students' class positions based on test scores prove this fact in figure 03.

**Figure 3.** Class positions based on test scores



It was revealed that social and psychological aspects contribute to the achievement levels of the students. Therefore, considering the above facts and data from School Base Assessments, the overall academic performance of SSSs is evaluated in figure 04.

**Figure 4.** Overall academic performance



The single-parents and their students who have received help in different forms have shown desirable academic performances. For example, according to Figure 04, 14% of students have performed above the average level, and these students have received some type of help like; financial aids, scholarships, free tuition, free meals, counselling and guidance, assistance at home etc. On the other hand, 72% of students who have performed below the average level have not received any help to face the issues and challenges. Findings also showed a significant correlation between student's academic achievement levels and the support they receive from the single-parent and society.

However, findings also give hope if additional help is provided for both single-parents and their children, not only the academic performance of the students but also their social, physical, psychological and spiritual well-being can be positive.

## CONCLUSIONS AND SUGGESTIONS

### Conclusions

It is evident from the study that the issues and challenges that single-parented SSSs face have adverse effects not only on their academic performance but also on the overall well-being of the students. In addition, low parental involvement in students' academic careers and less attention of school administration, teachers, welfare societies and educational counsellors have aggravated the issue. However, SPHs' students at the senior secondary level can successfully overcome the issues and challenges on their academic performance if the causes that create the adverse effects are adequately addressed by the ground-level stakeholders of the education system, together with the single-parents and their students. This is evident as 2% of students

have excelled in their overall performance, while 14% are above average. This will result in better academic performance by SSSs in SPHs.

### Suggestions

Single-parents should be guided to equip themselves psychologically to deal with being single-parents and face the challenges and issues. This is essential because it will affect the school administration, teachers and educational counsellors to be more productive in assisting single-parented students in performing well academically.

School administration, teachers, and the welfare societies' members should have a joint mechanism to help single-parents and their children to face the difficulties and challenges they come across in their journey of academia. For example, trying to get them scholarships, free tuition, free meals, psychological support etc., are prominently recognized.

Educational counsellors should be prepared to provide the necessary help and psychological guidance for single-parents and their children.

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## Development and Validation of a Scale: Assessing Secondary School Students' Pro-Environmental Behaviour and Attitudes

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### ABSTRACT

The main purpose of this study is to develop and validate an instrument to assess levels of Pro Environmental Behavior and Attitudes (PEB) of grade 8 and 10 students in the Sri Lankan context. First, related previous studies and related scales were studied and an item pool was established. Relevant common items were identified in different scales and some items were moderated or redesigned to make them more suitable for grade 8 and 10 students in the Sri Lankan context. The first draft of the questionnaire containing 45 items was reviewed by a panel of experts and according to the expert recommendation, 5 items were eliminated. The final questionnaire was based on a five-point Likert scale (Strongly disagree - 1 to Strongly agree - 5) was administered to a randomly selected 972 (529 male and 443 female) students. Exploratory Factor Analysis (EFA) with varimax rotation were used. Adequacy of sample size for EFA was tested by the Kaiser-Meyer-Olkin (KMO) and Barlett Sphericity tests (0.714). Reliability analysis was done using the Cronbach Alpha coefficient (0.894) for the whole scale. The final version of the scale contained 32 items that explain 49.7 of total variance with six factors (i.e., Household behavior - 8 items; Civic action - 5 items; Recycling behavior - 6 items; Environmental Sensitivity-5 items; Environmental Awareness - 4 items and Environmental values - 4 items). The final scale consists of 32 items proved to be a reliable and valid instrument for assessing attitudes and behavior of junior secondary students in the Sri Lankan context.

## INTRODUCTION

Sri Lanka is facing serious environment related issues mainly due to human behavior in the recent past which need immediate action (De Alwis & De Silva, 2020; Geekiyanage et al., 2015; MERE, 2010a). Further, UNESCO (2020) warns that “What we have learned so far does not prepare us for the challenge. And the window of opportunity is closing fast”. We must urgently learn to live differently” (P1). As such it is the responsibility of school education to ensure that younger generation acquires environment related knowledge, attitudes and skills demonstrating environmentally responsible behavior.

The term behavior related to environment has been conceptualized differently with different terminology. For example, drawing from various sources Krajhanzl (2010) provided a list of 7 terms including “environment-preserving behavior”, “environmentally responsible behavior”, “ecological behavior”, “sustainable behavior” ,etc. (p, 252). Another distinction between the terms is that Environmental behavior, and Pro-environmental behavior. According to Krajhanzl (2010), Environmental Behavior (EB) of an individual may be unintentional and not reflected; in such case the person does not realize the impact of his/her behavior. Pro-Environmental Behavior (PEB) is such behavior which is generally (or according to the knowledge of environmental science) judged in the context of the considered society as a protective way of environmental behavior. This study focuses on assessing the relationship between Pro- environmental behavior and attitudes of Grade 8 and 10 children in Sri Lankan context.

According to Ajzen and Fishbein (2000), attitude is a summary evaluation of a psychological object captured in such attribute dimensions as good-bad, harmful-beneficial, pleasant-unpleasant, and likable-dislikable, Millar and Tesser (1986) suggested that there are two components of attitudes, cognitive and affective. Cognitive components contain one’s beliefs about certain objects, whereas affective components contain feelings related to that object.

Some studies have focused on the affective aspects of adults’ environmental attitudes and behaviors (Allen & Ferrand, 1999; Geller, 1995; Kals et al., 1999; Mayer & Frantz, 2004). It is important to study how the affective components of Environmental attitudes and behavior are related school-aged population. This is important at a time when Educational authorities are preparing for new educational reforms in line with the sustainable development goals to be implemented in 2022. However, there is lack of research evidence in Sri Lanka regarding assessing environmental attitudes and behavior of school-aged children.

Understanding young people’s environmental attitudes is important because in time they will face environmental problems and will need the skills and disposition to work on resolutions for these problems (Bradley et al., 1999). It is also important to assess the PEB of school-aged children and its relationship with attitudes. Then the environmental education can be planned in such a way that favorable attitudes can

be formed in children which in turn leads to PEB.

Thus, the purpose of this study is to examine the relationship between levels of attitudes and PEB of Grade 8 and 10 students. This research consists of two phases: Development and validating an instrument to assess attitudes related to Pro-environmental behavior and to examine the levels of attitudes and behavior towards the environment among junior secondary students. This paper focuses on the development and validating an instrument to assess the relationship between environmental attitudes and Pro-Environmental Behavior.

## **MATERIALS AND METHODS**

### **Development of the scale.**

The first step of developing the scale was to study related previous studies and scales employed by other researchers for similar purposes and establish an item pool (Gkargkavouzi et al., 2018; Dunlap et al., 2000; Leeming et al., 1995; Atabek-i git et al., 2014; Ugulu et al., 2013; Geiger et al., 2018). Several common items were identified in different scales. However, when moderating items some items were removed or redesigned to match them with the maturity level of students (i.e., Grade 8 & 10) in the Sri Lankan context. Thus, the first draft of the questionnaire containing 45 items were prepared and it was reviewed by a panel of science, technology and language experts for appropriateness, relevance and language clarity of items. According to the recommendations made by the panel of experts 5 items were eliminated from the item pool with some wording changes in some items. A five-point Likert scale (Strongly disagree - 1 to Strongly agree - 5) was selected for the scale. The drafted scale was administered to a sample of randomly selected 972 students (529 Male and 443 Female students) and collected

data was used for (EFA)\_using SPSS version 22.

The EFA was used to determine the construct validation of the study thereby the selected items are intended to be included in the final version of the scale. Before conducting EFA the sample size for EFA was tested employing the Kaiser-Meyer-Olkin (KMO) and Barlett Sphericity tests.

### **Sample and collection of data**

The population of interest was Sri Lankan public school students who were studying in grade 8 and 10 in 2020. The sample was selected randomly including 21 educational zones representing all nine provinces of the country. One class of grade 8 and 10 students from each school was chosen from randomly selected 28 schools. There were total of 972 students in the sample, 529 of which were female and 443 of them were male. Questionnaires were administered during normal school hours and participants were asked to evaluate themselves in the classroom. The students' answers to the items were thought to show their underlying attitudes and actual behavior towards the environment.

### **Data analysis**

According to the guidelines to interpret KMO measure Beavers et al. (2013), the value of KMO matrix of current study is 0.714, which falls under the range of Middling and test value of chi-square is 1743.02 which is significant ( $p < 0.05$ ). The result shows that the sample size was sufficient for the factor analysis. The PCA method which is an approach to factor extraction was employed (Malhotra & Satyabhushan, 2010). The current study employs EFA and the extraction method was chosen as PCA with varimax rotation. Reliability analysis was done using Cronbach's Alpha coefficient using SPSS

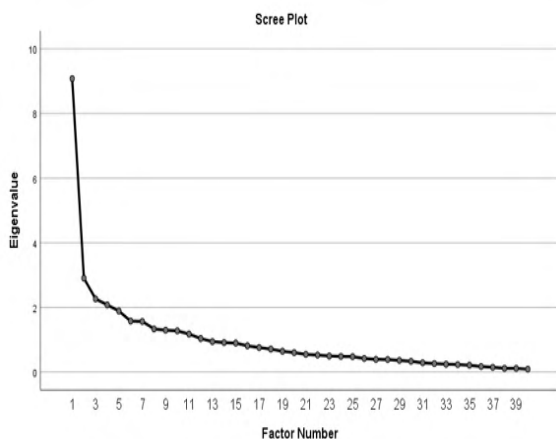
version 22. Cronbach's Alpha coefficient was 0.894 for the whole scale. Then, Cronbach's Alpha coefficient was calculated for 6 factors separately.

## RESULTS AND DISCUSSION

According to the guidelines to interpret KMO measure Beavers et al. (2013), the value of KMO matrix of current study is 0.714, which falls under the range of Middling and test value of chi-square is 1743.028, which is significant at five percent level ( $p < 0.05$ ). The result shows that the sample size was sufficient for the factor analysis.

The current study employs EFA and the extraction method was chosen as PCA with varimax rotation. Eigen Values greater than or equal to 1 and items with factor loading greater than 0.4, were considered as the criterion for the extraction of the factors. The analysis showed that there were 6 factors in the scale. The total variance explained by these factors was 49.47%. The resulted scree plot of the analysis shows Eigen values which were obtained in figure 1. The minimum point of the factor loadings was specified as 0.4 then factor loadings smaller than this value were not included in to the scale.

**Figure 1.** Scree plot of Eigen values



The following Table 1 shows percentage of variance explained from each factor and the total variance.

**Table 1.** Variance explained by six factors

Factors	Eigenvalues	% of Variance Explained
F1	9.079	22.67
F2	2.903	7.26
F3	2.264	5.66
F4	2.078	5.20
F5	1.886	4.72
F6	1.576	3.94
Total		49.45

Above table shows that there are 6 factors and these 6 factors account for 49.45% of the total variance. The First factor of the scale (Household behavior) includes 8 items, the second factor (Civic action) includes 5 items; the third factor (Recycling behavior) includes 6 items; fourth one (Environmental Sensitivity) includes 5 items; fifth one (Environmental Awareness) includes 4 items and sixth factor (Environmental values) includes 4 items. According to EFA results 8 items were excluded out of 40 items. The final scale was consisted of 32 items.

### Reliability analysis

Reliability analysis was done using the calculation of Cronbach's Alpha coefficient. Cronbach's Alpha coefficient was 0.894 for the whole scale. Then, Cronbach's Alpha coefficient was calculated for 6 factors separately. The results are given in Table 2

**Table 2.** Results of the Cronbach's Alpha Coefficient Reliability analysis

Factor	Cronbach's Alpha Coefficient
F1	0.835
F2	0.789
F3	0.786
F4	0.714
F5	0.760
F6	0.670
Overall	0.894

The overall picture of the analysis is summarized in the following table No.3.

**Table 3.** Summary of the extracted factors with examples

Fact ors	Name	No. Item s	Example
F1	House hold Behavior	8	For saving energy, I turn off the lights in my house when they are not used
F2	Civic Action	5	"I encourage others to stop destructive environmental behavior"
F3	Recyclin g Behavior	6	I use reusable ecofriendly bags instead polythene bags
F4	Environ mental Sensitivit y	5	All living organisms are precious and worth preserving
F5	Environ mental Awarene ss	4	I enjoy reading books and magazines on environmental issues
F6	Environ mental Values	4	In Sri Lanka we have lots of environmental problems, we must pay attention to protect our environment
Tota l		32	

## CONCLUSIONS

The instrument was prepared based on items selected from literature and redesigning those according expert comments to make it more suitable for the junior secondary students in Sri Lankan context.

The development process of this instrument was planned according to acceptable procedures assuring the reliability and validity of the scale. For example, Internal consistency can be measured using the test of Cronbach's Coefficient Alpha. It is a measure that determines the degree to which an internal consistency exists among the indicators within the same factor (Tavakol & Dennick, 2011). Cronbach's alpha values for all the factors in the present study fall in the range of 0.714 to 0.894 indicating high internal consistency of all the extracted factors. Since majority of the indicators were selected from literature it was in one hand the relationship between items and factors are uncertain, on the other hand, it is needed that these items are appropriately connected with the extracted factors. Therefore, EFA was employed. wiin extracting factors. selected since it minimizes the correlation across factors and maximizes within the factors (Nunnally, 1978).

The present study focused mainly on environmental behaviors in the private sphere such as saving water, saving energy, planting trees in the home garden, encouraging friends and neighbors to practice eco-friendly habits and reuse of household products, since participants are school students; still too young to contribute to public sphere behaviors including political approaches, environmental policies and active involvement in environmental organizations. In that way, environmental behaviors are divided into 3 factors; household behavior, civic actions and recycling behavior that have environmental impact. Attitudes are also divided into 3 factors as; Environmental sensitivity, environmental awareness, and environmental values. Finally, research findings showed that the scale is valid and reliable and it can be generalized in testing the scale with other grades in the junior

secondary level students in the Sri Lankan context.

### Acknowledgement

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## Students' Involvement in Online Learning in the Context of Covid-19: A Case Study of University Undergraduates

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### ABSTRACT

The Covid-19 epidemic had a massive impact on education. As a result of this, students began and continue to rely on online teaching and learning. This study employs a psychometric approach to assess students' involvement in online learning. Data was obtained from a survey of 97 randomly selected undergraduates, representing the first year and second year of a public university. With the help of prior scales, a four-dimensional psychometric scale was created. Structural equation modelling (SEM) was employed to evaluate the validity of the measurement model, and the results confirmed the validity of the model. The scale was loaded as an aggregate of physical, sentimental, intellectual, and agentic involvement. The research sample had an overall moderate degree of engagement in online learning with an average level that is not adequate yet could improve. Even though students are accountable for their learning, tension and anxiety may arise due to striving to keep up with their education and stay motivated and involved in online learning. Also, students' involvement levels varied significantly ( $p < 0.05$ ) depending on the academic year and degree program and insignificant with network bandwidth, device use, and internet connection type. This result predicts the positive possibility to continue online learning under the Covid-19 pandemic even with fewer resources but with some behavioral changes. Finally, these findings and evaluations will aid policymakers and decision-makers in identifying various groups of students who will require attention to increase their level of participation in online learning.

## INTRODUCTION

The Covid-19 epidemic had a wide range of effects on people's lives, with one of the most significant being a massive impact on education. According to UNESCO, the pandemic has severely impacted 98 percent of the world's student population, resulting in institution closures (UNESCO, 2020). From the end of March 2020, all elementary, secondary, and postsecondary education in Sri Lanka has been halted from its usual course (Hayashi, Garcia, and Maddawin, 2020). Even though the government attempted to reopen education institutes the same way as previously, all attempts to continue amidst the second and third Covid-19 waves were unsuccessful.

As a result of this circumstance, students began and continue to get virtual teaching and learning, utilizing Zoom, Microsoft Teams, and Google Meetings as often as feasible. In June, almost all faculty at state and non-state higher education institutions in Sri Lanka shifted to online learning (Hayashi, Garcia, and Maddawin, 2020). The phrase "online learning" was defined in this study as "internet-based learning that unites students and teachers in a virtual environment, mostly in the synchronous form." However, this new scenario of online learning has implications for both teachers and pupils since stress and worry may grow, leading to significant mental health concerns and difficulties in adjusting. Although all students maintained 88% of active participation rate in online learning, active involvement in classes had been a considerable concern (Hayashi, Garcia, and Maddawin, 2020). Because of that, evaluation of this process is also vital to make improvements in online learning. Recognizing that online learning is self-motivated (Smart and Chappel, 2006),

and based on solid evidence from previous literature that its quality and efficiency can be measured through student engagement (Beer, Clark and Jones, 2010; Burrows, 2010), this study employs a psychometric approach to assess undergraduate students' involvement in online learning at a public university during the Covid-19 pandemic and to investigate how the students' level of involvement structure with different demographic characteristics.

This research can be used as a reference for developing policies and making choices connected to online university education. An in-depth study of students' levels of engagement in online education would give insight into how to create and execute technology-based knowledge mobilization techniques to maintain the educational system's long-term viability, especially during a pandemic like Covid-19.

## METHODOLOGY

The phrase "student involvement" refers to students' active participation in faculty-led courses/subjects, as well as their desire to learn and dedication to education (Christenson, Reschly, and Wylie, 2012). With the help of prior scales (Reeve, 2013; Sinatra, Heddy, and Lombardi, 2015), a four-dimensional psychometric scale was created. The four dimensions were Physiological, sentimental, intellectual, and agentic. All measurements were related to activities on Zoom platform since it is the most used platform in universities to conduct online classes. Physiological dimension statements included how much students are active in online courses, their involvement, and effort (E.g., Switch on camera, ask/answer questions in lecture, use chat box to communicate with the instructor and batchmates). Sentimental engagement statements related to how

much mental effort pupils put into completing learning activities. Students' sentiments toward instructors, learning activities, and their sense of belonging, are referred to develop intellectual statements. Students' efforts that contribute to learning are addressed in agentic engagement statements.

Face validity was tested after items were developed. After a pilot test, the re-modified items were confirmed, and the survey instrument was completed. Finalized scale, which uses a 5-point Likert scale, contains thirteen items. Second-year and third-year undergraduates from a public university are purposively selected since they were engaged in virtual learning at that moment. Data was collected through a cross-sectional survey. A Google form was shared among all students in 2 batches; 97 submissions were made. From that, 53 were second-year students, and 44 were third-year undergraduate students. The sample represented all three-degree programs as 45, 27, and 25, respectively. At the beginning of the survey, students' consent was obtained while maintaining data confidentiality.

IBM SPSS version 23 and IBM AMOS version 26 were used to tabulate and analyze the data. The data was checked for missing values, and an exploratory factor analysis was used to establish the survey questions' factor structure. Cronbach's alpha and construct reliability values were used to assess the measuring scale's reliability. Maximum likelihood estimation was used in structural equation modelling to determine the validity of the psychometric scales using route analysis and pooled confirmatory factor analysis. As a partial objective of the study, one-way ANOVA testing was used to find correlations among student characteristics and their level of engagement in online education.

## RESULTS AND DISCUSSION

Items of the measurement model were loaded under four latent constructs as reviewed in the literature. It is acceptable to consider that engagement in online learning is an aggregate of physical, sentimental, intellectual, and agentic involvement.

Each item in the measurement model's Cronbach's alpha values exceeded the threshold level of 0.7. The pCFA findings proved that the hypothesized measurement model was valid and trustworthy. All standardized factor loadings were more outstanding than 0.6 and significant, putting them over the 0.5 criteria (Wolfinbarger and Gilly 2003). The model's Construct Reliability (CR) values were higher than the 0.7 criteria (Nunnally and Bernstein 1994). AVE value estimations above the threshold level of 0.5 indicated convergent validity (Hair, Black, Rabin, and Anderson, 2010). The model's discriminant validity was established according to Fornell and Larcker (1981).

**Table 1.** Construct validity and reliability of the measurement model

Construct Scale item		Item mean	SD
<b>Physiological Involvement (PI)</b>			
CM 2.993 (SD 0.728), 0.887, CR: 0.766, AVE: 0.510			
<b>PI 1.)</b> <i>I often keep switch on my web camera while at the lecture</i>	0.617***	4.03	0.951
<b>PI 2.)</b> <i>I often unmute my microphone to ask questions or answering questions while at the lecture</i>	0.745***	2.87	0.778
<b>PI 3.)</b> <i>I often use chat box to ask question or answer questions while at the lecture</i>	0.667***	2.08	0.948
<b>Sentimental Involvement (SI)</b>			
CM: 3.013 (SD 0.837), 0.796, CR 0.817, AVE 0.598			
<b>SI 1.)</b> <i>When we work on something in online learning, I feel interested</i>	0.804***	2.95	0.881
<b>SI 2.)</b> <i>This online learning is fun</i>	0.713***	3.38	0.962
<b>SI 3.)</b> <i>I enjoy learning new things in online learning</i>	0.800***	2.71	1.089
<b>Intellectual Involvement (II)</b>			
CM 2.351 (SD 0.623), 0.895, CR 0.777, AVE 0.569			
<b>II 1.)</b> <i>I go through the work for online learning and make sure that it's right</i>	0.815***	2.63	0.858
<b>II 2.)</b> <i>I think about different ways to solve a problem</i>	0.653***	2.32	0.785
<b>II 3.)</b> <i>I try to connect what I'm learning to things I have learnt before</i>	0.619***	2.40	0.812
<b>II 4.)</b> <i>I try to understand mistakes when I get something wrong</i>	0.635***	2.05	0.834
<b>Agentic Involvement (AI)</b>			
CM 2.921 (SD 0.778), 0.893, CR 0.803, AVE 0.576			
<b>AI 1.)</b> <i>I let my teacher know what I need and want in online learning</i>	0.763***	2.81	0.928
<b>AI 2.)</b> <i>During online learning, I express my preferences and opinions.</i>	0.746***	2.94	0.899
<b>AI 3.)</b> <i>When I need something in online learning, I'll ask the teacher for it.</i>	0.768***	3.01	0.930

Note factor loadings (\*\*\*)significant at p 0.001 because these variables were set to 1.0 to control construct variance, p values were not calculated), CM construct mean, Cronbach's alpha, CR: composite reliability, AVE: average variance extracted

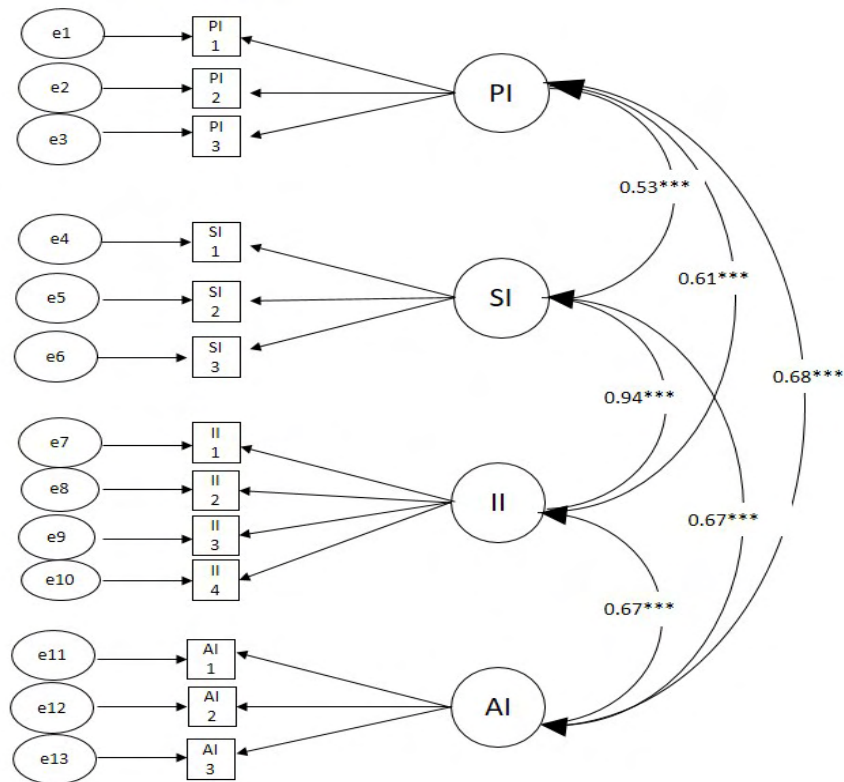
Inter factor correlations were larger than the square root of AVE CFI 0.93, RMSEA 0.06, normed chi square 2.73, p 0.001 and Bollen-Stine bootstrap p 0.002. The Google form got 97 answers representing three-degree programs (53 second year undergraduates and 44 third year

undergraduates), with the majority of responders (66%) being female, mirroring the gender composition of the enrolled students in these two batches. The majority of students (80.4%) say they have continued their studies so far (maintaining a class), and they use their phones (51.5%) and laptops (46.4%) in

equal percentages to log into online classrooms, with only 1% utilizing other devices like tablets. The majority of students (54.6%) use mobile data to

enroll in online classes, but a significant number (45.4%) utilize Wi-Fi, which corresponds to the data on device type.

**Figure 1.** Path diagram with standardized coefficients



Note GOF indices RMSEA 0.06 CFI 0.93 2 df 2.73, ( $p$  0.001 Bollen-Stine bootstrap  $p$  0.002). \*\*\*1% significance (All the abbreviations for the dimensions and scale items were introduced in the table 1).

However, most of them (60.8%) confirmed that their network bandwidth is modest because it varies depending on their connection type.

The research sample had an overall moderate degree of engagement in online learning (CM 2.78, SD 0.58, Max 5, Min 1), with average levels of each dimension which is not adequate and yet could improve. Even though students are accountable for their learning, tension and anxiety may arise due to striving to keep up with their education and stay motivated and involved in online learning. Aside from that, social isolation caused by the epidemic might be a factor (Chiu, 2021). However, intellectual involvement is slightly low when compared with the other three-dimensions. Students may lack interaction with the instructor and other batch mates compared to in-person learning.

Also, students' involvement levels varied significantly depending on the academic year ( $p = 0.001$ ) and degree program ( $p = 0.025$ ). Third-year students had a greater degree of involvement (CM 2.99, SD 0.62) than second-year students because they have learned physically and virtually at the university and interacted with instructors in person. Still, second-year students have not been exposed to actual classes like them. The difference between the three courses might be due to the number of classes, instructors, and the strategies they are using in online classes and course content.

Another important finding from this study is that students' network bandwidth, device use, and internet connection type do not impact their level of involvement in online classes. Many students are facing issues with that respective aspect in Sri Lanka, but it may not decide their engagement in the class and indirectly their performances as well. This information is positive to continue online learning under the Covid-19 pandemic

even with fewer resources but behavioral changes.

## CONCLUSIONS

Students' engagement in online learning is an aggregate of physical, sentimental, intellectual, and agentic involvement. The validity requirements for a psychometric scale designed to evaluate undergraduate students' degree of participation in online learning were satisfied. As a result, the created instrument can be securely suggested for different student groups, with the caveat that it must be cross-culturally validated and modified before being used in research. Majority of the study sample uses mobile phones and mobile data for online learning, and they have a moderate level of network bandwidth.

The study indicates that undergraduate students' participation in online classes is modest in the relevant population. This could be due to social isolation, tension, and anxiety developed due to virtual learning. This is insufficient and may be enhanced via behavioral knowledge rather than enhancing physical resources, which is a fact in the face of a pandemic like Covid-19. Based on the data, this study suggests that the degree of participation varies depending on the demographic features of the undergraduates, such as academic year and degree program. Differences in the number of classes, instructors, and their strategies in online courses could be possible causes of these results. Insignificance with some physical resource availability leads to the possibility of continuing online learning under the Covid-19 pandemic even with less resources but with some behavioral changes in both students and teachers. Finally, these findings will aid policymakers and decision-makers in identifying various groups of students who will require attention to increase

their level of participation in online learning. Given that the world has been dealing with the Covid-19 epidemic for a longer time, the study's findings will aid in a substantial long-term investment in the education sector, notably in the field of online learning.

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## Prospective Teachers' Understanding of Active Learning

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### ABSTRACT

The pre-service teacher education programme in national Colleges of Education in Sri Lanka has been facing a challenge to transform traditional didactic instructional process to a more learner-centred direction. The purpose of this study was to find out the prospective science teachers' understanding about the active learning and how their understanding change as they complete a two-year institutional training period. 77 science prospective teachers were randomly selected from a population in the academic year 2017/2019. Data were collected using the open-ended questionnaire, informal discussions, and written documents. Results showed that at the beginning, prospective teachers explained active learning in various ways and were unable to give a clear definition. Majority of them learnt as passive learners in the secondary level classes and thought development of subject matter knowledge through group activities is the way of active learning. When they followed the pre-service curriculum engaging learner-centred activities, laboratory work, field trips and teaching practice they experienced learning theories and teaching-learning methodologies and gradually developed the understanding of active learning. There were no observable changes in the middle of second year. Prospective teachers, further equipped with good knowledge and practicalities on active learning showed a gradual transformation in their understanding.

## INTRODUCTION

Education system in Sri Lanka has been challenged to transform traditional didactic instructional process to a more learner-centred direction. Consequently, the concept of active learning has received increased interest and is becoming commonly practiced in classrooms lately. It is evident from research that active learning is one of the most effective learning approaches which promotes students' learning (Crouch & Mazur, 2001; Deslauriers, Schelew & Wieman, 2011; Haak, HilleRisLambers, Pitre & Freeman, 2011; Naiz, Aguilera, Maza & Liendo, 2002; Nehm & Reilly, 2007).

Active learning is a comprehensive concept, most often centralized on learner-centered and activity-based processes. It is not possible to provide one specific definition for active learning. It focuses on how students learn, not just on what they learn. Theoretically it is based on the learning theory 'Constructivism'. Prince (2004) explains "active learning is generally defined as any instructional method that engages students in the learning process. It requires students to do meaningful learning activities and think about what they are doing." With active learning, students play an important part in their own learning process. They build knowledge and understanding on their prior knowledge and experience in response to opportunities provided by the teacher. Johnson and McCoy (2011) described that learning is learner-centred; an active process not a passive experience of absorbing new information. Therefore, effective teaching should be learner-centred and allow students the opportunity to construct knowledge as they encounter new information. Therefore, active learning stands in contrast to traditional modes of instruction in which students are passive

recipients of knowledge from the teacher (Faust & Paulson, 2012).

Active learning promotes interest among students, conceptual understanding of concepts and conceptual change among them. Instead of those aspects, students develop different ways of thinking by means of extended, focused mental effort. Therefore, it fosters students' aptitude to construct new knowledge as active learners. Research found that students who experience active learning usually exhibit greater knowledge and understanding of course content (Chickering & Gamson, 1987; Ruiz-Primo, Briggs, Iverson, Talbot & Shepard, 2011). Those are the current requirements in the education system to address the global challenges effectively. To fulfil the requirements mentioned above, teachers must develop and strengthen their knowledge and skills related to active learning, based on the theory of Constructivism. Then they can provide opportunities for the students and guide them to learn actively. Presently, many teachers in our schools are aware of the importance of active learning and its efficacy but they do not know what exactly active learning is or how to incorporate it into their teaching-learning process. Therefore, exploring prospective science teachers' understanding of active learning and to what extent the pre-service teacher education programme will build up the knowledge and skills related to active learning is a timely need.

At present, in the school system; pre-service science trained teachers need to have a thorough understanding of the learner-centered pedagogical aspects related to teaching and learning science. Therefore, it will be necessary for prospective science teachers to develop their understanding of the active learning to face the challenges in the future, both in the classroom and in society. This study

seeks to provide an overview of the current state of active learning by investigating the theoretical understanding of the concept in pre-service teacher education. It aims to strengthen and deepen prospective teachers' understanding of the current state of knowledge about the conceptual use of active learning and to provide theoretical and methodological directions for future research. Hence, it will be beneficial for the advancement of science teaching-learning process in the school system throughout the island. It can be observed that many research studies have been carried out globally on active learning, while none of these studies have focused on pre-service teacher education in Sri Lanka. This research will therefore shed new light on field of teaching and learning science in our schools

### **Research question**

To what extent does the pre-service teacher education programme at the NCoE transform prospective science teachers' understanding of the active learning?

### **Objectives of the study**

- To explore prospective science teachers' conceptual and methodological features and views on active learning.
- To examine what kind of coursework, assistance, and supervision is provided by the National Colleges of Education to develop active learning.
- To find out how far the pre-service teacher education programme is instrumental in changing prospective science teachers' prior understanding of active learning.

## **MATERIALS AND METHODS**

The focus of the research demands qualitative approach, and therefore the research methodology was selected

paying attention to qualitative research tools. The reason behind this was that the implementation of the research was based on finding out prospective science teachers' initial concepts and views on active learning and to which extent they have changed over the time with their involvement in the training course. These changes could be seen in their verbal responses, classroom discourse, interactions with the peers and in presentations and written documents such as lesson plans, and reflective notes. The overall results of the changes should be in their classroom practices. According to Bogdan & Biklen (2007) the descriptive information can be collected when processing a qualitative research method. In addition, Ploeg's (1999) studies confirm its ability to provide complex descriptions about the reality of a given situation. Therefore, it was experienced that qualitative research method would provide opportunities to collect rich data in the natural setting and it is the most appropriate research method to explore the current understanding of the active learning and its impact on transforming the prospective science teachers in this research.

Owing to the large size of the prospective science teachers in the seven National Colleges of Education, this study was narrowed down to Siyane National College of Education. From this population, seventy-seven (77) prospective science teachers (male 15, Female 62) who were recruited for the academic year 2017/2019 were purposively selected for the study. Data was collected from these prospective teachers, using three techniques: the open-ended questionnaire, informal discussions, and written documents. A questionnaire with open-ended questions eliciting prospective teachers' views of the active learning was administered three times during the second year maintaining

scheduled time intervals. Informal discussions were conducted at the beginning of second year when prospective teachers were following the essential components of the pre-service curriculum and syllabi. It focused on prospective teachers' views of selected aspects of active learning. Data was collected from informal discussions again in the middle and at the end of the second year. It was also important to understand the expected competencies which should be developed in the prospective science teachers and how prospective teachers concentrate on active learning in their lesson planning. For this purpose, the following documents were analyzed: Pre-service teacher education curriculum, Science syllabus with teacher materials and learner materials, Education practice syllabus, Science textbooks Grade 6-11, Lesson plans from the sample.

The data was analyzed qualitatively using the method, content analysis. Prospective science teachers' understanding was categorized after thoroughly examining the data gathered from the questionnaire, informal discussions and written documents. More specifically, data was initially examined for patterns and determined the set of codes to categorize data. Then codes were assigned to the data and the codes of similar content together into concepts and appropriate themes were linked and identified. The overall purpose of categorization was to determine the evolving understandings through constant comparison. Results were reported in the order of the data analysis, beginning with the first-order perspective that yields themes of reference.

1. Main features included in the definition.
2. Understandings and views as an instructional approach.
3. Views as a learning approach.

In order to accomplish the objectives of this study it was important to triangulate the findings. Therefore, data gathered from three techniques was triangulated and results were obtained.

## RESULTS AND DISCUSSION

The data from the questionnaire and informal discussions provided credible evidence of the understandings that prospective teachers have when they enter the National Colleges of Education. This evidence shows their former experience, and therefore, these views must be critically examined in order to change them through the course provided by the college. At the beginning, prospective teachers explained active learning in various ways and were unable to give a clear definition. It seemed that at the beginning of the second year, they had difficulty in conceptualizing the overview of active learning. According to their views majority of them learnt science as passive learners in the secondary level classes, and they thought that development of subject matter knowledge through group activities is the essence of active learning. They have engaged in diverse hands-on activities following the instructions given by their teachers. Therefore, they had common misconceptions that "active learning is doing group activities according to the instructions given by the teacher and when preparing activities teachers should give each and every step to complete the task". These ideas are evident of the fact that active learning was not made accessible to prospective teachers during their secondary level science education as students. In Sri Lanka, science textbooks are the main teaching-learning resource for teachers and students in schools. Content of the textbooks mainly focus on diverse activities but most of them do not provide opportunities for constructing new knowledge. Students should complete the

tasks following given instructions. Therefore, there were no phases to stimulate students' brain and increase their learning potential. Teachers strictly follow the syllabus and the textbooks. Most of them follow the traditional didactic teaching without engaging students in simple hands-on activities. A combination of all these facts proves that they did not learn science meaningfully at the secondary level. In addition, at the beginning, nearly 100% of them had the view that active learning makes unnecessary noise in the classroom. It consumes time and directly influences classroom management. These ideas confirm their lack of have proper understanding of active learning. None of them were able to understand the importance of minds-on activities. Lesson plans written by prospective teachers showed that at the beginning of the second year all of them (100%) focused on activity based, learner-centred lessons in their teaching-learning process rather than the basic features of active learning. They planned different hands-on activities including each and every step and there was no scope for mental activities. The term active learning implies both physical and mental activities. Therefore, hands-on activities are not adequate for the students, and they must also have minds-on experiences to learn actively. According to this evidence they did not seem aware of how active learning can be applied to their teaching-learning process in the real classroom setting.

At present, what is expected in the classroom is that teachers should facilitate students' construction of new concepts by themselves through their models. Teachers who do not have adequate understanding of active learning are less equipped to facilitate students to construct these concepts. Therefore, teaching-learning recommended to be used in today's classroom can directly

conflict with prospective science teachers' presently conceived perceptions of active learning. Therefore, it is essential to build a new kind of professionalism and new competencies among the prospective science teachers in general. It is teaching for creativity, curiosity, critical thinking and helping them to realize their full potential instead of students being passive consumers of information. However, it is assumed that the goal mentioned above could be attained through pre-service teacher education and, it is the best way to prepare effective teachers not only for today but also for tomorrow.

Pre-service teacher education curriculum allowed prospective teachers to engage in interactive experiences in four broad areas: Professional subject area, Special subject area, General subject area and Co-curricular activities. It provides frequent opportunities throughout the programme for prospective science teachers to develop their knowledge of active learning and avoid the misconceptions. When they follow the pre-service science syllabus engaging specially in learner-centred teaching-learning methodologies, laboratory work, field trips and classroom practices they experience active learning. As a result, a gradual development in their understanding of active learning could be seen but there were no significant changes in the middle of second year. Continuation of course work, making prospective science teachers obtain good knowledge, better understanding and practicalities on active learning showed a gradual transformation in their understanding.

At the end of the second year, responses from the sample illustrated the comprehensive knowledge they have acquired throughout the pre-service teacher education. Majority of prospective teachers realized the concept of active learning and the significance of hands-on activities as well as minds-on activities. Therefore, they agreed that hands-on

activities are not enough for the students to learn meaningfully. It seemed that they comprehend what should happen in active learning and how teachers can facilitate students' active learning process by creating a conducive classroom environment. They experienced how they can incorporate minds on activities when preparing hands-on activities and how students are both physically and mentally active when engaged in these activities. Further, they acquired the knowledge that active learning is a co-operative work and students play a more active role in the classroom, taking responsibility of their own learning. Teachers should facilitate students' construction of new knowledge of the related concept on the basis of prior knowledge and experience they have. It should encourage the thinking ability of the students. Therefore, active learning contrasts to traditional modes of instruction and are more effective than traditional didactic instructional process. Lesson plans written by prospective teachers showed visible changes in the activities. Majority of them created relevant activities without providing each and every step and directing students towards mental processes. According to this evidence, majority of them seem aware of how active learning might apply to their teaching-learning process in the real classroom setting. It seemed that at the end of second year prospective teachers valued their own knowledge and skill development and built positive attitudes towards active learning. They recognized the need for expert knowledge based on active learning before attempting to construct their lessons. This proves that prospective teachers' initial understanding of active learning inclined to change at this point. Although many efforts have been made to equip prospective science teachers with active learning, unfortunately, even after two years, desired objectives have not been achieved to the expected level. It urges the

researcher to investigate impacts which hinder the expected transformation.

## **CONCLUSIONS AND RECOMMENDATIONS**

The findings of this study indicate that initially, prospective science teachers did not have a clear understanding of the active learning. Their views on the active learning were vague. They had difficulty in conceptualizing the overview of the active learning. Therefore, they had common misconceptions on active learning. Even after six months, during second year, the significant exceptional change could not be seen except for a few shifts in prospective teachers' view of the active learning. At the end of the two-year institutional training period (end of second year) their responses illustrated the comprehensive knowledge and experience they have acquired throughout the pre-service education programme. Nearly 100% of them believed "active learning as an activity-based process which students activate physically" at the beginning of their training, yet towards the end of the programme they experienced it as "a process which activates students physically and mentally". Finally, it could be concluded that changing prospective teacher understanding of active learning should and can occur during their pre-service education period. Pre-service teacher education curriculum was structured to provide opportunities and expose prospective teachers to face this challenge of teaching more effectively. The procedures employed and explicit instruction given during the pre-service teacher education programme facilitated prospective teachers to develop their understandings and application of active learning in the real classroom setting. It is recommended that pre-service teacher education programme needs to provide more opportunities to help

prospective teachers acquire exact perceptions of the active learning and experience it meaningfully in the real classroom setting. Lecturers who implement the science curriculum need to be prepared with activities designed specifically to provide the experience of active learning. In addition, a thorough investigation is necessary to look into the challenges and then propose appropriate remedial measures with a view to developing active learning in pre-service teacher education programmes in Sri Lanka. In the same manner, especially National Colleges of Education as apex bodies of pre-service teacher education now need to seek new constructive paths to instructional methods and relevance of curriculum. Then, it could achieve the target of developing a competent teacher who can cater to the demands of the future.

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## Implementation of Collaborative Language Learning for Tertiary Level Students in the ESL Classroom in Sri Lanka.

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### ABSTRACT

This study aims to analyze the effectiveness of implementing collaborative language learning for the tertiary level students in the ESL (English as a Second Language) classroom in the Sri Lankan University context. The researchers conducted an action research and convenient sampling was used to select the sample group of the research. Thus, 50 second-year students were selected from the Department of Fine Arts, University of Kelaniya. The research participants were divided into control and experimental groups and were given a pre-test. The pre-test was followed by a treatment period. The treatment period was three weeks long. During this period both the control and the experimental groups were instructed to conduct a mini-research on Costume Analysis and Camera Movements of the movie "Shakespeare in Love" and to present it at the end of the three weeks. The control group completed this task individually while the experimental group completed it in small groups. After the treatment period, a post-test was conducted. The observations during the treatment period and the scores of the pre and post-tests were analyzed. The qualitative data were analyzed through thematic analysis while the quantitative data were analyzed using Minitab. The results of this study revealed that there was a positive and significant improvement in the scores of both the experimental group and the control group. Yet, the experimental group who worked collaboratively outperformed those who were in the control group. Moreover, the qualitative analysis suggests that collaborative working strategy works as a motivational tool, anxiety reducer and it promotes in-class interactions which are essential for the development of communicative language. Thus, the researcher suggests the learning sessions should be integrated with both individual and collaborative learning strategies.

## INTRODUCTION

The traditional lecture hall is designed to facilitate passive information flow from lecturer to undergraduate. Collaborative learning takes a different approach, emphasizing student-centered learning. According to Jhonson & Jhonson (1999), Collaborative learning (CL) is a set of teaching and learning practices that encourage students to work together in small groups to maximize their own and each other's learning. Thus, the collaborative learning strategy is mainly used to benefit the students by having students learn from their peers. Yet, at present, due to time constraints, teachers and lecturers find it difficult to implement collaborative learning strategies in the classroom. Yet, many research studies, have proven that collaborative learning is more effective when compared with individual learning. According to Deutsch (1949), collaborative learning led to positive interdependence in the classroom while individual learning made the classroom more competitive, and it finally led the whole classroom to negative interdependence. He also states that peers are considered as a resource in cooperative learning, and interactions between members are valued because each member's success depends on the success of others. Peers who have negative interdependence regard one other as rivals. Moreover, numerous assertions have been made that small group interactions in the classroom for language acquisition lessen reliance on teachers and improve the learner's ability to participate successfully in conversation. Further, Hedge (2002) claims that one of the fundamental goals of communicative language instruction is to assist students to develop their capacity to participate effectively in conversations, and collaborative learning strategies aid in this development. This supports the implementation of a collaborative learning

strategy in the ESL classroom because it will develop the student's communicative abilities as well as the competencies.

Thus, this study aims to investigate how collaborative learning strategy and individual learning strategy affect the performance of the tertiary level students in the ESL classroom in the Sri Lankan context. Even though there are several researches on the effectiveness of collaborative learning, none have been done in the Sri Lankan University context.

## MATERIALS AND METHODS

### Informed consent form

With the prior notice to the Head of the department, a consent form was distributed among undergraduates which was to be filled by themselves after informing them about the study.

### Handouts

Handouts were prepared to give the basic knowledge for the students, which would help them to understand the key terminologies under the topic "Costume analysis and Camera movements". 50 copies of the handout were used during the treatment period.

### Pre-test and post-test papers

A pre-test and post-test were held to collect data for the study. The pre-test was conducted to examine the present knowledge of the undergraduates on the targeted topic while the post-test was conducted to see the progress of the students. Both the pre-test and the post-test included 30 questions where 10 questions were multiple-choice questions, 15 questions were short answer questions, and 5 questions were long answer questions.

### **Minitab Software**

The collected data of the research were analyzed using the Minitab Statistical Analysis Software because this study will be using the quantitative approach and it will be dealing with statistical data.

### **Procedure**

For this study, both quantitative and qualitative approaches (mix method) are used. The quantitative approach is used as the study deals with numerical data, which are the test scores of the participants. In addition, Babbie (2010) states that the goal of using Minitab Statistical Analysis Software to conduct a quantitative research study is to determine the relationship between an independent variable and other dependent or outcome variables within a population. Thus, this study aims at analyzing how the scores of the students, which is the dependent variable, change when using the collaborative learning method and the individual method of learning, which are the independent variables of the study.

Moreover, a qualitative approach is used to analyze the researcher's observations during the treatment period, especially during the participant presentations. All the observations were recorded in a booklet and finally taken into consideration in the process of data analysis. Thematic analysis was used to analyze the qualitative data (observations) of the research.

The research process started with the selection of the sample. As the sample of the study, 50 second-year undergraduates who are studying Bachelor of Film and Television Studies at the University of Kelaniya were selected. Convenient sampling was employed for the selection process. Then the participants were informed about the study and their role throughout the study because according to Govil (2013), the participants of the study should have prior knowledge of the work expected from them. The selected second-

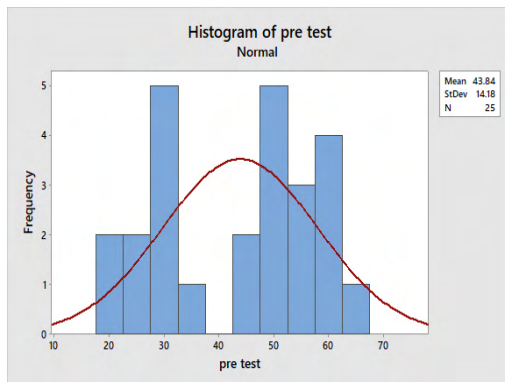
year students were given a test compiled from the Michigan English Test to evaluate their level of proficiency to consolidate that no significant difference existed between the undergraduates. Then the sample was divided into two groups as the control group and the experimental group. A pretest was then conducted to check to examine if the learners had any previous knowledge of the target lesson topic. For the pre-test paper, 30 questions were included. Out of the 30 questions, 10 questions were multiple-choice questions, 15 questions were short answer questions, and 5 questions were long answer questions where they had to answer in 4-5 lines. After the pre-test, the marks were collected, and the treatment period was initiated. During the treatment period, both the control group and the experimental group were given the handouts on *"Costume analysis and Camera movements"* and were explained the basic terminologies. Then the participants in the control group were asked to collect details about the costumes and camera movements of the movie *"Shakespeare in Love"* individually and do a poster or an oral presentation of the topic while the same instructions were given to the participants of the experimental group, but they were asked to do it in groups collaboratively. The participants were allowed to prepare the presentations and search for details only at the in-class time. This treatment period was 3 weeks long. During the week, 4 hours long sessions were taken as in-class time at the Computer Lab of the Faculty of the Humanities, University of Kelaniya. Meanwhile, the researcher observed the participants closely throughout the treatment period, especially while the participants were presenting the final presentations. The significant observations were noted down. Then after the participants presented their presentations, they were given a post-test. Then, the collected data were analyzed

using Minitab Statistical Analysis Software while the observation notes taken by the researcher were analyzed using the thematic analysis.

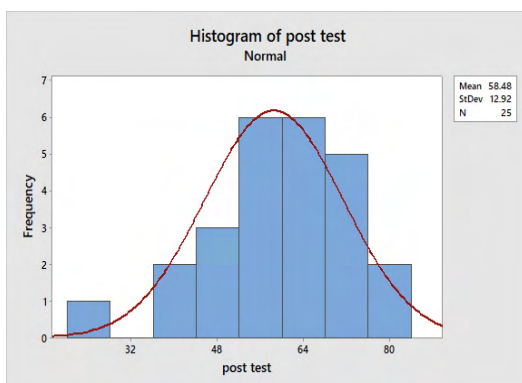
## RESULTS AND DISCUSSION

As mentioned in the above section, a pre-test and a post-test were conducted for both the control group and the experimental group. For each the pre-test and the post-test, marks were given out of 100. Then the marks were collected and entered into the Minitab Statistical Analysis Software and subjected to analysis.

**Figure 1.** Pre-test control group



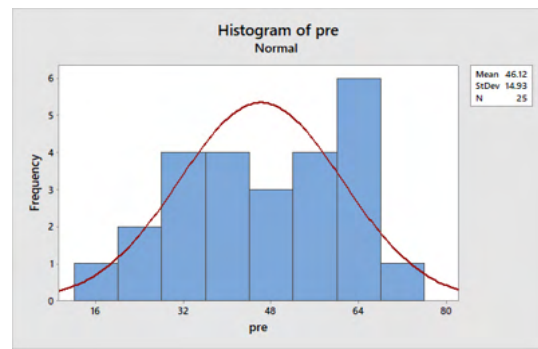
**Figure 2.** Post-test control group



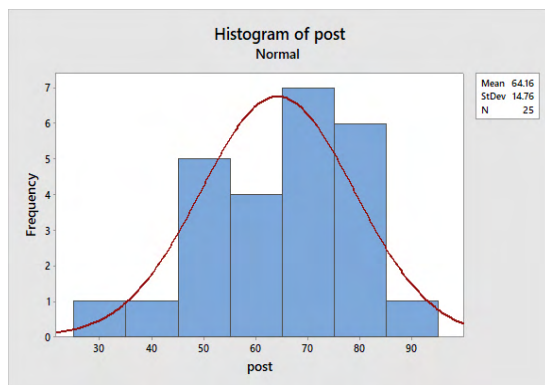
The above two histograms (Figure 01 & Figure 02) show the distribution of the pre-test and the post-test marks of the control group.

The mean of the pre-test is 43.84 and the distribution is right-skewed. On the other hand, the mean of the post-test is 58.48 and the distribution of the post-test is also right-skewed. Although both the distributions are right-skewed, comparatively, the graph of the post-test is skewed significantly to right than of the pre-test. Hence it is clear that the individual activities that have been used during the treatment period are effective.

**Figure 3.** Pre-test experimental group



**Figure 4.** Post-test experimental group



The above two histograms (figure 03 & figure 04) show the distribution of the pre-test and the post-test marks of the experimental group.

The mean of the pre-test is 46.12 and the distribution is right-skewed while the mean of the post-test is 64.16 and the distribution of the post-test is also right-

skewed. Even though the distributions are right-skewed, the graph of the post-test is skewed significantly to right than of the pre-test. Thus, it is evident, that the collaborative activities that have been used during the treatment period have had a positive impact on the performance of the undergraduates of the experimental group.

As both the post-tests show an improvement in test scores to be specific with these two improvements, the significant difference of the post-test and the pre-test of the control group and the experimental group was taken into consideration.

**Table 1.** T-test of the pre & post-tests of the experimental group and the controlled group.

		Mean	SD	Sig. (2-tailed)
Pair 1	Total experimental pre_test vs Total experiment post_test	-18.04	13.39	0.002
Pair 2	Total control pre_test – vsTotal control post _test	-14.64	17.76	0.049

According to Table 1, a paired sample t-test was conducted to the control group to compare the significant difference between the pre and post-tests (*Pair 02*). The p-value of the above comparison is (0.0493) and it is less than 0.05. Hence there is a significant difference between the pre and post-tests scores. Consequently, the paired sample t-test was conducted to the experiment group (*Pair 01*) to compare the significant difference between the pre and post-tests.

The p-value of the pre and post-test comparison is (0.02) and it is also less than 0.05. Hence it is evident that, there is a significant difference between the pre and post-test scores of the experimental group. According to the above description, both the experimental group and the control group show a significant improvement in the test scores. Further, the significant difference values of the control group and the experimental group are (0.493) and (0.002) respectively. Thus, as the significant value of the experimental group is lesser than the control it is evident that, comparatively, the experimental group has a significant development in the test scores and the experimental group has outperformed the control group.

When analyzing the observations of the study, many important facts were noticed. The observations were analyzed through thematic analysis as follows.

### Motivation

During the in-class time, the majority of the participants in the control group had high motivation levels in the first few sessions but towards the last sessions, there was a significant drop in their motivation levels. At first, the participants in the control group were taking down notes, reading articles, watching video tutorials and were actively asking questions from the lecturers. Yet, towards the end, the speed of their work decreased and most of the time they were distracted. On the other hand, the motivation levels of the experimental group were low during the first week. During that week, the students were reluctant to communicate with other group members and most of the time they were trying to do their individual duty towards their group. Yet, from the second week onwards there was a huge boost in their motivation levels. This was observed by the researcher during the treatment period. The interaction between the group members

increased considerably and they were trying to help each other in the group. Moreover, all the groups were very competitive and interaction took place among groups to get updates about the progress of the group work. Thus, Ibrhim (2015) stated, the main reason for this is being around with other people gives a sudden energy that instantly revives the dull senses.

### **Real time interactions**

In the experimental group, it was observed that the participants were actively interacting within the group as well as among the groups while in the control group the interactions were rarely observed. Most of the interactions took place between the participant and the lecturer. Confirming this fact, Deutsch (1949) states that in a competitive setting, students desired less group interaction to avoid giving an advantage to rivals. Further it was observed that the participants of the control group were highly depending on the lecturer while less dependency was noted in the experimental group. When a problem arises within a group, the participants of the experimental group tried their best to solve it by discussing it with each other. Most of the time, they were successful in solving their issues on their own.

### **Task achievement**

All the participants of the experimental group and the controlled group selected to do an oral presentation. In the experimental group, the PowerPoint presentation included a variety of information on the given topic. That was one of the most significant observations noted during the study. The participants of the control group also successfully completed their tasks but compared to the experimental group the majority has gone to in-depth analysis on the given topic. Emphasizing this fact, some authors state that, students will be encouraged to be

objective and democratic when working in groups. He further states that this is opposed when working alone as they do not have a chance to exchange ideas, the ideas generated will be limited in thought and creativity.

### **Anxiety**

While doing the oral presentation it was noted that the participants of the control group were comparatively anxious than those who were in the experimental group. Thus, at some points, the anxiety led the participants to do certain mistakes when presenting. Additionally, the researcher observed some participants were stammering, breaking nails and gently tapping the floor while the hands of some participants were shaking while doing the presentation. Further, there were some participants who forgot their lines and could not perform well because they were too nervous and confused. Confirming this fact Kagan (1977) points out that, when working alone, the responsibility of completing a task and the risk of facing any form of embarrassment due to a mistake is high. Thus, this might cause high anxiety levels in the participants.

## **CONCLUSIONS**

The analysis of the data proves that collaborative learning is more effective when compared to individual learning (Competitive Learning) although both the experimental group and the control group show a significant progress in the test scores. As there is a progress in both the groups, it was concluded that by using both methods students can improve their learning. Supporting this argument, Davee and Baker (2007) have introduced the "Cooperation-competition" model and they defined it as "an instruction strategy combining components of cooperative learning with the positive aspects of motivational competition through inter-

group competition between collaborative teams". Thus, this emphasizes that the learning sessions should be integrated with both individual and collaborative learning strategies. Further through the analysis, it can be concluded that collaborative working strategy works as a motivational tool, anxiety reducer and that it promotes in-class interactions which are essential for the development of communicative language.

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## Undergraduates' Future with Virtual Learning Platform: A Legal Analysis in Sri Lanka.

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### ABSTRACT

Advancing the fulfillment of the right to education for all is one of the major challenges today. Millions of children and undergraduates worldwide remain out of school and universities are deficient in educational opportunities as a result of many economic, social and cultural barriers, as well as lack of quality education conditions. Sri Lanka has had the traditional method of teaching in person for decades until Covid 19 pandemic changed the circumstances drastically as virtual learning platforms came in to force after March 2020. As stated in the Global Education Agenda in 2030 by UNESCO it introduced print-based learning, one-way broadcasting like television and radio programs, or social media and learning platforms via web which conducts distance learning and study skills that must be supported by way of new teaching, learning and guidance strategies. Therefore, the problem addressed in this research paper is, the impact of Covid-19 on Sri Lankan undergraduates' equal educational rights and future challenges. For this study, information was gathered through qualitative and quantitative tools by conducting online surveys among 50 undergraduates. Documentary analysis and thematic analysis methods were mainly used to analyze the data and suggest solutions for online theoretical education. Analysis unveiled the violations of educational rights of the undergraduates under the virtual learning platform and the long-term impact on future employment. Finally, the research concludes providing possible recommendations to protect the educational rights of undergraduates in Sri Lanka.

## INTRODUCTION

Many years before education focused on the holistic development of human nature and the spiritual, moral, social, cultural and economic progress of the community. It should also include respect for human rights and fundamental freedoms and within the framework of these values, should be attached to the benefaction of education to peace, understanding, tolerance, and friendship among nations and racial and religious groups. Therefore, in 1948 education was recognized internationally for the first time as a human right through Universal Declaration of Human Rights (UDHR) in Article 26 (1) which states that, "Everyone has the right to education" (United Nations).

Further, free, and compulsory education system was introduced to Sri Lanka during the Dutch Colonial period. Under the Universities Act of 1978, Sri Lankan higher education system was established and the University Grants Commission (UGC) was created to plan, coordinate the state university education and maintain academic standards. Though their goal was to increase equitable access to higher education system and to develop undergraduates' skills and knowledge required as 21<sup>st</sup> century citizens covid-19 pandemic had a detrimental effect on these plans. According to 2030 agenda of Sustainable Development Goal, providing education was one of their goals but because of this current pandemic education was limited to distance learning (UNESCO, 2020). Unfortunately, in reality, virtual learning platforms affected the equal education rights of undergraduates and projected their future into immeasurable risk. These long-term effects should prompt the Sri Lankan government to strengthen the foundation of the right to education and to take a fresh start by taking advantage of the advances in technology which must be

implemented systematically in the higher education sector.

In this study a survey was conducted among 50 students at University of Colombo, General Sir John Kotelawala Defense University, University of Kelaniya, University of Moratuwa, University of Sri Jayawardanapura and Sri Lanka Law College. Among the above mentioned universities, 37.3% of undergraduates study in first year and final year. Currently the majority of students participates in lectures via zoom (92.2%), and 5.9% through MS Teams. Apart from that, a considerable number of undergraduates has no idea whether this virtual learning platform is more helpful for their higher education or not, while 26.3% of students equally say Yes and No to distance learning method of education. Therefore, this research expects to provide solutions to mitigate the negative impact of covid-19 has on undergraduates' equal education rights and future challenges in Sri Lanka. Though, this research focusses on undergraduates' educational transformation, there are few limitations.

### Objectives

- To identify the current legal frameworks regarding educational rights of undergraduates in Sri Lanka.
- To investigate the principal issues faced by undergraduates during the Covid-19 period in Sri Lanka.
- To compare the advantages and disadvantages of virtual learning platform in Sri Lankan educational system.

### Significance of the study

In "The Impact of COVID-19 Pandemic on Education System in Developing Countries: A Review" by Tadesse, S. and Muluye, W. (2020) show the impact of coronavirus on children, students, teachers and parents in relation to the

educational system and challenges of online learning . During this period, theories which help students make sense of the world and can help to navigate the questions that arise from sudden changes by providing a roadmap for them to get the most outcome from this period (Hart, C., 2020). According to the “Guidelines to Strengthen the Right to Education in National Frameworks” right to education cannot be achieved without strong national legal and policy frameworks (UNESCO, 2021).

## **MATERIALS AND METHODS**

### **Participants**

In this study, data was collected from fifty respondents who were studying at different universities in Sri Lanka. There were, 27.5% male undergraduates and 72.5% female undergraduates. The age of the respondents ranged from 20 to 30 years.

### **Data**

The first part is regarding the age group, gender, university name, academic year and current studying method. The second part focuses on three factors namely, transformative learning theory, experiential learning and self-determination theory (Hart, C., 2020). Only Sri Lankan undergraduates participated in the online survey. Out of the 10 questions, the last three questions required the undergraduates to explain the advantages, disadvantages and experiences of virtual learning platforms..

### **Design**

The work used a thematic analysis while finding out the undergraduates' experience, views and opinions regarding virtual learning platforms. However, the given details can be biased on their knowledge and experiences.

## **Procedure**

The respondents were selected from several universities based on their degree. Respondents were well informed regarding the objective of this research and the data collection method. The given information was gathered via an online survey. Apart from that many other legislative enactments related to educational rights are referred to as primary sources. And for a successful outcome, journal articles, online articles, theses and books were used as secondary sources. This research paper will fill the gaps in research regarding the provision of equal education rights and protecting the future of undergraduates by implementing the laws with the current pandemic.

## **RESULTS AND DISCUSSION**

### **Legal frameworks regarding educational rights of undergraduates in Sri Lanka**

International framework for the right to education cannot be accomplished without strong national legal and policy frameworks that lay the foundation and conditions for the delivery and sustainability of free, inclusive, equitable and quality education. Such frameworks can provide the continuity of education and learning during times of crises. In 1960 United Nation Educational, Scientific and Cultural Organization (UNESCO) adopted Convention Against Discrimination in Education (CADE) which has the duty not only to prescribe any form of discrimination in education but also to promote equality of opportunity and treatment for all in education as per Article 4 (CADE, 1960). In addition, Article 28 (1) (b) of Convention on the Rights of the Child (CRC) “Encourage the development of different forms of secondary education, including general and vocational education, make them available and accessible to every child, and

take appropriate measures such as the introduction of free education and offering financial assistance in case of need” and provide it accessible for higher education for all (CRC, 1990). Apart from the above legal frameworks, International Covenant on Economic, Social and Cultural Rights (ICESCR, 1976), Convention on the Rights of Persons with Disabilities (CRPD, 2008) and Global Convention on the Recognition of Qualifications concerning Higher Education (GCRQHE, 2019) provide equitable access to quality higher education and support lifelong learning opportunities for all in above conventions provisions. In 1978, Constitution of the Democratic Socialist Republic of Sri Lanka provides several fundamental rights under chapter 3 of the constitution but educational rights were not mentioned directly. As per the Article 27(2) (h) of The Directive Principles of State Policy and the Fundamental Duties is the main provision which provides the right to education and states that, “The complete eradication of illiteracy and the assurance to all persons of the right to universal and equal access to education at all levels”. This article relates to Article 12(1), 12(4) and 17 under Fundamental rights chapter and Article 21 (3) declares that in this article the word “University” means any institution of higher education. However, the Constitution does not mention any infringement regarding education rights of the undergraduate in Sri Lanka.

### **Principal issues faced by undergraduates during Covid-19 Pandemic**

In UDHR, Article 26 states that technical and professional education should be available in higher education and there should be equal access to everyone. According to the Article 29 of the 1978 Constitution, “The provisions of chapter 6 do not impose legal rights or obligations, and are not enforceable in any court or tribunal. Further, no question of

inconsistency with such provisions shall be raised in any court or tribunal”. Therefore, questions arise whether the educational rights of undergraduates were violated during this pandemic, to whom they can report of such infringement or how they can be compensated. .

Though, education plays a vital role in undergraduates’ life, this was totally changed during this pandemic period in 2020 forcing all the educational institutes to adopt online learning methods (Tadesse, S. & Muluye, W., 2020). Currently higher education is conducted through Zoom, Microsoft Teams and other distance learning platforms. When conducting educational activities online 70.6% of undergraduates faced lack of network coverage and accessibility issues due to the poor internet connections as per the survey. However, this connectivity issue creates inequity among undergraduates when they engage in team activities, listen to lectures, attend practical sessions and examinations. According to Rameez et al (2020) “It was inappropriate on the part of teachers and administrators to expect the students to come on board while they were facing challenges of this nature under a health calamity of unprecedented and disproportionate dimension”.

Apart from these, broad economic downturn will be the main challenge for undergraduates during this Covid-19 pandemic. Data from the survey of this study shows that 7.8% of students faced financial problems when adapting to the new normal. Most of the students are less likely to have the resources such as PCs, high speed internet access and e-library facilities. Furthermore, some of the study materials cannot be referred for free or some study guides cannot be found online. Such inadequacies could lead to inequitable scenarios in the education sector.. Therefore, lower- income undergraduates will suffer in terms of equity (Bevins, F., 2020).

Besides, Sri Lanka is a developing country and technology is yet to improve to give maximum facility to all scholars to learn via online (Hayashi, R., 2020). Based on the survey, 15.7% out of 50 undergraduates were facing technical issues. Tadesse's study (2020) points out that, in Ethiopia most of the people live in rural areas with limited or no access to electricity. Moreover, it explains that though there are facilities, without proper monitoring strategies students may use the technology inappropriately. Also, open educational resources, technologies and access to digital tools must be available to teachers and students to achieve successful outcomes in higher education. (UNESCO, 2020).

Another major effect of Covid-19 on undergraduates was the postponement of the regular intake by more than 3 or 4 months and the government was forced to close every educational institution including state universities, state and non-state tertiary education institutions. Such disruption in higher education directly and indirectly effect and raise concerns regarding age when entering the skilled workforce as it reduces the chances of becoming a well experience professional in society (Hayashi, R., Garcia, M., Maddawin, A. & Hewagamage, KP., 2020). Consequently, undergraduates feel insecure about their education and life in the new normal.

### **Advantages and disadvantages of virtual learning platforms in Sri Lankan educational system.**

According to Hart (2020) , Jack Mezirow's transformative learning theory helps to understand the current world which does not correspond to current evidence. This theory helps sudden shift to online learning caused by Covid-19. In comparison to other sectors, Law, Medicine and Engineering undergraduates' rights are infringed with

this virtual learning platform. For example, law students have to complete 6-month period of apprenticeship under the supervision of a senior lawyer, but they are unable to observe the court proceedings due to Social Distancing requirements. However, Australian Rule of Law Education Centre (2020) shows that, by offering free online court experience called "Virtual Law Day Out" for teachers and students in New South Wales can avoid disadvantages of practical sessions to some extent. According to the answers of the undergraduates, virtual learning platforms provide benefits such as time and cost saving and less violations in educational rights of students in this method of learning. Moreover, Australia use virtual learning platforms and they provide reliable network connections to all the citizens. Further, their technology, education and economy are in the highest rank and every person has access to information. They conducted theoretical and practical sessions to their undergraduates without any technical failures. (Rule of Law Education Centre, 2020). Sri Lankan education system was forced into virtual learning platforms in accordance to the transformative learning theory. Currently, higher education system of Sri Lanka gives more weight to practical education (Samarasingha, I., 2020). Among the 50-students 50% took advantage of the online platform such as it provided them with the ability to revise the lectures multiple times at their own pace. . This characteristic may lead a student to follow David Kolb's theory of experiential learning (Hart, C., 2020). Out of 50 students 22% agree with this theory because they need to learn beyond the structured lessons and do their own experiments which help maximize their knowledge. For that purpose, self-determination theory will be helpful for more effective learning with the others during this pandemic (Hart, C., 2020). The main advantage of virtual learning

platform is keeping one safe and healthy and all the respondents unanimously agreed to that point.

In the Global Education 2030 Agenda UNESCO, states their aims as: "Education shall be promoted understanding, tolerance and friendship among all and enable all persons to participate effectively in a free society" (UNESCO, 2021). However, respondents claim that virtual learning platform is not suitable for certain courses such as sports, nursing, laboratories, music, dancing and art courses. Further, online learning is challenging for undergraduates when facing examinations due to poor internet access. Also, lecturers face several inconveniences while conducting examinations online (Tadesse, S., 2020). According to Son's study, 71% of respondents had increased levels of stress and anxiety due to the Covid-19 pandemic and some of them used mental health counseling services. The main reason for this anxiety is the types of distractions while engaged in studies. Distractive environment, interruptions from family members, household chores and social media affect undergraduates' focus on their academic work (Son, C., 2020). Moreover, lack of outdoor activities such as sports, organizational works, volunteer activities and social gatherings affected the mental health of the undergraduates. This study also discovered that virtual learning platforms make undergraduates depressed due to the heavy work load given by the lecturers. Further, a minority of respondents indicated that, their sleeping patterns were disrupted as a result of changes in the usual lecture timetable. 80% of students claim that virtual learning platform will make low productivity when they are engage in real life activities. Themajority of undergraduates indicated negative impacts of Covid-19 on academic and non-academic activities, health and issues related to lifestyle.

## **CONCLUSIONS AND RECOMMENDATIONS**

### **Conclusions**

Covid-19 pandemic has been a great teacher to the whole world and introduced e-learning, work from home (WFH ) concept and etc. This research paper presented solutions to several challenges undergraduate face during the Covid-19 pandemic.

In conclusion, findings of this research expect to introduce the practical learning guidelines to higher education system and highlight that the existing laws for the right to education in Sri Lanka need to be adapted and amended according to the new normal. Such actions could ensure that every student gets equal educational rights including other rights which help maintain law and order peace in society.

### **Recommendation**

On virtual learning platform, lecturers should be creative and should find effective and modern methods to deliver lectures (Yusnilita, N., 2020). According to Miao, F. secondary education in Sri Lanka introduced many options to do their studies through online distance learning, television based distance learning, radio based distance learning and print based distance learning (UNESCO, 2020). By introducing many options for higher education system, it will be possible to reduce the disturbances of network and many other issues. For instance, lecturers can make interesting videos elated to the subject area and conduct lectures without explaining the presentation. Course work, duration of the course, assessment criteria and internship criteria should be adapted according to the new educational system and the need of various employer s (U.S. Department of Education, 2012). As per this recommendation university administration should identify the

significant needs of the world and re-design all course content.. Apart from that, using more group assignments for undergraduate will help them to build and maintain good academic relationships with their colleagues and improve leadership skills. Also, it will help undergraduates reduce stress and anxiety. Further it will lead undergraduates to perform well and achieve their goals easily while learning online.

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ADVANCEMENTS IN SCIENCES & HUMANITIES

## The Perceptions of University Students on Virtual Learning during Covid-19 Pandemic

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### ABSTRACT

The current technological developments permit engagement of numerous ways to design online content. It is crucial to consider the favorites and perceptions of learners while designing the online developments to make the learning effective and efficient. Preference of the learner is related to the readiness or preparedness of the student to take part in two-way learning and the causes prompting the readiness for virtual learning. The term 'perception' in this study highlights various views and concerns of university students on online learning. Hence, the objective of this study is to investigate the perception on e-learning among university students in Sri Lanka using both undergraduate and Postgraduate students from the Sabaragamuwa University of Sri Lanka (SUSL). Primary data were gathered by distributing a well-structured questionnaire which comprised both open-ended and closed-ended questions. Around 175 questionnaires were sent to both undergraduate students and postgraduate students who are following various courses in SUSL with the help of email and social media platforms and gathered 125 responses that can be used for this study. Convenience sampling techniques have been used to select the sample and gathered data have been analyzed qualitatively following thematic analysis. As the result different perspectives on online learning have been investigated and presented descriptively. This study is relevant for the academics as it facilitates them in gaining an understanding of the university students' opinions towards online learning in this pandemic situation. Recommended strategies will also be beneficial for academics to make the online sessions effective and interactive.

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## INTRODUCTION

With the global spread of the Covid-19 virus, educational institutions have been intentionally closed in order to safeguard their pupils from any viral exposures in a highly socialized student population. Lockdown and social distance are the only ways to halt the development of COVID-19 by interrupting the transmission chain. The closing of educational institutions has had an intellectual and psychological impact on a huge number of pupils (Al-Nofaie, 2020).

In a framework where schools and colleges are closed indefinitely, educational institutions are looking for ways for students to complete their studies in line with the Institute's academic calendar. COVID-19 has been a catalyst for educational institutions all around the world to embrace innovative techniques in a short period. (Dubey, 2021).

Many academic teams have shifted to online mode at this period, using Microsoft Teams, Zooms, or other online platforms (Hayashi et al., 2020). It is crucial to highlight that educational institutions in impacted regions are looking for ways to overcome barriers in order to continue teaching, but the quality of learning is dependent on the amount and efficiency of digital access. In terms of student motivation, enjoyment, and interaction, the online learning environment differs greatly from the traditional classroom setting. Learning effectiveness is determined by how the information interacts with the online environment, as well as by recognizing the hurdles that students' experiences (Haththotuwa & Rupasinghe, 2021). This study is important since the online education system has never been done on this size before, and it is similar to a large social experiment. First, an unprecedented lockdown of COVID-19 administration resulted in a hasty transfer to the online

system, leaving institutions with a limited time to design and implement online course content. Students' learning and experiences may be blended into this environment to make online learning easier, more efficient, and successful (Hidayat, 2020).

Second, even when the lock-in is lifted, life will not be the same in the aftermath of the COVID-19 outbreak, and online learning is here to stay, especially when combined with traditional offline classrooms.

While the length of the pandemic and the likelihood of re-infection remain unknown, social estrangement may become the new normal. As a result, all educational institutions should be prepared to move more course content to an e-learning platform and adjust course structure and curriculum as needed. The findings of our study can be useful in determining the online platform's learning environment in order to encourage successful learning (Sahbaz, 2020).

## MATERIALS AND METHODS

The primary data have been used for the current study. Primary data were gathered by distributing a well-structured questionnaire which comprised both open-ended and closed-ended questions. Around 175 questionnaires were sent to both undergraduate students and postgraduate students who are following various courses in SUSL with the help of email and social media platforms and gathered 125 responses that can be used for this study. Convenience sampling techniques have been used to select the sample and gathered data have been analyzed qualitatively following thematic analysis.

## RESULTS AND DISCUSSION

The results of the data analysis indicated that more than 65% of the students were happy with online education during this

lockdown while 17.3% of them preferred offline learning. Most of the students (70%) preferred to use Zoom for their online education due to the user-friendliness and ease of access.

According to the respondents, "It is good to begin work early, and it helps to manage the day effectively." Normally physical lectures begin around 9 a.m. Online lectures begin at 7.00 a.m. Therefore, it saves time while eliminating the traveling time and cost. Respondents stated that it is possible to have lectures at nighttime which has never been practised before. That is also an advantage of Covid-19 pandemic as perceived by some respondents who possess /have a positive mindset. During the survey, it was revealed that some students advocate/prefer to interact with discussions in online classes. However, they rarely have the chance during some lectures. According to the perception of the postgraduate students, productivity of the lesson could be maintained by directing questions to students at certain intervals during the lesson. It will motivate students to continue their active engagement in online lessons

"Even though we feel bored to participation in the lectures, if the lecturer pays attention to us by calling names, we may be motivated to remain active in the online session." However, some respondents stated that if the lecturers tend to ask questions from the students, then the rate of participation decreases drastically. Due to that reason, some lecturers do not raise questions or pointing out students during online sessions. However, it badly affects students, and some students learn nothing although they remain logged-in the online session. They might be engaged in other tasks during the online delivery.

This study investigated the most effective communication method as perceived by postgraduate students. As per the analysis, posting in university website, Text

message, e-mail, Telegram and WhatsApp are commonly used methods to communicate regarding class updates and sharing the links for the online lectures. This study revealed that WhatsApp is the most effective communication mode to share class updates (82%). However, some respondents stated that email communication is better than communicating via WhatsApp, as email is a mode of formal communication.

However, the general idea of the respondents was that WhatsApp is more user-friendly and it is easy to refer to the WhatsApp groups to have updates. Further, they mentioned that "We are always get in touch with the social media and WhatsApp for our personal communication. As we are always there in the platform, it is convenient to receive messages and class updates so as responding them quickly and easily."

Self-motivation was identified as the most significant factor that motivates university students to online learning. This can be noticed among the postgraduate students at SUSL. The students who have a high motivation towards learning tend to be present at the online session five or six minutes before the commencement of the session.

Some students always join for the session as convenient to them and their joining time does not get noticed.

Therefore, a monitoring mechanism is recommended by the respondents to make online sessions more effective. As per the views of the respondents, time to timeslot assessments will help increasing the participation of the students and respondents identify that as an effective learning technique.

There was a section in the questionnaire to identify the preference of the students on short breaks during online sessions. 85% of the university students preferred a 10-minute break for each one-hour online session. However, the students have

experienced that some lecturers continue the session over three hours without giving a single break during all three hours. As perceived by the students, it reduces the effectiveness even though the lecturers might perceive that to be an efficient strategy. However, they mentioned that some lecturers give 20 – 30 minutes break to take breakfast or lunch. The majority of the students represented in the sample did not agree to such long breaks as it wastes time to be spent in productive learning.

Moreover, most of the respondents felt that there is a problem in obtaining quick responses from lecturers and this might possibly be due to 'Technophobia'. The term "Technophobia" is the fear, dislike, or avoidance of new technology. Technophobia, which is not a formally known mental illness, is the extreme and illogical fear of technology. As respondents I have felt, lecturers are motivated when the students respond quickly. It implies that the students actively listen to the lecturer's delivery.

Self-control is also identified as an important concern related to online learning among university students. Although all the other aspects are designed systematically and strategically, if the students fail to control themselves while learning online, the effort becomes ineffective. The students accepted that they should exercise control over themselves while avoiding social engineering, chatting and other disturbing actions which move their attention from the studies during virtual learning.

## CONCLUSIONS

Due to the corona pandemic, many students have positive attitudes about online education, according to the findings of this study. It is discovered that online learning is conducive to learning since it

offers learners with flexibility and convenience. Students appreciate the well-organized information, which included filmed films that were published to university websites.

It has been suggested that, in order to enhance the learning experience, each class should include interactive sessions with quizzes and assignments at the conclusion of the lesson. Many students, however, stated that online classes are difficult than traditional classrooms because of technological hurdles, delayed answers, and the instructor's failure to adequately handle information and communication technologies.

To make an online course more efficient and successful for the learner, all of these elements should be taken into account. Nearly at the culmination of the COVID-19 pandemic, it could be observed that the educational system is improving, with online platforms being used for academic help, even in a hybrid manner with traditional classrooms. As a result, this research is beneficial for rethinking and redesigning higher education with online components.

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## Defining Determinants of Anxiety Underlying Psychological Impact of Online Testing

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### ABSTRACT

The Covid-19 pandemic exercises an authoritative influence on the global academic milieu, necessitating institutes fully converting their mode of delivery from an in-class construct to a distant learning factor. Similarly, this urgency drives Sri Lankan educators to rethink of the shift in learner assessment as remote electronic testing is a relatively novel experience to the local student body. This study expects to bridge this gap by establishing the stance; as the causative agents of anxiety generating online impact on the psychology of the online test takers are only moderately influential, they can be mitigated through accurate identification and application of qualified mechanisms. The research incorporated a mixed methods design involving undergraduates of the Faculty of Medicine and Allied Sciences, of the Rajarata University, Sri Lanka. Both descriptive analysis and Thematic analysis were used. The questionnaire detailed five divisions of information: anxiety on content and structure of the question paper, anxiety on time management, anxiety on technical issues and computer literacy, anxiety on change of exam atmosphere, and demographics. The question guide of interview delved deep into the above categories. Typing speed, technical failures, change of exam setting, lack of experience, and excessive belief in physical exams were distinguished as the undoubtable causes of anxiety. Pessimism towards the alternative process and inconvenience caused by incidental circumstances propelled aversion towards online testing. The perpetuated exposure to online testing accompanied by remedial measures will breed positive perspectives. The teachers should be more attentive in designing the tasks and implementing the test. More research should be initiated to establish what further variables in online testing environment can catalyze adverse effects on the local student population.

## INTRODUCTION

Infectious Coronavirus which allegedly saw its outbreak towards the end of year 2019 has profoundly taken over the globe in its all nooks and corners surmounting in incidence and mortality rates. Inherent contagiousness by way of spread of respiratory droplets has expedited its conquest across the nations, resulting in direct restrictions being imposed across diverse sectors. Education was threatened from the onset and this phenomenon predicated a shift in pedagogical trends; remote learning or distance e-learning modes which are relatively new, specially, in developing and under-developed countries, were implemented with a vision to open access to an uninterrupted process of learning even amidst the crisis.

Even though videoconferencing, webinars, and blogs had been some of the famous distance learning methods, educational platforms, such as Zoom gained immense popularity as an efficient environment in this totally abrupt pandemic. Despite certain inconveniences when it came to delivery through internet-based mechanisms, theory was taught continuously. The next level of the process was how to organize reliable e-assessment procedures in order to offer diagnostic, formative and summative feedbacks. Online testing was the answer that came forth. On-campus E-exams had been already conducted in a proctored environment. Yet, these online tests are usually faced by the students at their individual home-settings, uncontrolled exam centers. Therefore, the challenges they encounter are specific and varied, ranging from tangible disorders to psychological impacts.

This study aims to investigate causes of anxiety that affect students in online testing. If blended learning is reinforced in Sri Lanka in the future, results of the

current study will propose criteria to make decisions on feasibility of online testing in the Sri Lankan education context. In addition, this study strives to identify pitfalls in online testing in Sri Lanka and take necessary measures in order to divert them in future e-tests.

Researchers currently tend to probe into the strengths and drawbacks of online testing, perspectives of students and teacher population on E-testing. Lina El salem et al. (2020) stressed that remote online tests are more stressful to students and the students are worried about exam duration, modes of questions, technical problems that arise during online exams. Poor behavioral habits are caused due to stress resulted in online testing. Hayashi, R. (2020) emphasized that 90% of undergraduates in Sri Lanka have access to internet, yet, providing laptops and uninterrupted, affordable, high-speed internet access, particularly for students in poor households or remote areas” are identified challenges in terms of online education in Sri Lanka. F. Kharbat (2021) explained that students are not satisfied in an e-proctored exam setting, and it is not a substitution to traditional proctored exam atmosphere. J.M. Arnold (2016) found that there would be a probability to cheat at online formative test; nevertheless, there is no evidence of paying off though students cheat in online tests. B. Boitshwarelo (2017) implied that questions in online tests are not innovative and do not assist students to scale up their cognitive skills. A. Ahmed (2021) reported that internet speed, cost, and authenticity are prevalent challenges in online testing.

## MATERIALS AND METHODS

This research focuses on the psychology impact which is a vast scope, thus, necessitating the researchers deploying a mixed-methods approach to collecting data. The study aimed to scaffold the

existing knowledge deficiency prevalent in the context of online testing in the local literature. In order to excavate which underlying causes impact the students' psychology adversely, their first-hand experiences and resulting opinions of the online testing during the COVID-19 Pandemic were accumulated by implementing a survey for quantitative data and an in-depth interview for qualitative data. The target population was the undergraduates of the Faculty of Medicine and Allied Sciences of the Rajarata University of Sri Lanka. Through Convenience Sampling method, a sample of 321 students was selected. The participants were First Year and Second Year students and they consisted of both males and females.

### **Survey**

For this cross-sectional study, data were basically collected through an online survey. The questionnaire consisted of four major sections with a view to let them converge towards the research topic from different, clear-cut perspectives: anxiety on content and structure of the question paper, anxiety on time management, anxiety on technical issues and computer literacy, anxiety on change of exam atmosphere. The questionnaire also listed demographics for additional assistance in making fundamental decisions in cases of insufficient or contradictory information. The accompanying indicators were age, gender, course, English language proficiency level and computer literacy level. The number of items presented was fourteen, mainly with "Yes/ No" questions while a few questions demanded clarifications where possible. An example item is "were you nagged by the form of the online exams?" The participants received the questionnaire as a Google Form via Email. They were given one week to complete and submit their responses. The data were measured for their percentages.

### **Interview**

Athubaiti (2016) clarified that self-reported data can be affected by bias. Against this backdrop, in order to steal more of insight, more clarifications behind certain answers and similarly, to consolidate findings from the survey, an in-depth interview was conducted with 10 participants who had already participated in the online survey. They were selected through Convenience Sampling and included both males and females. The interview guide consisted of four open-ended questions. A sample item is "Were you o.k. with an un-proctored exam setting which was different from the traditional classroom? Please explain" Interviews were conducted as a Zoom meeting. The interviews were recorded with the participants' consent by three different interviewers at three different settings at the same time. They were transcribed by one interviewer after holding a discussion round to share any complication that had arisen. Thematic Analysis was employed to analyze the data. This was analyzed through careful reading and coding. The coded data were shuffled to appropriately heap them around four major themes:

complications surrounding time management, technical facilities, computer-handling, and common difficulties, influence of exam setting, envisioned mishaps, and comparative psychology. The answers lodged with certain questions were transferred to other questions where possible after identifying correspondence and relativity between them. This facilitated theme-assignment and approach to conclusions. The interview data also could replace some recall biases which were possible in the survey.

## RESULTS AND DISCUSSION

The primary purpose of the research was to probe into causes pertaining to psychological impact of the students taking online testing during the COVID-19 pandemic. A survey and an in-depth interview were conducted as data collection methods for this. 321 participants were recruited for the online survey and 10 students from the same target group were enlisted to speak on their views in the interviews which were also conducted online. Both the questionnaire and the interview consisted of questions which assessed different aspects of psychological impact. The raw data underwent a descriptive analysis and a thematic analysis before the conclusions were deliberated.

### Survey

Among the participants, 54.8% (n=176) and 73.8% (n=237) were not nagged by the difficulty of questions and the form of assessment respectively. Time management issues were reported by 80.7% (n=259) of the participants while 85.5% (n=272) tackled insecurity regarding their typing competence. Nevertheless, notably 77.9% (n=250) had an intermediate computer literacy and 75.7% (n=243) of them were familiar with the learning platforms. Signal reception problems were raised by 67% (n=215) of the respondents. The participants also found problems in speed and data: 67% (n=215) and 31.8% (n=102) respectively. Comparatively, though 80.7% (n=259) said they missed the traditional exam hall, 63.6% (n=204) also agreed that they were comfortable with home setting for testing.

### Interview

In order to cross check and explore the effects of online testing even further an in-depth interview was scheduled with 10 subjects who had already locked their responses in the questionnaire. The

recordings were transcribed and percolated to drain the most relevant details in respect to the research topic. Subsequently the data were passed across thematic analysis in order to code and re-locate under several themes to draw comparisons between them. The first two themes, complications surrounding time management, technical facilities, computer handling, and common difficulties and influence of exam setting were the elements of stress. The question guide included different points of discussion for them but certain responses by the subjects to a specific question seemed to be related with another question too. For instance, S8 said "I was a little anxious about time as it took time for the pages to load" to the question on time management. This refers to technical mishaps too. S1 and S2 said that they were worried about timing only at the beginning. S7 said "I was anxious about timing". For S8 and S10, prolonged time for the pages to load occurred to be a delay factor. For S9, her typing speed caused anxiety over time.

S1 said in respect of her patience for traditional exams, "I feared I would have some technical interruptions, so I would have to re-start doing the exam". Later on, with regard to any difficulties that arose, she said, "I had no such technical issues". S3 said "I was worried about internet connection". S4 spoke of her anxiety about signal failure while S8 said that she was worried as there were connection issues. S9 had had site crashes. Only S6 said that she should improve her IT skills, but she herself mentioned she could manage. S2 and S9 had typing speed concerns.

The subjects found anomalies regarding the new setting: change "inconvenient", missing traditional setting, absence of an invigilator, distraction at home, absence of exam mentality, and lack of familiarity. An unprotected setting was deemed unsuitable by 4 subjects based on the grounds that there was no occasion for

clarification and that there was occasion to cheat.

As of the theme “comparative psychology”, analogous and contrasting comments were evaluated so as to approach the outcome of the subjects’ preference between online testing and physical exams. S1, S3 and S7 said that they liked physical exams the most whereas S4 liked online testing. S5, S6 and S9 saw traditional exams are more practical for higher exams owing to the nature of their course. Envisioned mishaps served as the criteria to gauge the size of effect the causes can continue to bear upon the subjects in case they sit for more online testing. In summary, S2, S3, S8 and S10 said that they would be more confident, and anxiety would be lower next time. S1, S4, S6 and S7 said that they would still worry over time management, technical issues and IT skills.

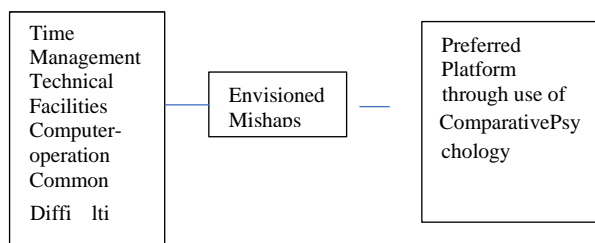
As per survey results, even though the rates of computer literacy and familiarity with learning platforms were deemed high, a sizable amount of respondents had reported anxiety over time management. High percentages were reported in areas such as typing speed, signal reception, internet speed, technical functionality, data and change of exam setting. These were analyzed parallel to anxiety regarding time management for these causes can hinder quick handling of the entire process.

These assumptions/findings were further validated through the results of the interview. As per the calculations, their time management concerns were fueled by fear, technical failures and typing speed. The students’ interest in physical exams was largely built on familiarity and disbelief in the practical aspect of online testing for higher and more difficult exams. This could also be a perspective based on the nature of exams peculiar to the course they are enrolled in. the change of the setting was remarkably characterized by less familiarity, absence

of an invigilator (unprotected), lack of motivation and distractions at home. These matters are inter-related so that it is permissive to judge that absence of an invigilator and disturbance at home can degrade motivation level. The expectation by the subjects that there will be fewer problems, thus lowering anxiety, in the future testing to be held in the online context implies a positive change of attitudes.

As this research utilized convenient sampling method, results could not be generalized to a great extent. Nevertheless, ultimate findings warranted by valid analytical methodology, evidently detect principal constituents that behave as impetus to generate different degrees of anxiety amongst the students in general. The sample, by an unexpected error in methodology, included 16 participants who had not faced any online testing to the date of selection. As every student did not indicate the number of times, he/she had sat for any form of assessment, some rates listed may entail relative discrepancies. Similarly, reasons behind certain yes/no questions were not clearly or fully acknowledged. These unclear corners were attended to through the in-depth interview to a greater extent.

**Figure 1.** Elements of Stress in Online Testing



**Table 1.** Participants' responses in percentage

Categories of opinions of participants	YES	NO
<b>Anxiety on content and structure of the question paper</b>		
Were you nagged by the level of difficulty of the questions that were likely to appear on the paper before exam?	45.2%	54.8%
Were you nagged by the form of the online exam? E.g.: written, oral, open book etc?.	45.2.%	73.8.8%
<b>Anxiety on time management</b>		
Were you partially worried about insufficient completion of your syllabus due to COVID pandemic?	81.92.2%	18.1.1%
Were you worried that you would not be able to manage time during online exams?	77.9.9%	-
Computer literacy	75.7.7%	24.3.3%
Were you skilled in working with educational platforms such as Zoom and MS Teams?		

<b>Anxiety on technical issues and computer literacy</b>		
Did you have interruptions on signal reception?	67.7%	33.3%
Did you have problems with mobile data?	31.8.8%	68.2.2%
Were you concerned that it would take a longer time than you expected to type your answers?	85.5.5%	14.5.5%
Did you have interruptions on speed?	67.7%	33.3%
<b>Change of exam , atmosphere and anxiety</b>		
Were you comfortable in an un proctored exam setting?	32.1.1%	67.9.9%
Did you miss the traditional exam hall?	80.7.7%	19.3.3%
Were you comfortable with the home- environment doing online exams?	63.6.6%	36.4.4%

## CONCLUSIONS

This cross-sectional study analyzed anxiety-driven causes affecting online testing which comes across as a viable decision to scaffold educational access across millions of students in all primary, secondary, and tertiary levels in the immediacy of the COVID crisis. The

consequences as generated by these elements can accrue debilitating effects to impair test performance, thus resulting in less test scores. The study also aimed to measure the size of effect each stimulus could produce in order to identify improvability and approaches to improve. The data collected through an online survey and in-depth interview were assessed by Descriptive Analysis and Thematic Analysis. Thematic Analysis was applied in particular to initiate an inductive approach so that a bottom-up analysis was formed. As per the results, three major stress-agents were found: anxiety on time management, anxiety on technical issues and computer literacy, and anxiety on change of exam atmosphere. Palmer (2007) emphasized the influence of environment over the students. Lawrence, Kinney, O'Connell and Delgado (2017) established that technical issues act as interruptions amongst the test takers. Despite high causality found among the target population, Thematic Analysis could conclude that the latter forms of anxiety were directly correlated with the former; low signal reception, typing speed, internet speed, technical functionality, data and the change of exam setting can delay test performance, thus, igniting a lateral consequence across test scores. Nevertheless, their technical anxieties were imaginary to some extent and when certain technical issues arose in the context, they were mostly accidental. Less familiarity with the entire process of online testing and reinforced beliefs in the mode of physical exams for over thirteen years of school education have driven the participants to disqualify the novel exam setting as improper where their expectations and needs are not met. These conditions can be improved. Widespread internet coverage, low-cost data, Wi-Fi facilities, proctored exams and long-term exposure along with better IT skills can be suggested as applicable measures to rectify the situation. Students will change

their lukewarm attitude if their motivation is uplifted by making subtle remedial changes in the entire process of online testing. Focus should be centered not only on technical facilitation, but also, specially, on persuading the students to adapt to the new trend despite and dislocating apprehensive mental fixtures. It is recommended that the teachers prepare themselves taking the above reasons into consideration. They should be lenient and flexible with the format of the question paper as well as with the format of the exam. Further research should be initiated to recognize the effect of the online exam setting upon the students.

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## Improving Oral Communication Skills Through Online Collaborative Activities

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### ABSTRACT

Pasdunrata National College of Education as a provider of teachers to the system of education, especially English teachers, has an utmost responsibility of moulding them into quality competent teachers. It is of great importance that these teachers are taught to be capable of handling classes with a good command of English. Though Covid 19 pandemic restrained the physical functioning of the college, the skill development of the student teachers has to be incrementally maintained to achieve the aforesaid goal. The objectives of this research were to study the perceptions of the student teachers on the effectiveness of pair work and group work in improving their speaking skills in English, to examine the challenges they faced in adopting online mode in their learning process and to identify the most suitable teaching techniques to improve their communication skills. The research design selected was action research with two cycles. Thus, data were collected through questionnaire with five-point Likert scale questions, open-ended questions, focus group discussions, marks obtained from the pre-test, post-test and notes taken from my own reflective journal. Data thus collected were analysed using Microsoft excel, paired sample t-test and thematic analysis. The results revealed that proper planning and implementation of pair and group work online, employing new techniques, constant practice and constructive feedback greatly influenced student teachers to improve oral communication skills and to promote their confidence.

## **INTRODUCTION**

The whole education system, from elementary to tertiary level, not only in Sri Lanka but also in the entire world, has been affected by Covid 19. due to Covid 19 pandemic since March 2020. Amidst many difficulties online mode was introduced for the continuation of education in Sri Lanka by October 2020. Accordingly, online modes came to play a major role in educating students. Hence, MS Teams was recommended by the ministry of education for conducting lessons for the student teachers of all the National Colleges of Education. However, in addition to the knowledge gaining theoretical component, student teachers must be well equipped with the practical component. Equal time slots were allocated in their timetable in improving four skills of English. Though the lectures were conducted online equal attention had to be heeded on the practical component as well.

Equipping these student teachers with a good command of English is an utmost importance as it enables them in handling the authentic classroom confidently. Since they are studying from home the exposure and the opportunities to use the English language are less and it negatively affects them when they step into the authentic classroom. Therefore, it was decided to plan and implement a number of speaking activities employing pair work and group work in improving oral communication skills of the student teachers online.

## **MATERIALS AND METHODS**

An action research was conducted for 88 student teachers of English of the year 2018/2019 employing the purposive sampling method. This study was conducted to implement speaking

activities online to see whether the same effect can be obtained as in the live classroom. Students were provided with more opportunities through individual, pair and group activities, under the premise that Vygotsky's zone of proximal development theory comes to play since more knowledgeable students keep scaffolding and widening the horizons of the skill ability level of the less knowledgeable students through collaborative activities.

This research of two cycles underwent the steps: planning, implementation, observation and reflection. Thus, the activities conducted were story building, role-playing, panel discussions, forums and dramas conducted based on short films. A pre-test was conducted prior to the intervention. Thus, speaking activities were conducted every Monday through MS Teams and the mistakes committed by the student teachers during the speaking activities were identified and noted down. During the first cycle, from October to December 2020, student teachers had to use the day-to-day familiar WhatsApp group calls when preparing for pair or group activities which caused numerous difficulties in planning and organizing them. Anderson (2011) states that proper designing of online learning system enables to determine the learner's needs and their existing knowledge levels. According to Biggs' (1995,1999) constructive alignment approach, Students are guided by the outcomes and the assessment tasks measure what they have learnt and enable them to become self-directed learners. Further, providing feedback and monitoring peer feedback create opportunities to evaluate the alignment. Receiving and providing feedback play an important role in this approach since it enables the students to identify the gaps in knowledge and receive guidance

to achieve learning outcomes. During the first cycle, mistakes they committed were noted down and feedback was given at the end of the whole session. Accordingly it was identified that the student teachers committed pronunciation mistakes especially words starting with /s/ sound, e.g. /Isku:l/, /Istju:d nt/ and /g v m nt/ and many more, incorrect use of prepositions such as 'join with', participate for' etc. use of incorrect tenses, modals and parallel structures. Certain errors had been fossilized and had to take much effort to correct them through individual feedback. After identifying their common mistakes grammar and listening activities were designed and sent to their Google Classroom giving students sufficient time to engage in and they were discussed on every Friday. Thus, students were given several opportunities to engage in constant practice. After the first cycle, a questionnaire was administered to examine the challenges faced by the student teachers in adopting online mode in their learning process and to identify their perception on the effectiveness of pair and group work in conducting speaking activities online through a five-point Likert scale questionnaire and open-ended questions. Thus, the second cycle was planned considering the suggestions given by the student teachers.

During the second cycle from January to May 2021, individual, pair and group activities were conducted. "Breakout rooms", a facility given in MS Teams was used in group work which enabled the group members to engage fully in discussions conveniently where the teacher could visit each group and give adequate guidance whenever necessary. Notes were taken down related to the mistakes they committed and pointed out at the end of each pair or group presentation enabling them to identify

their mistakes clearly. Marks were awarded according to a rubric designed similar to IELTS speaking activities. Since all the activities were conducted online, it was intended to create an environment similar to the real classroom that involved a lot of interaction among the students.

Focus group discussion and a post- test were conducted at the end of the second cycle in order to identify the effectiveness of conducting collaborative speaking activities online.

Five-point Likert scale questions were analyzed using Microsoft excel software while the open-ended questions and the data collected through the focus group discussion were thematically analyzed. Paired sample t-test was employed to analyze test scores.

The questionnaire was administered after the first cycle in order to identify the challenges they encountered and the effectiveness of conducting activities online. The second cycle was planned considering their suggestions and was implemented for five months. Accordingly, the number of students engaged in the activities on each day was limited and feedback was given after the performance of each group. A reflective journal was maintained while the activities were conducted.

## RESULTS AND DISCUSSIONS

This action research was conducted in two cycles. The perceptions of the student teachers on conducting English speaking activities through pair work and group work were considered after the first cycle, data collected through a questionnaire was analyzed. Accordingly, student teachers had faced difficulties connecting with members in the discussion prior to the group activities given and when a large number

of students joined the session, disturbances had been caused making it difficult to turn on their microphones and videos. Also, a limited number of students got the opportunity to take part in the events while others had to wait long hours. According to their perception, pair work and group work were unsuccessful since the group members could not collaborate fully in planning and organizing the activities, a large number of students taking part in one session and giving feedback after completing all the activities were not effective.

They suggested to limit the number of students participating in each session and to give feedback at the end of each group presentation because providing feedback at the end of the whole presentation was proved to be ineffective. When their perceptions were taken at the beginning of the online process, the majority was in the opinion that conducting pair work and group work for speaking activities online was ineffective and face-to-face learning is always successful than virtual learning. When the challenges they encountered during online learning were considered, they mentioned of connection problems, faults in the devices, external noises, power failures, bad weather conditions, authentic feelings, blurred facial expressions and gestures, etc. Out of these, certain circumstances were unavoidable while others could be adjusted with proper planning.

The second cycle was planned considering the suggestions given by the learners after the first cycle. A focus group discussion was conducted with the same sample after the second cycle and was revealed that the majority, except three were very positive about conducting pair and group activities online for speaking activities. According to them, they had not seen much difference between live and virtual

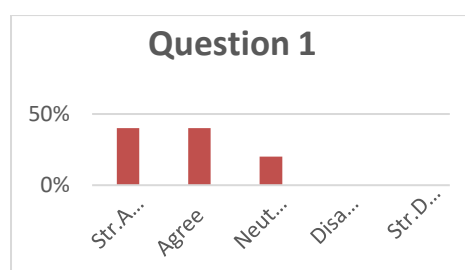
learning. It is considered a very successful mode of conducting activities. They have obtained many opportunities to correct their mistakes and has improved confidence in presenting their views on any platform.

Analysing the reflective notes in the journal indicated that the number of errors they committed during the speaking activities had been reduced gradually due to constant practice and constructive feedback. By the end of the second cycle, they had improved their oral communication skills a lot. Analysing the data obtained at the focus group discussion, notes in the reflective journal, and marks of the pre and post tests were analyzed, it was revealed that fluency, lexical resources, grammatical accuracy and pronunciation of the student teachers had improved to a greater extent from October 2020 to May 2021.

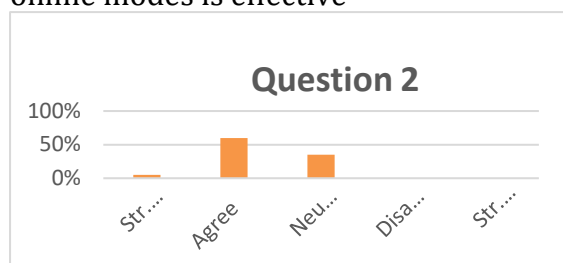
**Table 1.** Questionnaire on students' perception on effectiveness of conducting pair & group work online.

Questions	Total	Str.Agree	Agree	Neutral	Disagree	Str.Disagree	Total
Que. 1	20	40%	40%	20%	0%	0%	100%
Que.2	20	5%	60%	35%	0%	0%	100%
Que.3	20	0%	45%	55%	0%	0%	100%
Que.4	20	20%	70%	10%	0%	0%	100%
Que.5	20	40%	45%	15%	0%	0%	100%
Que.6	20	0%	30%	50%	20%	0%	100%

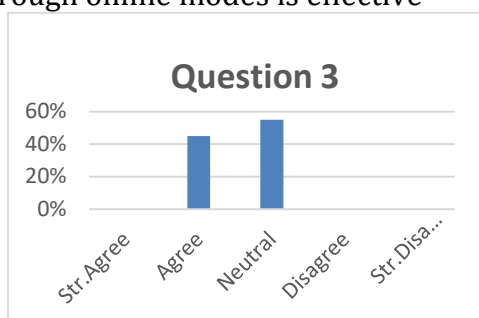
**Figure 1.** You engage in your studies effectively during stay-at-home period



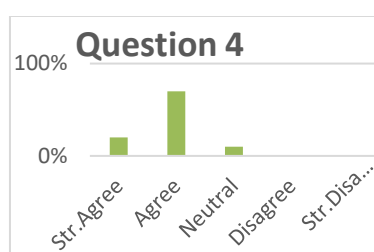
**Figure 2.** Gaining knowledge through online modes is effective



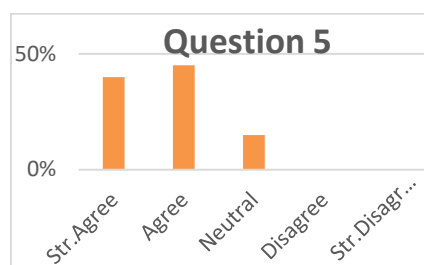
**Figure 3.** Conducting speaking activities through online modes is effective



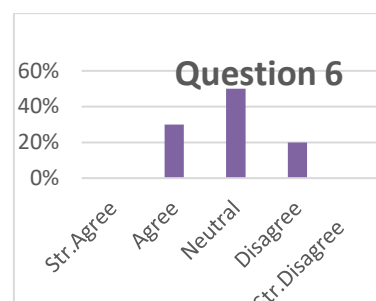
**Figure 4.** Conducting grammar and listening activities are helpful to get the mistakes corrected that you commit while speaking



**Figure 5.** Online mode of conducting speaking activities improves your oral communication skills



**Figure 6.** Group work and pair work for speaking activities can be effectively done through online mode.



**Table 2.** Analysis of pre & post-test marks

Pre Test Scores	88	62.20	2.43	0.26
Post Test Scores	88	75.15	3.10	0.33

Difference =  $\mu$  (Pre Test Scores) -  $\mu$  (Post Test Scores)

Estimate for difference: -12.943

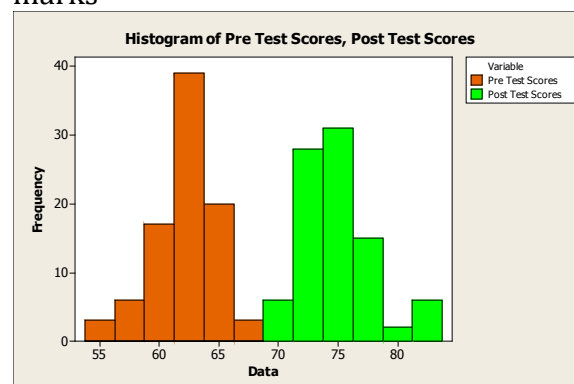
95% CI for difference: (-13.772, -12.115)

T-Test of difference = 0 (vs not =): T-Value = -30.83 P-Value = 0.000 DF =174

Both use Pooled St Dev = 2.7848

P-value 0.000< 0.05 Therefore null hypothesis is rejected. It is statistically significant that the intervention used to improve the speaking skills through pair work and group work of student teachers is effective.

**Figure 7.** Analysis of pre & post- test marks



## CONCLUSIONS

With the closure of schools and higher education institutes the mode of education was totally transformed to online and conducting pair and group activities in speaking activities for the student teachers of English at the beginning was challenging. The student teachers were on the opinion that conducting pair and group activities online for improving speaking skills was very ineffective due to technical issues and the magnitude of the class, but it was converted to a positive view after completing the second cycle with the changes made mainly due to the suggestions given by them. Providing a lot of opportunities to speak in English enabled them to sharpen their English-speaking skills. Also, grammar and listening activities assigned to students through Google Classroom after identifying their mistakes committed during the speaking activities had been very effective since the errors were discussed with the basic rules.

Due to proper planning and implementation of the intervention process after identifying the problem, by employing new techniques in grouping and group discussions such as breakout rooms, providing numerous opportunities for constant practice, limiting the number of students engaging in the sessions, giving individual and constructive feedback related to the mistakes they committed, the online mode was converted to an effective mode of teaching and learning in developing oral communication skills of student teachers. A significant improvement in the communication skills of the student teachers was well noted at the end of the second cycle.

Promoting communication skills of student teachers of English is a vital need. Thus, by examining the positive results of this intervention, it is evident

that despite widespread prejudices, activities for improving speaking skills can be effectively implemented by selecting and implementing activities relevant to their levels, making them rather challenging and employing new technological techniques.

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## Effects of Study Habits on Student's Academic Success based on the Gender

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### ABSTRACT

Study habits have a significant impact on a students' academic success or failure. Research studies have revealed that there is gender-based differences in the study habits of the students which have led to anomalies in their academic performance. This research was conducted to investigate the study habits of students based on their gender and how they affect their academic performance. A sample of grade eleven students including 237 boys and 150 girls from schools in Sri Jayewardenepura education zone, Sri Lanka was used for the study. It was found that girls are more likely than boys to follow study habits. The social roles expected from each gender also has caused a difference in how the study habits are applied to the learning process. This situation is also considered in several studies as a barrier in developing good study habits. According to the findings and suggestions of this study, both girls and boys must focus on adopting good study habits for better academic performance. It is the responsibility of teachers and parents to support and motivate students to practice them.

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## INTRODUCTION

Education is the most important tool in human resource development. The involvement of educated men and women in the development process is an essential factor in the development of human resources. In 1990, the World Conference on "Education for All", held in Jomtien, Thailand, affirmed the need for equal education rights for all, regardless of gender. Equality of educational opportunities was also highlighted in the Incheon Declaration for Education 2030 to achieve the goals for sustainable development over the next 15 years. This declaration also emphasizes that there is a large gender gap in access to education, uninterrupted educational participation, and educational achievements. The elimination of gender inequalities of this sort is set as a goal of sustainable development in education by 2030. International and local research studies in Sri Lanka have also revealed a difference in the educational achievement level based on gender [Zunica and Forgasz, 2017, Athurupana, Shoja and Ebenezer, 2018, Ahize, 2019, Snyder, Brey and Dillow, 2019].

The successful educational practices that students use in the learning process contribute to their good academic performance. This is confirmed by the study conducted by Senadhira, (2007) based on the school end term examination results which revealed that there is a relationship between the study habits and the academic success. Moreover, the study carried out by Lankathilaka (2010) based on the achievements at the GCE Advanced Level Examination in Sri Lanka revealed that the study habits of students have a great impact in obtaining better results. Another study by Ng. et al, 2016 on academic achievement and time management of secondary school

students in Malaysia reveals a link between nonacademic activities and the performance levels. This study also mentioned that several habits of students such as watching television, spending time for internet browsing, playing video games and texting frequently on mobile phone may negatively affect the academic performance. Research literature such as [Athurupana, Shoja and Ebenezer, 2018, Amuda and Alli, 2018] has revealed that there is a gender difference in the way the study habits are used to achieve higher education performance.

Moreover, according to several research studies conducted in India, it is highlighted that girls follow better study habits than boys [Kumari and Chamudeshwari, 2015, Ilahi and Khanda, 2015 and Kanchana, 2017]. Based on the research carried out by Tomar and Gupta (2016) to investigate relationship between the study habits of students with different performance levels and their gender, it was revealed that girls in India follow the study habits such as sitting in the front rows in the classroom, engaging with homework, spending more time on self – study and discussing subject matters with friends. Researchers have also cited that socio cultural factors around girls also influence them to spend more time with studies [Devi and Woldestadika, 2015, Kumari and Chamudeshwari, 2015, Madelif, 2015, Khan, 2017, and Nuthnap, 2017 ref].

Kumari and Chamudeshwari, 2015 further revealed that more time is available for girls to focus on studies as their freedom is limited to move out from their residences, whereas boys have more freedom and leisure time to get involved in extracurricular activities which lessens their available time for academic activities at home. Madelif,

2015 points out that according to sociologists' perspective, the bedroom culture has significantly contributed to girls' better performance in education. It was found that support and supervision from parents are important for students to maintain good study habits [Senadhira, 2007 and Li and Qiu 2018]. Kanchana, 2017 points out that family backgrounds provide better facilities and support to boys than to girls in order to maintain study habits. Chowdhury and Ghose (2014) have revealed that mothers play a significant role in influencing good study habits in boys. They also state that in recent times mothers also have high expectations towards girls' education and this attitude now has a positive impact on promoting good study habits in girls.

The study in this paper focuses on study habits that contribute to educational success and the differences in how they are applied to the learning process based on gender. Identification of differences in students' study habits based on gender can help reduce the performance anomalies and performances level in gender. Both male and female contribution to the workforce is essential for economic development of any country. Gender based performance anomalies of education create an imbalance in the workforce. Different study habits and in turn the different levels of performance based on gender can also influence the changes of social role and status of women and men in society in the future. Furthermore, these factors also contribute to socio-cultural problems in a traditional society such as Sri Lanka.

## **MATERIALS AND METHOD**

In this research, the study on the relationship between study habits and

gender was conducted based on two main objectives given below;

1. Identify the nature of study habits used by students based on their gender.
2. Examine the factors that affect students' study habits according to their gender

This study was conducted under the Sample Survey Research Methodology of the Descriptive Research System. Moreover, both qualitative and quantitative tools were used in data collection to avoid the disadvantage of confining the sample survey information to the surface.

Questionnaires, interviews, document sources and observation sheets were used as data collection tools and tables. Both qualitative and quantitative data analysis methods were used in data analyzing stage and graphs, tables and charts were used for data interpretation. Boys and girls from government schools in Sri Jayewardenepura Education Zone in Colombo District, Sri Lanka were considered as the population of data for this research.

In the selection of samples, girls' and boys' schools were excluded, as the research objective is to investigate whether there is a difference in learning process based on gender under the same learning environment. Therefore, samples were randomly selected from the Sinhala medium mixed schools of type 1AB, 1C and type 2 in the Sri Jayewardenepura Education Zone. The total research sample included 237 boys and 150 girls studying in grade eleven in 14 schools, 70 teachers and 200 parents.

## **RESULTS AND DISCUSSION**

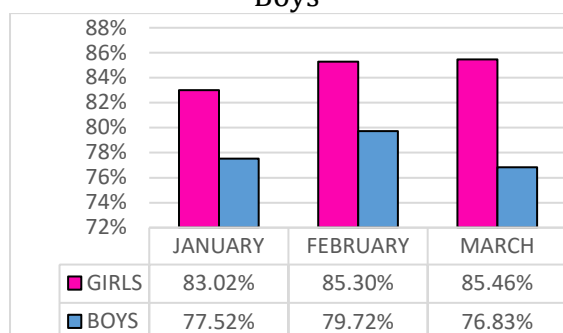
The academic performance of the selected student sample was observed under a number of study habits namely, school attendance, homework, methodical maintenance of the study materials, reading habits, study plans.

For this the habits such as methodical maintenance of study materials, reading habits and study plans were obtained from Senadhira (2007). In addition to these habits school attendance and homework were also included as study habits based upon the author's teaching experience for more than a decade. Moreover, the factors which would affect the study habits were also investigated for the same sample of students.

### School Attendance

According to the results obtained from this study, it is perceived that there is a gender-based difference in school attendance. To this end the attendance of boys was lower than the attendance of girls. Particularly from January to March the attendance percentage of girls is reasonably higher than the attendance percentage of boys. This is depicted in figure 1. In addition to that it was noticed that unlike girls the boys tend to get late to come to school. Boys normally come to school with the intention of associating and playing with their friends.

**Figure 1.** School Attendance of Girls and Boys

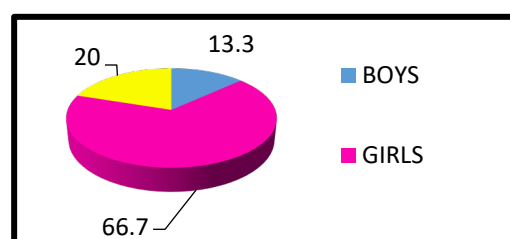


### Homework

It is identified that boys are less interested and reluctant to complete homework assigned by the teachers as an extension of classroom activities as depicted in figure 2. students provide different reasons for this situation such as hectic schedules due to tuition classes,

getting many assignments for every subject, laziness and being under the impression that the assignments are not marked by the teachers.

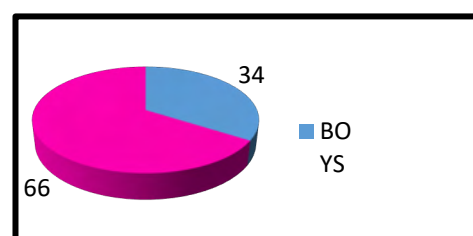
**Figure 2.** Homework of girls and boys based on the data received from Teachers



### Methodical maintenance of study materials

When examining the practice of note writing and maintenance of study materials, it was found that girls maintain more clear and organized study materials compared to boys. Students interest on missing note completion is also analyzed and it is observed that boys rarely tend to complete missing sections on notes unlike girls. The use of methods like making short notes to memorize subject matters were observed from girls. This is reflected in figure 3.

**Figure 3.** Study materials completion for girls and boys



### Reading habits

Senadhira, (2007) emphasizes that reading and using library facilities are successful study habits. Based on the literature, usage of library facilities by the students is not at an acceptable level.

Majority of the students go to the library only during the library period and they do not take the advantage of the library facility. This study revealed that there are weaknesses in students' reading habits irrespective of the gender. If students are forced to read it was observed that the boys tend to read the school text books and the girls tend to read novels.

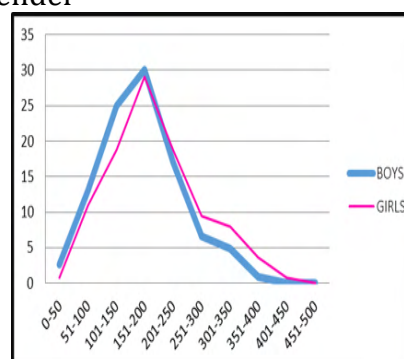
### Study plan

Girls are more likely than boys to set a daily schedule and plan their learning activities. Accordingly, girls have a habit of prior arrangement of notes, textbooks and other study materials according to their school schedule for the next day.

Research has shown that girls spend more time on their education than boys. Also, it is observed that most of boys do not set up particular time allocations for their studies. It is also found that girls spend approximately same time on re-studying or memorizing subject matters, as the time they spend for learning. However, this practice is very rarely found among boys and it is clear that girls spend less time than boys on leisure activities.

It is evident that following the above-mentioned good study habits positively affect the educational success of both boys and girls. This can be justified through figure 4 which represents total marks of 5 subjects obtained for both genders from the sample. Figure 4 depicts that the girls have obtained higher marks than boys.

**Figure 4.** Student performance based on Gender



### Factors effecting study habits

Based upon the interviews performed for this study the following factors were surfaced as the ones which would affect the study habits of the students.

#### Parental supervision

Parental supervision is essential to sustain students' learning process. It was revealed that the parents of the girls themselves look after the educational activities of the children as compared to the parents of the boys. Among the parents, mothers provide the most support, assistance and guidance for their children's academic activities. Also, boys get more support from their fathers for academic activities than girls.

#### Environment around the residence

The environment has a greater impact on boys' study habits. For example, noisy surroundings and lack of space and facilities would negatively affect study habits.

#### Social roles expected from the society

In a country like Sri Lanka, there are social and cultural expectations for each gender with respect to the roles that they play in society. For example, sometimes boys have to contribute to their family's economic activities, which can be seen as a barrier to their study habits. Similarly, having to support the day-to-day domestic chores is another barrier to girls' study habits.

## CONCLUSIONS

This research performed a thorough investigation on study habits used by students based on their gender and the factors that affect the students' study habits according to their gender. To this end, the study habits taken into consideration include school attendance, homework, methodical maintenance of the study materials, reading habits and study plans. The study revealed how girls and boys practice these study habits and the impact these study habits have on the overall academic performance. When considering the nature of study habits along with the gender of the students, it can be concluded that girls are more focused towards practicing study habits than boys. Thus, the academic performance analysed through the selected sample of students also uncovered the fact that good study habits have a positive impact on academic performance.

Furthermore, this study examined the factors which affect study habits and it was possible to discover these factors as parental supervision, environment around the residence and social roles expected from the society. It can be concluded that there is a responsibility on parents and teachers in enforcing good study habits on students. According to the results obtained from the research, having to deal with the expectations of the society with respect to the social roles of each gender also affects their study habits and the learning process.

## ACKNOWLEDGEMENT

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## Impact of Covid-19 on Primary Education: A Study based on Primary Schools in Hatton Education Zone

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### ABSTRACT

This study explores the impact online primary education has on students' learning from teachers' view. The objective of this study was to explore the primary teachers' view on technical skill, students' and parents' interest on online education and to analyze online education's impact on primary students' academic learning. The study helps students and teachers to know the impact of online education on students' learning and related factors. 30 primary teachers randomly at Hatton zone of Nuwaraliya were selected. All teachers were given the same questions, through telephone and WhatsApp to obtain their opinion regarding the online education. Results suggested that some major efforts must be made to improve online technology and skills and motivate parents to facilitate the learning opportunities for students to engage in online education. It is recommended to develop a better online learning environment during this pandemic to adapt to that environment.

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## INTRODUCTION

Recognizing the global impact of the novel corona virus, the World Health Organization (WHO) declared it as a pandemic on 11th March 2020 (Jena, 2020). The corona virus disease, which is dubbed as Covid-19, is one of the most critical perennial problems confronting the contemporary world today (Agba, Ocheni, & Agba, 2020). Education is one of the most critical sectors affected by Covid-19 pandemic across the globe. In terms of the education sector, most of the governments temporarily closed schools and the continuous lockdown has had a significant impact not only on students' education but also on students' mental health.

Sri Lanka is one of the South Asian countries affected by the novel Covid-19. The first outbreak of the Covid-19 in Sri Lanka was detected with a Chinese tourist on 27th January 2020, and the infected local person was identified on 11th March 2020 (Erandi, Mahasinghe, Perera, & Jayasinghe, 2020). The government isolated Covid-19 infected areas and imposed a lockdown. The government subsequently declared a nationwide curfew due to the increase in the Covid-19 cases and several other measures were also taken to prevent the spread of the virus.

In this context, the Sri Lankan government closed all the schools in the country and suspended all academic activities (Adaderana, 2020). The government also imposed a nationwide curfew and lockdown on 2020 2021 (Newsfirst, 2020). During this period, Sri Lanka's education sector faced various challenges especially primary teachers. Thus, this research aims at identifying the challenges encountered by primary teachers at Hatton zonal education division in the Nuwaraelliya district. This

research clearly states the challenges faced by primary teachers of education specially in a child's knowledge of using online. Opinion regarding the online education, student attendance, parent's student interest is in fact examined with reference to primary teachers' views.

During the pandemic, remote learning became a lifeline for education but the opportunities that digital technologies offer went well beyond a stopgap solution during a crisis. Due to this, the systems can adapt the learning experience to suit students' personal learning styles with great granularity and precision. But Hatton zonal education division lacks skills in using the online system. Parents also lack interest in online classes and student participation reduces day by day, could be due to the challenges faced by primary teachers of education. This study examined 30 primary teachers' views about their experience of online teaching and the way it affected them as learners and future teachers.

Transitioning from face-to-face to online learning can be an entirely different experience for teachers and students, which they must adapt with little or no other alternatives available. But the education system compelled to adopt a system that they are not prepared, and it will be a new change for teachers. Furthermore, online education may depend on the expertise in and exposure to Information and Communications Technology (ICT) of both teachers and students, reliable Internet connection and access to digital devices, minimum supervision of parents and guidance to students and performance interest of the students.

Not being fully prepared for adapting to online teaching during COVID-19 and the

need to develop skills in ICT are also key factors.

Learning attitudes are rooted in the support that students receive from teachers and families and both teacher practices and parental emotional support are important for the development of students' attitudes.

Teachers need to assess student interest. Parents can play a crucial role during home schooling such as ensuring that their children follow the curriculum and supporting their children emotionally to sustain their motivation and ambitious goals in a situation where there is the lack of peer support. In fact, parents might struggle to engage in their children's schoolwork while fulfilling their job or other family obligations and underestimating the importance of their support for their children's skill development.

Directed instruction (e.g. the teacher sets clear goals for students' learning, asks questions to check whether students understand the material and feedback need to assess student interest

### Sampling

30 primary teachers were randomly selected at Hatton zone of Nuwaraliya. All teachers were asked the same questions via telephone and WhatsApp to get opinion regarding the online education

## ANALYSIS AND FINDINGS

### Opinion

After obtaining the primary teacher's views and opinion regarding the online education, the total number of items were checked accordingly;

- 1 -bad/no
- 2- good/yes

Table 1. Some statistics related to primary teachers

Age group (years)	Primary teachers opinion	Primary teachers respondents
20-30	2	7
30-40	1/2	11
40-50	1	2
Above 50	1/2	9

Table 1 shoes that the total 7 respondents felt online education system is good at the age between 20-30 and 13 respondents' comment that both age between 50-years and above as appropriate. 2 respondents give negative opinions, and they are above 40-50 years

Teachers had to conduct all their online teaching activities with their existing skill and it is entirely a new situation after this pandemic. Lack of sufficient knowledge on online education system relates to the age to conduct online teaching activities. Teachers' knowledge about using technological tools and Internet connect with age and teachers who are in the age of 40 are mainly affected by online education due to lack of sufficient knowledge in using technological tools, and Internet.

In today context women is a prominent source of income to the family. The financial demands in the middle-class family increase day by day due to the cost of living and other reasons in this context. 21 female teachers are dissatisfied about the monthly salary for being unable to manage their family which has led to stress.

**Table 2.** The Grouping of respondents on technical skill on online system

technical skill	Primary teachers' opinion
Yes	11
No	19

When examining the relationship between respondents on technical skill and online system, 11 primary teachers have technical skill whereas 19 do not have enough technical skill on online system. Distance learning has become very popular after Covid pandemic. online education teachers need special skills or knowledge to successfully teach online system specially children.

**Table 3.** The Grouping of Respondents student interest on online classes

student interest	primary teachers' opinion
Good	9
Bad	21

Interest of students was evaluated by the feedback, attendance and being adaptive to the instruction and according to the respondents on student interest and online system 9 primary teachers have positive opinion but most of the primary teachers' opinion is negative. Traditional face-to-face interaction between teacher and students is a good way in child education

**Table 4.** The Grouping of respondents parents interest on online classes

student interest	primary teachers' opinion
Good	12
Bad	18

Interest of students was evaluated by the parents' involvement and according to the responses on parents' interest and online system, 12 primary teachers have a positive opinion and 12 primary teachers have a negative opinion online system. During the Covid-19 pandemic, children and their parents must be at

home continuously. The learning alternative chosen during the COVID-19 emergency is online learning. In fact, parents' education level plays a huge role. The level of parental education affects the continuity of children's education. The mindset and educational orientation given to their children will be influenced by the level of education of the parents.

## CONCLUSIONS

The study aimed at investigating primary teachers' opinion to taking classes on the internet. The objective of the study to investigate the factors impact of online education on student's learning by primary teachers' opinion. The population of the study was 30 primary teachers who were randomly selected from the Hatton educational zone. COVID-19 pandemic's effect on teaching and learning forced to change the education method across the world and developing countries like Sri Lanka need to plan a different platform for different class levels.

Internet bandwidth is relatively low with lesser access points, and data packages are costly in comparison to the income of the people in many developing countries, thus making accessibility and affordability inadequate places like Hatton Policy-level intervention is required to improve this situation. The affordability and accessibility, technical skill and essential skills and knowledge varied is identified as a challenge. Furthermore, parents' education level plays a huge role which influences child education

Looking ahead will want to closely monitor and ensure that funds are being used efficiently and that resources are available to support learning recovery

interventions, particularly for those students who need them most.

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## Stakeholders' Perspective on Water Education Among School Students: A Case Study Of

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### ABSTRACT

Education is an important way to socialize the individual through change in his thoughts and attitudes. Water and related issues have emerged as major social problems in recent times. One section of the world suffers from dehydration while the other wastes water. This will lead to huge deficits of water in the future and will be a root factor for countless social problems such as disease, poverty, abuse and plunder. In this context, education on water and water security must be provided to all. The best way to do this is to introduce water education in the school curriculum as a compulsory subject and to incorporate it in extracurricular activities from primary to secondary education. The objective of this study is to discuss the importance of water education and how to develop it in the school curriculum. This research has adapted the qualitative method. The data for this study was collected primarily through case studies and also by using the world café discussion method with stakeholders from selected educational sectors. This study emphasizes that the inclusion of education about water in our school curriculum is crucial to building a sustainable future community. This is because a living being cannot live in a world without water. The sole fact that water education will be included in the school curriculum of Sri Lanka it is not enough to improve the regional water security of the country because the awareness among the public about the importance of water and the changes that take place in relation to it is very low. Therefore, this study recommends the necessity to make water education an optional or compulsory subject in the Sri Lankan school curriculum for grades 6 to 9.

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## INTRODUCTION

Education is the key for social changes. It is a great way to socialize?? the individual through change in his thoughts and attitudes. Water and related issues have emerged as major social problems in recent times. In other words, it has become a global problem today. Some so-called political prophets have predicted that in the future the war between the nations of the world will be for water. In this case, we have to think about water and how to protect it. One part of the world suffers from dehydration while the other part is wasting water. This will lead to huge deficits in the future and will be a root factor for countless social problems such as disease, poverty, abuse and plunder. In this context, education on water and water security must be provided to all. The best way to do this is to introduce water education in the school curriculum as a compulsory subject as well as incorporate it in extracurricular activities from primary to secondary education. This study attempts to analyse the stakeholders' perspective on water education among the school students.

To make awareness on water and water security among the public has recently emerged as one of the foremost targets of nation states and the international community. They have used various strategies to achieve their ultimate target. Despite this, it has been observed that there are failures and insufficiency in the implemented programme and projects. This experience shows that water education must be incorporated within the school curriculum as either a subject or units of an extra-curricular activity.

The inclusion of the subjects on water in Sri Lanka's school textbooks and co-

curricular activities will not pave the way for full access to water education among school children. When considering this fact, this study aims to analyse the importance of water education in the school curriculum of Sri Lanka and the stakeholders' perspectives on incorporating it in the school curriculum.

Education about water is very antique. From ancient religious literature to modern literature, research has put forward a variety of ideas about water and its socio-economic, cultural and political significance. Apart from this, with the help of modern scientific knowledge, various research on water and their effects and the processes related to their management have been presented with different results and recommendations. The following reviews of previous studies on water education in the school curriculum reveal the importance of water education in the school-level teaching programme.

UNESCO's Study on Learning about Water – Multiple-Perspective Approaches (2012) explores on applying multiple perspectives for Education for Sustainable Development (ESD) to freshwater issues. This study specially describes the multiple perspectives such as scientific, historical, geographic, Human Rights, gender equality, Values, cultural diversity and the sustainability perspective on water in educational aspects. The study of UNESCO's learning and training tool is a great guide to designing a water educational syllabus at school level. Beyond these initiatives, UNESCO designed and conducted various forums on water education in 2015. Through this programme, various issues and solutions were forwarded on water education in school education for sustainable development (2015).

Sammel and Alison (2014) attempted to map out the current state of formal water education in Australia based on questions about what it may actually mean to be water literate in his study. This study was conducted with special reference to Australian science education among undergraduate, pre-service teaching cohort in their third year of a Bachelor of Education (Primary). The analysis suggests that the question arising for water education in Australia is not whether the ACS or [future] teachers should be addressing issues associated with water, but rather how and to what end goal.

Amahmid et al. (2019) conducted a study on water education in school curricula among students of Morocco. The objective of the study was to explore the status of water education in the Moroccan curricula designed for Primary and Lower Secondary School levels and assess the students' knowledge, attitudes, and behaviour regarding water-related issues. The study results showed that water-related topics are incorporated in the curricula with multi and interdisciplinary approaches and the most involved are Sciences and Geography; however, there is a lack of field and extracurricular activities.

Meghan McCarroll and Hillary Hamann (2020) discussed and defined the concept of water literacy through examining existing surveys and studies of water knowledge, attitudes and behaviors in both student and adult populations. In addition to this, they summarized water literacy levels and knowledge gaps that exist around the world through this study.

Thusyanthini and Siyamalan (2021) conducted a survey on value-based water education especially in the science

curriculum used in Sri Lankan schools. Due to it being a science subject it had been endorsed as a compulsory subject and water related studies were included. They described that there is insufficiency in the area of value-based water education in the grade 6 to 11 science subject curriculum and suggested that value-based water education at all levels will definitely improve sustainable water resource management.

The above literature reviews have revealed the natures and trends of global and Sri Lanka in the field of water education. However, this study examines the place of education on water in school educational programme in the present contexts of water security related crisis from the stakeholder perspectives

## **METHODS AND MATERIALS**

Water related studies are carried out not only using scientific methods but also through social science approaches. At the same time, studies on water and water related problems are being done through qualitative research approaches in addition to quantitative approaches. This study adapted the qualitative method to study on the stakeholders' perspective on water education among the school students in Nallur Educational Zone. The data for this study was collected primarily through case studies along with the world café discussions with stakeholders from selected educational sectors and textbooks from grades 6 to 9 were examined using content analysis method.

It was concluded in the world café discussion with stakeholders belonging to the Nallur Divisional Secretariat during the meetings conducted in June and July 2020 that communities will have to face

various challenges related to water security in the future and there is a lack of awareness among the people regarding water security. Furthermore, they proposed that it is necessary to increase water and water security related activities among school students. Some participants recorded that water education has to be incorporated in the school curriculum beyond some subjects of school education in Sri Lanka like science, hygiene covered through delivering core units as well as extracurricular activities.

In this regard the team organized another discussion during the latter part of July and the first week of August 2020 with stakeholders from educational sectors such as the National College of Education, the Teacher Training Colleges, the Technical Colleges, Environmental Activists, Schools, Educational Institutions, Mass Media, Medical Officers and Public Health Officers. Find below the participant details.

The discussion with above mentioned participants was organized based on well-structured questions which were designed to provide the best opportunity for the participants to precise the nature and reality of water education in the contemporary school curriculum of the Sri Lankan educational system. In addition the significant case studies which focused on a single aspect of water education were recorded from the participants through personal interaction.

It has to be mentioned that the books published by the Educational Publications Department of Sri Lanka and provided by Ministry of Education for school students through the free educational programme were also included as data material.

## RESULTS AND DISCUSSION

Water Education is gaining global importance today. Starting from UNESCO to state governments and non-governmental organizations which carry out various awareness programmes on water and water security among the public and particularly among schools' students. However, water security is one of the biggest problems on global and state levels.

This discussion looks at the nature of water education and its importance in the school educational system of Sri Lanka from the perspective of stakeholders who are most involved with the education sector in the Nallur Divisional Secretariat under the following sub-titles:

### Water related subjects in school curriculum of Sri Lanka

The education system plays a very crucial role in any country towards achieving

<b>Table I</b> <b>Participant details in the world café discussion on water security of Northern province</b>	
Institutions	No.
National College of Education, Koppay	4
Teacher Training College, Koppay	5
Technical College, Jaffna	4
Environmental Activists	3
Schools, Jaffna	4
Educational institutions, Jaffna	5
Mass Media Jaffna	5
MOH/PHI, Nallur	5
Total	35
Source: Meeting Records 2020.	

sustainable development and strengthening social, cultural, historical and integral development, and is often called as the back-bone of the society (Alawattegama, 2020). The government of

Sri Lanka provides facilities to create a learning environment for children free of charge through the free educational policy which began in 1944. The free textbook programme as a part of this policy is to enhance the education quality and improve learning outcomes among the children. The government provides free textbooks according to the Sri Lankan school curriculum to all students from grades 1 to 11. This free education programme plays a significant role in developing knowledge, skills, attitudes and behavioral changes among students. It is possible to observe that the textbooks provided by the government provide some education on water with multiple perspectives such as history, geography, science, and hygiene.

Education on water is found in the contents of certain textbooks such as geography, history, civic and science while analyzing the textbooks published by Educational Publications Department of Sri Lanka. If the contents of the geography textbook from grades 6 to 9 is taken as an example, there are fundamental concepts and knowledge on water and related issues. In particular, some opportunities to discuss the contemporary issues of water and how to secure it are provided in the assignment sections which aims at students doing it at home by observing nature and other things with the guidance of the teacher.

If we look carefully, we can observe that very few chapters and their content describe and discuss on the nature of water and its issues in the textbooks given for geography (grade 6 to 9) which are compulsory subjects for school students. In analyzing the contents of geography school-books from grade 6 to 9 the priority to explain the importance of water security is very poor. For example, even

though the course unit on water is found in the grade 6 geography textbook, the book briefly describes only water using patterns, colourful pictures on water and its usage, the effects of water scarcity, water conservation measures, and the definition of water pollution. The grade 7 geography textbook provides information on monsoon winds and rainfall in Sri Lanka, as well as issues on water-related droughts and floods under the heading of natural hazards. The grade 8 textbook on geography is very brief about the different forms of water and its importance. In the meantime, the grade 9 textbook provides information on waterfalls and rivers in Sri Lanka as well as information on monsoon winds and rainfall. Just like the contents of the geography textbooks, there are some explanations on water and its usage in the science textbooks used from grades 6 to 11. These explanations are mostly based on the scientific perspectives in terms of biological, chemistry and physical aspects.

In considering the above discussion of content analysis of Sri Lankan free textbooks with special reference to geography grades 6 to 9 it has to be analysed through a stakeholders' perspective on water education in the Sri Lankan school system. The case studies recorded from stakeholders who engage with education, particularly in teaching, and the data collected through group discussions with various stakeholders especially belonging to the educational sectors were used in the qualitative data analysis. The following themes emerged from the analysis.

### **Practice of water education in school level: reality and challenges**

The role of education in creating, preserving and sustaining the right knowledge, skills and attitudes in the

context of the social value system are crucial for the wellbeing of any civilized society. It was accepted unanimously by the participants of stakeholder discussions that were conducted by the research team of Water Security for the Northern Province of the University of Jaffna. However, it has been recorded in the case study of a science teacher that education on water and its related matters should be improved because there is a lack of awareness on water and water security among the students and the public. Furthermore, he has mentioned that people consider that water is a quantitatively available resource in their region, and they never thought that drinking water is a limited resource on the earth. From this case study it was apparent that education on water is not only enough in the school curriculum.

### **Important of upgrading existing curriculum through incorporating areas of water security**

This is the obvious truth that existing water education in Sri Lankan school curriculum is not sufficient to create awareness on water security among students and the general public in the country. The other opinion of the participants in the discussion on water security was that extra-curricular activities for students should include topics such as water security, water management, water austerity practice, water pollution, water pollution prevention etc. For example, involving students in such activities as monitoring the water levels of local ponds, cleaning up pollutants in rivers, and using home wastewater for home gardens.

The geography teacher of a national school pointed out in his case study that the purpose of education is to develop a

positive attitude among students. Therefore, it is necessary to provide practical training to the students apart from the individual learning subjects. The present world and the country in which we live are facing various water related problems. To counter this, we need to provide water education among students through a knowledge-based teaching process and practical experience. These will bring about changes in students' knowledge, attitudes and behaviors about water and the water security process. In order to bring about the above changes among the students it is necessary to incorporate the multifaceted view of water within the existing school curriculum. For example, including essay and stories on water and its related issues we are facing today and motivating students to write or draw about these as essays, posters and short stories when studying the Tamil language subject. Similarly, other subjects like religion, history, etc. should include water knowledge-based chapters and water management activities according to their nature.

### **Is it necessary to develop new curriculum for water education in school education of Sri Lanka**

The necessity of water education among students and public is emphasized in the workshop organized by the UNESCO on "Water education and capacity building: key for water security and sustainable development" which aimed at discussing Education for Sustainable Development as a critical lever for advancing policies and practices in different areas such as water education for water security and sustainable development, marine knowledge, etc. (2015 b). This workshop summarized that water education should be structured into three main themes in order to accelerate action for sustainable

development: (a) tertiary education of water professionals; (b) water education in schools; and, (c) water education for decision-makers, water technicians, communities, stakeholders and mass-media professionals. According to this summarization of the workshop, water education occupies a central place in school education system. Because Schools are excellent places to foster water education since, they are well structured and are linked to the parent community.

Students will learn better what they can apply to their daily lives. Schools, Teachers, and textbooks are seen as the primary socializing agents for children. Schools provide students the space and time to develop the knowledge and skills at the same time the teacher functions as a moderator for expanding the students' positive attitudes. Beyond this, the textbooks seem to be a fundamental source for preparing students for the world by generating new visions, attitudes and skills. In this context, if we incorporate water education in the school curriculum as either a compulsory or an optional subject, the attitude and behavioral changes regarding the water security could be become a reality. This is because, through this water education students have an opportunity to know all matters related to water as well as it may be helpful to make water secure worldwide. e.g. learning about the water they consume is a first step to bringing knowledge closer to their own reality and obtaining this knowledge will be useful throughout their lives since it can be applied at home and improve their lives significantly.

In analyzing the data collected from the discussions with stakeholders who are attached to educational sectors and case studies recorded from selected school

teachers, the inclusion of education about water in our school curriculum is a determinant to build a sustainable future community. Because a living being cannot live in a world without water. Thiruvalluvar, a world-renowned divine poet and philosopher said that the world will not be without water.

When water fails, functions of nature cease, you say; Thus, when rain fails, no men can walk in 'duty's ordered way'. (Kural 20)

If it be said that the duties of life cannot be discharged by any person without water, so without rain there cannot be the flowing of water.

## CONCLUSIONS

Water-related issues have the most serious social consequences in contemporary society. Awareness among the public about the importance of water and the changes that take place in relation to it is very low. The interaction that each human being makes with water in their lifetime is inevitable. But concerns about water security or conservation are rare among them. Incorporating water education into the school curriculum is a necessity of the times. Because the future society is in the hands of today's students. They can create a water secure world in the future by inculcating a multifaceted knowledge, attitude and skills about water. This study also emphasizes that when water education exists in the school curriculum of Sri Lanka it is not enough to improve the regional water security of the country. Therefore, this study also stresses the need to make water education an optional or compulsory subject in the Sri Lankan school curriculum for grades 6 to 9.

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## **An Investigative Study on The Professional Development of Mentors in the Process of Mentoring Prospective Teachers**

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### **ABSTRACT**

Mentoring plays a vital role in the life of a teacher. The present qualitative study investigates how mentors enhance their professional development through the process of mentoring. Researches have shown that how observational learning with mental activity construct self – regulation towards the accomplishment of the professional goals of the mentor. As a pilot study, the case study method was applied to 10 participants., five new mentors, three sectional heads and vice principals working as mentors. Semi-structured interview method was applied to collect data. The questions of the interview were based on how mentors define their role as a “mentor” and how they enhance their professional development under five components. According to the findings of the study, five mentors without much experience in mentoring, mentioned that they were able to develop listening, empathetic responding and questioning skills when conversing with them. The second objective of the study was to identify how mentors gain benefits in mentoring. It is clear that all the participants gain some skills throughout the process of mentoring. It is obvious that mentoring supported mentors in different means in their professional development. It is suggested that the duration of mentor training should be extended. If mentors gain benefits from mentoring, it is apparently an investment for teacher education.

## INTRODUCTION

Mentoring plays a vital role in teacher education all over the world and it is becoming an essential component in the induction for novice teachers as well as the internship period in pre-service education courses. In considering the history of mentoring, the word “mentor” was derived from Greek mythology. According to literature, the term “mentor” originally comes from the epic poem of Homer, “The odyssey”. Mentor who is a good friend of Odysseus was asked to look after his son. Subsequently, the mentor coached the son and counseled him by looking after him from the birth until the end of his adolescence. In the history of Sri Lanka, “Disapamok Acharya” (teacher) and the chief incumbent of Samanera Bhikshus are considered as mentors. Mentors are recruited for different disciplines and in different methods from country to country. In the present pilot study, the researcher focuses on mentors considering the third-year prospective teachers in colleges of education and their professional development. Furthermore, the researcher uses few abbreviations in the study.

NM - Newly appointed mentor  
SM - Sectional heads as mentors  
VM - Vice principals as mentors  
PTs – Pre-service teachers

### Mentorship

Podson and Denmark (2000, p 31) define Teacher Mentorship as “helping newly appointed teachers/ beginners to acquire new skills and reduce stress”. They further mentioned that it supports prospective teachers (mentees) to improve their performance through a proper model and to socialize to the profession of teaching. The relationship between the mentor and the mentee is a very powerful tool in the process of mentoring. It is a nurturing process in which a more skilled or more

experienced person, serving a role of a role model teaches, encourages, counsels and befriends the less skilled or less experienced person for the purpose of promoting professional and personal development (Anderson, 1987). Mentors are the agents of filling the gap between an institution, an organization or a school (Aslen & Ocal, 2012; p; 32). They added that a mentor develops as a result of mentoring.

Mentoring fosters the professional development of both the mentor and the mentee. This process is crucial as mentors lay the foundation for the practical circumstances to acquire and develop different types of skills by novice or prospective teachers. Brenham (2011), through a survey in a mixed method research revealed that 70% of mentees (PTs) collaborated resources and ideas with other mentors while 95% of mentors attempted to change their teaching methods due to the effect of mentoring. By working as a mentor, an individual can enhance his or her professional development (Hanson & Moir, 2006, p; 453) and thus, they introduced some innovative ideas for mentors.

- Mentoring broadens teachers (mentor) views of themselves
- Mentoring broadens the understanding of teachers

From their research, they highlighted that 82% of teacher mentors were happy on their role due to the beneficiaries they receive to enhance their teaching and learning process. Almost all the mentors believed that reflecting their own duties helped them to have a career development. Smithey et al (2000; p; 303) stressed that, mentors are able to enhance classroom management and students behaviors effectively.

Therefore, mentors need to have professional development skills to

maintain professionalism as a mentor. Directly and indirectly some benefits are taken to mentoring. It is very important to identify how mentors, who were recruited for mentoring prospective teachers in colleges of education, gain benefits for their professional development through mentoring. Therefore, in the present pilot study, the researcher presents two research questions as follows;

- To examine how mentors define the term "mentor"
- To understand how mentors gain benefits from the process of mentoring for their professional development.

## **METHODOLOGY**

The qualitative research design was applied for the present pilot research study and the case study method was utilized as the research methodology. The case study is a way of organizing social data for the purpose of viewing social reality taking a social unit as a whole (Best; p.193). Ten mentors mentoring in the academic year 2016-2017 were purposively selected as the sample for pilot study in this research.

There were two vice principals (acting), three sectional heads and five teachers among them. Their experience in teaching profession varied from five to twenty years. They have fulfilled both educational and professional qualifications to be mentors according to the internship manual used in colleges of education. Semi structured interview method was utilized to collect data as interviewing is one of the best techniques to understand the experience, attitudes, views, intentions, comments, perceptions and reactions of the participants. The questions were included according to the following components of professional development.

1. Relationship Building
2. Leadership
3. Professional Satisfaction
4. Knowledge on Mentoring and Teacher Education
5. Career development

## **RESULTS AND DISCUSSION**

The purpose of this case study was to identify the experiences of the mentors on their professional development when involved in the process of mentoring. Considering the first question in defining the term "mentor", all ten mentors have attempted to define the term and the three newly appointed mentors have mentioned it as "helpers" while the other two have mentioned it as "guides". However, the experienced mentors have mentioned it as "facilitators". The case study with six participants conducted by Aslan and Ocal (2012 p. 39) defines "mentor" as a guide or a facilitator. Hobson et.al (2009) as cited by Aslan & Ocal (2012; p.39) defines the term mentor as a supporter. Considering the research findings, the mentors in the present pilot study seems to have an understanding on their role as a mentor. The data was further analyzed considering the themes on professional development.

### **Communication**

Effective conversation support for building trust with the client and learning to create such an environment is crucial in this type of a research. In the present study, five respondents (SM –VP) reported that they have not gained anything for their professional development from the conversations with the pre-service teachers. If pre-service teachers ask something, they were ready to answer. They also added that there is no special connection with them. Five NM mentioned that they were able to develop listening, empathetic, responding and questioning skills while conversing with them. One mentor teacher mentioned that

being with them was very useful to develop their empathetic responding skills. Personally, they try to think before the formal conversation with PTRs. In the process of teaching and learning, they were able to develop the pattern of talking especially as a counselor. They suggested that more practices on communication should be given to them during their programs on mentor training.

### Leadership

Considering leadership skills, the answers they have provided were categorized into a table.

**Table 1.** Improved Leadership Skills

Leadership Skills	Responses
Inspiring /motivation	7
Guidance	5
Assessing and evaluating , giving feed back	7
Planning and design projects	4
Maintain intra and inter personnel relationships	7

In the present study, all the seven mentors have stated that motivating and assessing PTRs have helped them to apply in their career. Nevertheless, three VM have stated that they already have leadership skills as they are vice principals. Leadership skills of individuals cannot be minimized. They were unable to recall what they have learned as leadership skills. NM and SM stated that being with them and supporting what they did (actions, research, projects and some activities in the curricular) have helped them to improve some skills to lead the PTRs of next year.

### Updated knowledge in mentoring and teacher education (mentoring)

All respondents gave similar answers that dealing with prospective teachers without updated knowledge on teacher education, was a challenge for them. Three new

mentors stated that sometimes knowledge was shared with them. One NM teacher has expressed her ideas on this regard as follows;

“My mentees were so active. We discussed before the lesson. Before that, I too searched information. It was interesting. Unknowingly, I developed some skills in teaching, by being with them”. NM and SM stated that they wanted to be teacher educators. By observing PTRs, they understood that they need to develop their career. One NM stated that she felt ashamed when PTRs seek support on their action research and technological support from them.

### Personnel satisfaction

All mentor teachers mentioned that getting selected to serve as a mentor is satisfactory. One SM has stated that supporting for the professional development of another person is a satisfaction which she can receive during her lifetime. Having discussed with each mentor, it was made clear that they are satisfied in supporting PTRs. VPM and SM mentioned that they are happy about the success of their previous PTRs. They still remember how they coached them properly in a humanistic manner.

### Career development

Effective mentoring guides the mentee for their career development. Being a mentor, career development is one of the key elements to be focused on. All five NMs stated that their desire to go beyond the current position have increased due to the following reasons.

- To feel self-worth, respect and attention from the teacher educator who is the supervisor of students in the college.
- To gain more recognition by being a teacher educator
- To be proud as an educated person

- To gain attention as a lecturer”
- To receive respect from prospective teachers
- To gain a fresh look on their current position

If pre-service teachers are satisfied about the process of mentoring throughout the assigned year, it is evidence for the success of the mentoring process of the mentor.

## CONCLUSIONS AND RECOMMENDATIONS

Considering the first objective of defining the role of a “mentor”, they identified their role as a supporter and a helper. In recent years, one day mentor training workshop was conducted for a group of assigned mentors by the college of education. As a result, mentors were confronted with difficulties to define the role of the mentor. Therefore, it is suggested that, at least a two day workshop with more activities should be planned and organized to inculcate the role of mentor.

The second objective of the present study was to identify how mentors gain benefits in mentoring. It is clear that all the participants gain some sort of a skills in teaching, learning process, such as the way of communication throughout the mentoring process. Mentoring supported mentors in different ways in their professional development. As it is a continuous process which extends up to a period of one year, they develop skills, attitudes and knowledge in teacher education to enhance their own professional development. The findings of this research would be useful for the field of teacher education as well. Further research can be conducted on the

leadership ability of the mentors through mentoring. In conclusion, it can be clearly mentioned that mentors gain benefits from mentoring for their professional development.

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## Factors Affecting Academic Performance of People with Visual Disabilities in the Tertiary Sector

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### ABSTRACT

The role of education in enriching people's lives is an undisputed fact. Most past studies have been conducted on the factors affecting academic performance focused on the sighted learners engaged in education in the academic systems. Given that the persons with disabilities are guarded/protected comparatively better in the Western world than in the developing nations, achieving academic goals for visually handicapped persons could be further challenging. This research is aimed at exploring the critical factors influencing academic performance of visually handicapped persons in Universities of Sri Lanka, a developing nation. Adopting a qualitative approach, eleven persons were purposely selected to represent varying levels of academic achievements in universities as case study subjects. The data collected through in-depth semi-structured interviews were analysed mainly through thematic analysis. Having a clear understanding of the key elements influencing academic performance of persons who are visually handicapped could make a significant difference to this community and is an eye opener for the policy makers in the tertiary education sector.

## INTRODUCTION

The estimates of WHO (2021) presents that there are more than 2.2 billion people having visual incapacities. Nearly half of them are severely impaired or blind. These individuals experience limited opportunities to excel in the academic arena due to their impairments. Much of the past literature conducted in developing countries show that education serves as a pathway to raise the standards of living of any kind of personality. This is equally true for the persons with visual incapacities.

Past research confirms that blindness of a person is not a barrier for learning. Spinath (2012) reiterates that problems of visually handicapped persons are not attributed to concerns of the cognitive domain. If that person is provided with the appropriate academic environment and tools, they could equally compete with the sighted counterparts. The social model of disability and the ICF model, in contrast to medical model, reconfirm this assertion that the disability of a person with impairments is attributed to the way the society reacts to his or her impairment (Kostanjsek, 2011).

The evidence from past literature on education of visually handicapped persons explains a range of factors affecting the academic progress including family background, encouragement and support, physical infrastructure, attitudes, type of education, ICT literacy, and English literacy. While acknowledging the significance of such factors, one can still explore the core limiting cause for the visually handicapped persons keeping in mind that the mainstream education systems are designed for sighted individuals. What matters may be the level of accommodation of persons with visual impairments in the academia for them to experience the knowledge acquisition and

their dissemination in the assessment process.

Focusing on the above gap in knowledge, the purpose of this study is to explore the critical factors influencing the academic performance of persons who are visually handicapped. The findings of this study will be useful to policy makers to acknowledge that the lives of persons who are visually handicapped could be empowered with education to enjoy a better quality of life, and thus to redesign the educational systems and approaches towards greater social inclusion of this disadvantaged community in the education arena.

This paper is organized into five sections, where the research approach is presented next. Results and discussion are detailed in section three. The conclusions and limitations are given last. Due ethical clearance from the academic authorities of the SLIIT university has been obtained to conduct this study.

## RESEARCH APPROACH

A qualitative study was conducted using informant interviews with eleven visually handicapped persons who have received university education in Sri Lanka. These were purposively selected as case study subjects to represent varying level of academic achievements. The profile of respondents consisted both male and female individuals between 20 to 45 age groups. The academic qualifications of participants varied from G.C.E (A/L) through to, graduate and Masters degree level. The data collection was mainly handled through in-depth, semi-structured interviews executed through telephone conversations. The participant's consent was obtained at the outset. Thematic analysis was used as the method of data analysis technique to identify the contributory and challenging

determinants of academic achievement. The findings of the thematic analysis were subsequently reviewed with Chairman of a leading social organisation representing visually handicapped graduates in Sri Lanka.

## RESULTS AND DISCUSSION

The thematic analysis focused on the respondent's perspective on academic achievement. Accordingly, several factors influencing academic performance were identified. The details of the analysis with supporting evidence are discussed in the next section.

### External support

Past studies highlighted several variables of external support received for persons who are visually handicapped from family, teachers, peers, and support from other parties.

One of the graduates who was totally impaired said:

*"Words cannot describe the support my parents and teachers gave for my education. They helped me by reading books and other study materials for me and many other ways.....*

*My father dropped me daily to the university by our car"*

A student reading for his master's degree said:

*"I got financial support from my parents. That was good. My friends' help was more useful for my work. They took notes for me specially about what lecturer said in the class. I could not see what he wrote on the board. You know our university is teaching for sighted people."*

It is observed that all the above facts have influenced academic achievement as these individuals had to undergo difficulties even though they receive support from different parties. These are also in conformity with Shahed, Ilyas, and Hashmi (2016) where the researcher has justified

the fact that people who are visually handicapped experiences difficulties and require external support to have effective/productive academic performance.

### Instructional strategies

At special schools and mainstream schools' educators use different techniques for effective accomplishment of tasks. As per the experiences of an Advanced Level student who learns at a blind special school said that:

*"My school used some effective teaching methods like geographical maps made from clay. It was helpful in clearly understanding the contents."*

According to one of the participants, not only in special schools, but also in main stream schools, the teachers have used various strategies in effective explanation of the contents focusing on visually handicapped students. However, according to the following statement by one of the participants, these kinds of teaching strategies are unavailable:

*"Teachers used different teaching methods because it was a special school. But when I started doing higher studies, it became very hard to adjust. All the lectures were held normally, and no special methods were used. So, I had to get my friends support."*

The relationship between existent teaching methods and students performance was proved to be positive and also negative (Maingi-Lore, 2016). It is in conformity with this study because in the participant's experience, the teachers sometimes have used their own strategies to educate children in schools, which had impacted towards academic achievement of persons who are visually handicapped.

### Physical infrastructure

Physical infrastructure is one of the significant dimensions for the visually handicapped, because a person who has visual incapacities constantly finds it

difficult to acclimatize with the facilitations. One of the undergraduates said:

*"Our school gave us special facilities like the science lab. It was a separate one, and it helped a lot. However, at the university, it was very difficult to adjust."*

As said by this individual, it is necessary for a visually handicapped student to have proper physical infrastructure facilitations since it assists academic performance. Yet, they have issues which make it difficult for them to adjust.

### **Deficiencies in resources**

Resources occupy an important position in a visually impaired person's life. For a person to reach a positive academic achievement, he or she should be catered with special resources as per their need. However, the results revealed that much of the existing resources in terms of materials, and educators are in dearth. Otyola, Kibanja, and Mugagga (2017) claims that visually handicapped students experience several challenges which impede effective academic performance. One of the totally blind undergraduates said that,

*"Some relevant books were not existent. Some books were not in the audio format. I could not type fast like others. I always need time without any restrictions for two or three hours."*

The educators expect all the students to be equally competent where the teaching strategies of the lecturers do not change to cater to a visually impaired person but only facilitate the sighted people. One severely blind graduate said:

*"We did not have a qualified braille teacher at school and other lecturers at my university did not use proper methods to teach me but only used pictures or white board which I found it so difficult to see because of my vision."*

The research findings of Dhara and Barman (2020) are also in conformity with the above finding, where they claim that the education needs to be equally equipped for all the people in an appropriate way which would ultimately result in achieving better academic performance.

### **Overview of the review**

As indicated in the methodology section, the findings of the thematic analysis were subjected to a review with the Chairman of a leading society of visually handicapped graduates in Sri Lanka. This individual himself is blind, a first-class graduate in sociology from the University of Colombo. He is in the 40-45 age range and is currently employed as a middle level executive in a government department.

Having accepted that the outcomes of the study are reasonable, he condensed his exposure and experience in the following manner:

*"...No need to reiterate that there are many challenges for blind people for realising their academic goals. Yes, there are many technical barriers related to academic processes, like inappropriate information sources and modes and providing information. Furthermore, the sighted community, both in the University and outside, must be empathetic toward our people."*

*To me...late Professor Wimal Weerakkody, of the University of Peradeniya, was the best example to show that blindness is not at all a barrier for reaching academic excellence. He was truly an exceptional international scholar, and I am aware that he has translated some famous Greek and Latin classics including the 'The Republic' by Plato to English."*

*Also, I can name at least eight to ten high achievers, graduated in the recent past. Some of them got super first classes, topped*

*the batch, in their own fields, like sociology, education, law, languages and education. We all had to overcome many hurdles. I can speak on behalf of our members... The most problematic is the study material and the way we are provided with information. If our people are given facilities, training on brail and computers, I am sure they can do much better."*

This insight explains the issues of the information and communication to and from the visually handicapped persons.

## CONCLUSIONS

This study reveals that there are several high achievers in the academic arena in several fields, of which some have even bypassed most other sighted colleagues confirming that blindness is not a barrier to academic success. Yet, even with this success, vulnerability of the challenges encountered by the visually handicapped indicates that education has to be equally equipped demarcating the necessary needs, accommodation of resources, strategies, and guidance for visually handicapped people. An appropriate academic environment should be provided for a person with visual impairment and blindness as their future is determined by education. Education is a key means of empowering this community. Providing the right training on modes of communication, brail and through the integration of computers and technology methods could be implemented to overcome current problems. The educational policy makers could use the findings of this study to strengthen the educational systems to accommodate their needs. The other stakeholders such as family members can also contribute towards effective academic achievements of this community.

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# **English Language & Literature**



## An Exploratory Analysis of Activities of Grade 11 English Language Textbook

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### ABSTRACT

This paper presents the findings of a survey that investigated the students' preference of the themes, lessons, and activities of the grade 11 English language textbook. The objectives of the study were to explore the appropriacy of the units, themes and activities and examine the role of the activities in improving speaking skills. A structured survey questionnaire was used to collect data in a non-experimental research design. We obtained our sample (n=207) from grade 11 students from 3 schools in the Colombo Division. Data were subjected to several statistical measures. It was reported that 83% of the students preferred the activities, but 17% reported that they disliked the activities in the workbook. 67.1% of the students reported the need for interesting activities. 62.3% of the students reported that they needed to learn English language grammar, while 60% of the students expressed the need for using technology for effective learning. One recommendation is adapting materials and activities to suit the current proficiency levels and preferences of the students. Using additional teacher-made communicative activities and adding supplemental speaking activities to support a balanced skills approach (BSA) are also suggested. A small sample contributed to low statistical power and limited generalizability of the findings. Limitations in statistical analysis and the non-representative sample reduced the generalizability of the results. Future studies involving a representative sample of students and a combination of quantitative and qualitative statistical measures are suggested.

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## INTRODUCTION

Textbooks play a role in learning and teaching. They contain instructional materials and teachers use them in the learning and teaching process as primary materials. Students, administrators, and learners are the consumers of textbooks and the uniformity of materials used in classes reflects the contents of any textbook. For two and quarter centuries, the English language has been in Sri Lanka as part of the Sri Lankan school curriculum, and every student is required to learn it.

Curriculum refers to the knowledge and practices in the subject matter in an area that teachers teach, and those students are supposed (and expected) to learn. A curriculum consists of a scope, or breadth of content, in each subject area and of a logical and achievable sequence of related concepts and activities for learning guided by intended learning objectives. The English language is a core subject in the Sri Lankan school curriculum and curriculum revisions always incorporate additions, deletions and modifications to the themes, units, and lessons from time to time. The curriculum revisions are done to align with the changing aims and objectives of education.

The textbooks provided by the government are a gift every student receives, and these textbooks contain lessons appropriate to the developmental stages<sup>1</sup> of students during the formative years. Textbooks accompany syllabi and in addition to them, various quality inputs are used to help students to learn English. Predicated on the principles of pedagogy, the lessons in the textbooks

are usually arranged in units and resolve around themes; materials that interest students to engage with the lessons and grasp the rudiments of the language are included. A scrutiny of the lessons of the grade 11 textbook indicates, that though the lessons have been intended to promote students' reading, writing, listening, and speaking skills in the English language, those lessons seem not to attract students to engage with the lessons.

Starting from *Our English Course* (1965), *English for Me* (1985), *English Every Day* (1990), *An Integrated Course in English for the A-Level* (1986), *World Through English* (1996), and *General English for A-Level Classes* (1999), the Sri Lankan school curriculum receives constant curriculum changes and syllabi revisions. Either experts with teaching credentials, professional qualifications, or materials, or writers with a background in curriculum innovation and change wrote those textbooks. Though a variety of textbooks have been used, the units, themes, and lessons in them tend to be either bland, uninteresting or beyond students' comprehension. Students' interest in learning English is dependent on many factors, for example.

Much of the complexity of English language education in public schools derives from the multiple levels of factors students have. Their volition, readiness, motivation, and the lessons may lead to boredom, disinterest, and discontentment. Lessons in textbooks, for example, should cater to all the proficiency levels of every student in every class, consider individual differences and invite personal

<sup>1</sup> Some educators contend that the lessons are either too easy or hard.

engagement; they should be relevant, interesting, useful, and innovative.

### **Review of literature**

Mukundan, HajiMohammadi and Nimehchisalem (2011) states that we need to evaluate textbooks as; the evaluation helps teachers or materials developers in making decisions on selecting the appropriate textbook. Ellis (1997) suggested *micro-evaluation* versus *macro-evaluation* in his study. According to Farrokhi and Saadi (2013), "the learners generally rated tasks and the teaching of speech acts as being highly effective in the learning of English, and they rated the language functions section of their textbook to be ineffective in this regard" (p. 2). They further contended that "these findings show that there are wide gaps between the Iranian learners' perceptions and the actual content of their textbooks (ibid. p. 2). Further to Cumaratunga (2012) the EFL learners are of the opinion that the absence of clearly defined objectives, the lack of suitable textbooks and a relevant methodology for teaching a second language, and no national guidelines for schools to follow" (p. 1) are reasons for the failure in the EFL education.

Ajideh (2014) emphasized that "textbook evaluation studies in Iran have focused on evaluating language teaching materials from teachers' perspective only" (p. 2).

Therefore, the importance of the investigating the perceptions of the EFL learners' about the textbooks and seeking their needs when studying English textbook for academic purposes has been given consideration. (Tawalbeh, 2018). Demir and Ertas (2014) also showed the importance of further carrying out further research related evaluation of textbooks, methods, and materials.

## **METHODS AND MATERIALS**

This study used a mixed-methods design, a combination of qualitative and quantitative dimensions of data collection<sup>2</sup>. A research team designed questionnaire was used to collect data from the sample. The questionnaire consisted of three sections (parts A, B and C).

Qualitative and quantitative data were gathered followed by structured interviews. The materials used in this study included semi-structured interviews and questionnaires. The questionnaire consisted of several questions and the students were asked to mark their preferences. The research team interviewed some of the teachers and learners to cross-check the validity of the responses. Some qualitative data were collected through semi-structured interviews.

## **RESULTS AND DISCUSSION**

The sample (n=207) included in this current study was derived from the Western Province in the Colombo Division. 67.1% viewed that having a clear explanation of the lessons they learn can be more effective. Following that, 62.3% of students reported that they needed to learn English language grammar, and 60% of the students expressed the need of using technology inside the classroom to have a better learning experience. Students were also inquired whether they liked or disliked the English language textbook and the reasons for their choice. Hence, it is evident that 83% of the students prefer the English language textbook, and 17% reported that they disliked the textbook.

Among the students who said they liked the English language textbook, 51% was female students and 49% was male

students, 61% agreed with the fact that the lessons that are included in the textbook were useful. 59% of students said that the textbook themes and lessons were useful. However, only 41% of the students said that the activities in the textbook were interesting. Though a small number of students said that they disliked the English language textbook (15% of students), the reason behind their disinterest was that some themes and lessons in the book were not useful to them. However, 11% of students expressed that the activities were not useful and 7.2% said that the book was very difficult to understand.

Students were of the view that there is a disparity between the standard of the O/L English paper and the types of activities given in the textbook. The four language skills are not given equitable weightage in the classroom making listening and speaking skills rather minimised or neglected as the main objective is to pass the written examination.

**Hypothesis:** Students like the activities in the grade 11 textbook.

A significant regression equation was found ( $F(1,201) = 14.800, p < 0.000$ ), with an  $R^2$  of 6.9%. The predicted results of students are equal to  $1.185 + 0.701^*$  (methods and materials used by teachers), where methods and materials used by teachers are: explaining clearly, teaching grammar, use Sinhala/Tamil where necessary, more pair work/group work, role plays, speaking activities, using extra learning materials, using technology, giving attention to students with low performance and giving extra guidance. The students' English language achievement level was measured by A, B, C, S, W passes. The students' English language achievement level increased by 0.701 with the type of learning/teaching

materials used in the classroom to teach English.

## CONCLUSIONS

It was revealed that some activities were not interesting, relevant, and innovative. It was also noted that more activities to improve the speaking skills were required. Furthermore, it was also noted that the students liked communicative activities that would improve their speaking skill. The students emphasised the need and necessity of including more communicative activities in the ESL Classroom.

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## Key Issues and Challenges of Lesson Materials: An Analysis of the G.C.E. Ordinary Level English Textbook

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### ABSTRACT

When examining the English Language Teaching (ELT) materials available in Sri Lanka, it could be said that most of them are alien and takes center-stage. As a result, in the process of language acquisition, students' own experience, contexts and life styles are devalued through under emphasis and trivialization; hence the sense of linguistic and cultural insecurity that the average student faces when confronted with English being reinforced. The objective of this study is to look at the appropriateness or mismatch of the teaching materials to the classroom context. This study employs the qualitative data analysis method and a textual analysis of the Grade 11 English textbook of both old and new syllabis done to examine the core language issues found in teaching material in a classroom context where English is taught/ learnt as a second language. Moreover, the G.C.E. Ordinary Level examination is deemed one of the key examinations that a Sri Lankan student has to face to fulfill the requirement of obtaining the minimal academic qualification. Hence, the study proposes that the English textbook designed for the Ordinary Level students should be designed in a way that would facilitate their second language learning process, and it looks at the extent to which that objective/ requirement is fulfilled through the selected textbooks.

## INTRODUCTION

This study examines the issues and challenges faced by teachers and learners when it comes to the use of Sri Lankan English in the local classroom context. A textual analysis of the G.C.E. Ordinary Level English textbook of both old and new syllabi is conducted to examine to what extent the lesson materials facilitate the language learning process of the users who learn English as a second language. The reason for specifically choosing the Grade 11 English textbook is because G.C.E. Ordinary Level examination is one of the key examinations that a Sri Lankan student has to face to fulfill the requirement of obtaining the minimal academic qualification.

Researchers have discussed the broader concept of World Englishes in the classroom and studies have been done on Sri Lankan English, English education in Sri Lanka, attitudes towards it, targets and standards etc. as well. Suresh Canagarajah, in his article *The Place of World Englishes in Composition: Pluralization Continued*, explores the possibility of using World Englishes in the classroom context, while also referring to the still existent inhibitions against it. Here, Canagarajah comments on the Metropolitan Englishes and World Englishes and how their uses differently approach negotiation within the classroom. The users of Metropolitan Englishes are reluctant to negotiate, but those who use World Englishes in classroom are always engaging in language games.

Canagarajah's writing is relevant to the topic that is discussed in this study, because he mentions how "WE is not tolerated in academic writing" or how "WE varieties are not given the same treatment because they come from multilingual speech communities" (Canagarajah, 2006,

p.603). At the same time he brings in examples to show how successful or practical it is to accommodate local Englishes in academic writing, or in general, in a classroom context.

In the book *Transforming Schools for English Learners: a Comprehensive Framework for School Leaders*, Debbie Zacarian defines challenges that schools face when teaching English in a variety of contexts. The author provides recommendations for creating effective and inclusive schools that can successfully educate and engage students of culturally and linguistically diverse backgrounds. Also, she provides suggestions to policymakers to create effective policies and to build an environment where an English language learner program can flourish.

When reviewing the scholarly sources that provide an overview to the selected topic, the article "Naduth Unge Baduth Unge" written by Arjuna Parakrama can be viewed as the only study that engages in "a symptomatic reading of the year 11 text" which was published in 1986 under the title "English every day" (Parakrama, 2010, p.86). Arjuna Parakrama has particularly selected the Year 11 text as it "represent[s] the culmination of 8 years of English teaching in the nation's schools, since the O/L marks the end of compulsory English within the system. English Language may justly be described as the single most important subject?? at the O/L, since it remains a pre-requisite for most private sector employment, as well as providing an entry requirement for admission to the Law Faculty and Law College and other professional courses" (Parakrama, 2010, p.86). Moreover, in this article, he examines English Language teaching and learning situation in the Sri Lankan context, the politics that operate

within it and the attitudes of language users towards the teaching/learning processes. In fact this study is greatly impacted by Arjuna Parakrama's reading of the Grade 11 text which was published in 1986. The recent publications of the same textbook have been selected with the intention of examining whether the situation has changed over time or it still remains the same. Parakrama engages in a critical analysis of the lessons or the components in that text to justify his argument that the teaching materials are not relevant to the context in which English is being taught and also shows how such lessons could further hinder the learners' ability to acquire the English language. As he argues, text books are designed to facilitate the urban elite community, therefore those are unrelatable to the others who belong to remote and underdeveloped community. Moreover, the author explores how a false added value is given to English, thus devaluing and ignoring the authentic Lankan experience.

Taking the aforementioned literature into consideration, this study discusses the appropriateness or mismatch of the teaching materials to the Sri Lankan English teaching/ learning classroom context.

## **MATERIALS AND METHODS**

A textual analysis of the Grade 11 English textbook of both old and new syllabi is done to examine the core language issues found in teaching material in a classroom context where English is taught/ learnt as a second language. The study takes a closer look at the contents of the selected textbooks (i.e. chapters, lessons, exercises etc.) to discuss their appropriateness and relevance.

## **RESULTS AND DISCUSSION**

### **Grade 11 Textbook – Old Syllabus**

This textbook has been prepared and distributed by the Ministry of Education and published by the Educational Publications Department. It has been written by a panel of ten writers. In "A Word to the Teacher" it is written that "teachers are required to build appropriate learning situations within the students' experiences to facilitate the internalization of language. Teachers should also realize that a language syllabus cannot be taught in watertight compartments from one year to the next; what a new text can do and does is to supply a different context to provide for novelty and innovation" (*English Pupil's Book*, 2007, p.vii). The textbook claims that "the texts are mostly 'home grown', drawing on the wealth of traditions, folklore and even the literature of the country" and it states that "this should certainly enable the students to feel at home and exercise their imagination in a foreign language-learning situation" (*English Pupil's Book*, 2007, p.viii). The textbook comprises eight lessons and it is to be examined whether the lesson materials included in this selected publication of the Grade 11 textbook fulfill the aforementioned mission of the writers, as it seems that the activities and components included in the text do not match the contextual realities and experiences that are familiar to the students.

The first unit titled "Relationships" begins with a reading passage on family bonds, and there is a reading that follows it, which is an extract from the novel *The Mill on the Floss* by Mary Ann Evans. To discuss friendship, the lesson incorporates an extract from William Shakespeare's play *The Merchant of Venice*, to discuss a father-daughter relationship, a passage on Kalidasa's *Shakuntala* is used and finally,

to present companionship, a story written by Pablo Neruda is used. When looking at these materials, Pablo Neruda's writing is the only piece of writing that seems contextually relevant. It could be said that this mix of materials is not quite appropriate as it is done with the presumption that every Sri Lankan student will have the same kind of access to the given contexts. Instead of achieving its objective of educating the students on the importance of bonds and relationships, which is in fact a very sensitive topic that should be carefully covered, this entire lesson confuses the whole idea of relationships, drawing examples from different Eastern and Western contexts.

In the second unit which is on "Culture" a sufficient amount of "culturally relevant" reading materials are provided; yet, it also comprises reading passages on Queen Victoria, Cleopatra and also an activity where students are expected to match the pictures of the statue of Zeus in the Temple of Zeus at Olympia in Greece, the Great Wall of China and the Big Ben with the appropriate descriptions. Even though the lesson unit is on culture, it does not really explore the cultural dimensions in the Sri Lankan context whereas it should have done so. Moreover, the lesson seems to be racist as it does not present information on an equal basis. The minority cultures are treated with less attention as more attention is paid to the Sinhalese culture. The lesson marginally focuses on the Hindu culture, yet there is a lack of information on the Christian and Islamic cultures. Cultural *differences* are highlighted through the characters in conversations [emphasis added]. The first role play in the lesson is a discussion that takes place between Kamal, Nizar, Geetha and Stephanie about the cultural festival that they are planning to organize at school. There too, Kamal, who represents the Sinhalese majority, is the person who

has "a broad idea about culture" (*English Pupil's Book*, 2007, p.32).

He is further credited by Nizar as follows. "I think Kamal will be able to clear our doubts in this field as he helped his sister with her project on cultural studies" (*English Pupil's Book*, 2007, p.32). In a context where the necessity of including the variety of Sri Lankan English in the local textbooks is felt, the given ideologies worsen the situation by highlighting the cultural and racial differences by prioritizing and promoting the ideologies of the majority.

In the unit titled "Health and Safety", there is a role play between the two students Subash and Vajira, which is again very superficial and distant from the Sri Lankan reality. An extract from the dialogue is given below:

Subash: Hello, Vajira. What a surprise! Come in.

Vajira: Thank you Subash.

Subash: Sit down. Can I prepare you something to eat? Some sandwiches?

Vajira: Er..no, nothing to eat. Thanks. I had milk rice for breakfast. I'm not hungry.

Subash: Then would you have something to drink? Orange juice? A cup of tea?

Vajira: Yes, perhaps an orange juice with some ice please. I'm quite thirsty.

(*English Pupil's Book*, 2007, p.66)

As it is seen, this scenario devalues authentic Lankan experience and calls for excessive formality which is not actually present in the ordinary day-to-day conversations that take place between people. It does not consist of any Sri Lankan thoughts or ideology that represents the variety; Sri Lankan English. There is a similar conversation in the fourth lesson unit "The Changing World", where a group of students engage in a discussion at a Provincial Level English Day competition. Given below is one such

evidence in literature to validate that the lessons are not designed in accordance with the linguistic realities in the Sri Lankan context:

Abdul and Sandra: Good morning, nice to see you this year too.

Upul and Uma: Good morning, nice to see you too.

Abdul: I heard that the competitions would start at eleven.

Sandra: At 11 o'clock! Really. That's too late, isn't it?

*(English Pupil's Book, 2007, p.87)*

Here, the excessively formal language that is used by the characters is obviously not a characteristic of a typical Lankan conversation. The use of the question tag "Isn't it" also suggests that the textbook relies upon the so called standard or the Western variety of English, or if specifically taken, the formal or the written variety, which is hardly used by the English language users in the Sri Lankan context. According to Suresh Canagarajah, "a classroom based on "standard" English and formal instruction limits the linguistic acquisition, creativity, and production among students [...] Classes based on monolingual pedagogies disable students in contexts of linguistic pluralism" (Canagarajah, 2016, p.592). This is the exact situation one could clearly see when it comes to the absence of SLE in the Sri Lankan English teaching practices and ELT materials.

In lesson unit six, there is a reading passage on "Satellite Communication". This lesson is fairly similar to what Arjuna Parakrama also highlights in his study of the Grade 11 text. Unit six of the English textbook that he has looked at also contains a lesson of similar nature, which is about computers. As Parakrama states, "it can be safely said that less than 5% of the students sitting the O/L would have ever seen a computer, much less used one at the time of taking this class. This entire

lesson would be a nightmare for someone who is unfamiliar with computers and computer technology" (Parakrama, 2010, p.90). In a similar way, this lesson on "Satellite Communication" makes matters worse. According to Parakrama, "(a) the contexts and the situations described in the text were oriented towards the elite, and were insensitive to the needs and experience of rural and underclass students (b) the focus and methods of teaching, including exercises etc., gave a clear message to the rural/underclass student that the English language was not for him/her" (Parakrama, 2010, p.92). It could be said that these lessons expect a certain kind of intelligibility from students who learn English as a compulsory subject in Grade 11.

Yamuna Kachru and Larry E. Smith claim that "although one's English proficiency is correlated with his/her ability to understand another person's communicating in English, cross-cultural competence is more important for understanding than grammatical competence" (Kachru and Smith, 2008, p. 68-69). Yet the issue in the Sri Lankan context is that the students do not share the same level of exposure with each other, depending on their socio-economic status and regional disparities. It can be said that the English teaching/learning in Sri Lanka has been a colossal and costly failure as it does not show any interest in adopting a homegrown variety of English that would facilitate the students' understanding and learning of English. Instead of initiating such a process, it holds onto the archaic standards and teaching methods that need major revisions. At the same time, the materials and teaching modalities used in the classroom as well as assessment structures are inappropriate and counter-productive.

### Grade 11 Textbook – New Syllabus

This has been written by a panel of five writers. In the section where the board of writers and board of editors write “A Word to the Teacher”, it is mentioned that “the textbook is designed to help the students to learn and use language in different situations locally and internationally” and the writers “hope” that they will be able “to make a difference in the lives of [the] students who are keen and enthusiastic to learn English” (*English Pupil’s Book*, 2015, p.vi). Yet it is to be explored to what extent this aim is fulfilled through this textbook and to what extent the English language learning process of the students in the Sri Lankan classroom context is facilitated by the content in the book.

The textbook comprises ten lessons. Lesson one, titled “Our Responsibilities” begin with a role play where “Vikum and Chamindu meet each other in the bus on their way to school”. The hypothetical dialogue that takes place between the two students seems to lack authenticity of the Sri Lankan experience. The two speakers Vikum and Chamindu are extremely polite to each other. For example, Vikum wants to offer his seat to Chamindu as the bus is crowded, which is a situation that would never take place in Sri Lanka, as in a crowded bus, seats are usually offered either to the disabled, old people, pregnant women or to men/women carrying small kids. However, the dialogue concludes with Vikum offering his seat to a pregnant mother. It can be said that the scenario which is used in the very first lesson of the book places on English an illegitimate added value that lies outside the realm of language use having devalued the authentic Lankan experience.

The second lesson titled “Facing Challenges” begins with a speaking activity where students have to match phrases such as water rafting, fall with

gravity, pole vaulting, parachuting, inflatable raft, skydiving, exiting etc. with the appropriate pictures. And the reading and writing activities that follow also ask the students to discuss and write about some “challenging activities/sports” that are not quite familiar to them. It could be said that such exercises distance the authentic Lankan experience from the rural non-elite students and favour the world view and values of the urban upwardly mobile upper/middle class.

The third lesson is about “Great Lanka”, which again ironically distances the Lankan reality from the students. The unit starts with a conversation that takes place between Kishan and his friends who meet at Kishan’s house to prepare a booklet on Sri Lanka for a class assignment. It is ironic that these students have to talk and find about their country just for the sake of doing “a class assignment”. Moreover, the conversation begins with Suresh and Kishan talking about a cricket match where “England has scored 23 for 01” (*English Pupil’s Book*, 2015, p.25). This shows how vague these examples are and how irrelevant they are to the actual context which the students are familiar with. In the same lesson, there is a brief description on Sigiriya which is presented with a picture in which the students can see a group of tourists riding on an elephant. A greater part of the description is about these tourists: “...There is a group of tourists riding on an elephant. The mahout who is on the elephant has a goad in his hand. The tourists seem to be enjoying the natural beauty of the surroundings...” (*English Pupil’s Book*, 2015, p.31). This description does not really educate students on Sigiriya, as nothing important or exceptional about the place is written there.

In lesson six which is titled “A Moment of Fun” there is a role play in which students talk about their annual inter-house drama

competition. The four dramas that will be performed are “The Caucasian Chalk Circle”, “The Christmas Carol”, “The Merchant of Venice” and “Everyman”. As Arjuna Parakrama in his study comments, “the difficulty of learning an alien language is made twice as difficult through this alien and alienating material” (Parakrama, 2010, p.88). The given plays are from the West and the ordinary rural students will not be able to fully comprehend such lessons as they are expected to think of a reality which is far away from their reality. Teachers will have to educate their students on these examples before continuing the lesson, yet it is highly doubtful if such practice is being carried out in the local English classrooms.

The rest of the lesson units also contain materials that are completely contradict Sri Lankan realities. For example, in lesson 07 there is a passage on “the last wishes of Alexander the Great”, in lesson 09, passages on “Crop Circles” and “Bermuda Triangle” that address the realities (as well as surrealities (?)) that are out of reach of ordinary Sri Lankan students. Hence, as Arjuna Parakrama states, “learning English not here learning a language that is legitimately Sri Lankan – in the technical vocabulary, an institutionalized variety – but learning a way of life that is at once *classist* and (neo)colonial in character, as well as discriminatory and alienating to those who do not have the “right background”” (Parakrama, 2010, p.92).

The students must have a particular degree of intelligibility to learn from the given materials, and that intelligibility would not be something shared in common or in the same percentage by every student, which proves the argument brought forth by Parakrama, that “...to a student who already finds the language difficult there are more debilitating factors that hinder and psychologically affect

his/her progress” (Parakrama, 2010, p.92).

## CONCLUSIONS

Taking into account the absence or the “disuse” of Sri Lankan English in the selected English textbooks, it could be said that these textbooks are not culturally appropriate, as they impose the culture of the western/inner circle countries in which they reflect the colonial views and attitudes. Due to this reason materials that are discussed in this study consist of several components outside the students’ range of experience and comprehension, the students’ acquisition of English as a second language (or sometimes a foreign language) will be made a difficult, impractical and unachievable task. Hence, as the need for a more localized variety of English is greatly felt, it is to be questioned why no attempt has been made to Lankanize the ELT material or at least to provide sufficient examples from the Sri Lankan context. This practice of distancing the reality from local students continues to take place, perhaps because ready-made materials are available in foreign-published texts and this makes the task of inefficient, unmotivated material-makers easy.

As given in Cecil Nelson’s *Intelligibility in World Englishes*, “As the status of English as a world language changes, and as the number of users of English grows, it is important to move beyond the traditional limits of language pedagogy and the assumption that all learners of English desire to speak one variety of English” (Nelson, 2011, p.82). As mentioned earlier too, the O/L English textbooks are designed for the urban upper middle class community and are insensitive to the others who belong to remote and underdeveloped community; therefore regional disparity and racism is visible throughout the textbooks. Further, the

focus and the methodology of teaching, including exercises and activities are targeted towards an urban upper-middle class/middle class community and they exclude the rural and underclass students, for these activities are not constructed based on the social context of the students.

To remedy this, materials with a familiar and culturally accustomed background would help and be more effective in teaching English language to a second language learner. As a result of the drawbacks that are clearly visible in the current English textbooks the outcome is a total failure as the students will learn the language technically just to pass an exam and not really with an honest intention of learning the language. It could be finally said that language is not entirely a linguistic entity. But it reflects a whole lot of a living society. Therefore the ELT materials, that are designed to fulfill the objective of facilitating the non-native learners' acquisition of English, need to focus on aspects such as culture, race, ethnicity, social classes and regional disparity, when teaching and learning English as a second language. If such measures are taken, it would benefit all students in an equal manner without making the process of language acquisition a difficult or unachievable task for some.

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## Needs Analysis in English for Specific Purposes (ESP): A Case Study of Human Resources Management (HRM) Undergraduates

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### ABSTRACT

Needs analysis plays a prominent role in designing curriculum, syllabus, and teaching and learning materials. The aim of this research was to define the English language needs of Business Management undergraduates ( $n = 124$ ) who are specializing in Human Resources Management (HRM). The data for this survey were collected utilizing a survey questionnaire and semi-structured interviews. The quantitative data gathered from the questionnaire were analyzed using SPSS whereas the qualitative data from the interviews were analyzed thematically. Results indicated that all the participants have understood the need of English in their academic and professional lives. Speaking was identified as the most important, yet the most challenging skill by most of the participants. Moreover, results showed that most of them possess adequate English knowledge. Though they identified the importance of English, 33.1% of the participants indicated that they can spend less than two hours per day to learn English. 56.5% of the participants were interested in learning advanced business English. Based on these findings, it can be concluded that analyzing learners' needs specially before designing ESP curriculum is very essential. The data obtained from this research are of relevance to researchers, instructors, and course designers to conduct future studies.

## INTRODUCTION

English for Specific Purposes (ESP) has recently gained prominence in teaching and learning contexts as several researchers have looked specifically into its nature and role. Robinson (1999) suggests that ESP courses should aim at providing students with their special needs in English. Munby (1975) defines ESP as a pre-specified and pre-analyzed English course in which all the materials are customized based on students' real life communicative needs and requirements. Savage and Storer (2000) suggest three questions for curriculum designers and instructors to concentrate on when designing an ESP course: 1. what do our groups of learners need to with English in their working environment? 2. What can they already do? and 3. What are the content areas which they need to talk and write about? Pre-exploration of the communicative needs of the participants, as Munby (1978) mentions, is essential since ESP courses demand the real needs of the learner. Therefore, administration of needs analysis seems indispensable for ESP courses.

Rather than teaching English according to what the teachers think their students need, it is essential to include the students into the process of decision making, taking their preferences and needs into account. The current development in the language teaching has changed the prevailing approach to curriculum development where Nunan (1999) mentions, "rather than fitting students into courses, courses should be designed to fit students" (p.148). It is evident that the focus is now on the learner and the needs, wishes, and goals of them have to be taken into account to make the students reach intended learning outcomes. Thus, a needs analysis is the foremost step to create a learner-centered curriculum. Hutchinson and Waters (1987) define needs using three

words: 1. Necessities, 2. Wants, and 3. Lacks. Brindley (1989) adds that needs are "the gap between what the learners' actual needs are and what should be taught to them" (p.56). Moreover, Al-Otibi (1994) describes analysis as exploring communicative tasks that are necessary to learn a target language. According to Jordan (1997), needs analysis can be interpreted as the process of diagnosing the learners' needs and organizing them based on their preferences. Thus, Taillefer (2007) states that the success of teaching and learning process of ESP depends on needs analysis. Added to that, Chamot (2007) mentions needs analysis can help learners adapt to the new learning system when their needs are recognized by the teacher.

There are various approaches to needs analysis. The most common approaches include Target Situation Analysis (TSA), Present Situation Analysis (PSA), learning-centered approach, sociolinguistic model etc. The present study considers Target Situation Analysis (TSA) and Present Situation Analysis (PSA) only. Out of those two approaches, TSA will be given more prominence. PSA is about learners' present language level and usage. PSA and TSA are interconnected since it is difficult to analyze target situation needs without present situation needs. Therefore, PSA and TSA will together discuss which methods should be utilized to create an adequate course for the participants.

It is noteworthy that when the specific language needs are not addressed based on language use, learners may end up being disappointed with their English language proficiency level once they enter the work place. Moreover, the efforts of English teachers would lack focus if the language needs are not identified in terms of language needs. Therefore, based on these facts, this study attempts to identify

the real language needs of second year Business Management undergraduates (n=124) who are specializing in Human Resources Management.

These participants followed a compulsory one year certificate course in English at their first year. They have a compulsory Business English course at their second year. Since they have studied English for one year at the university, it can be stated that they are aware of their English language needs. Based on this assumption, the researcher carried out this needs analysis with this group of students in order to identify their present and target needs which can be utilized in their future program.

This study aims to answer the following research questions.

Q1: What are the present language needs of the Human Resources Management undergraduates?

Q2: To what extent the current ESP courses offered at University of Kelaniya fulfil these needs?

Q3: What are the target language needs of the Human Resources Management undergraduates?

This study is based on an authentic analysis of learners' present situation needs and target situation needs. It also aims to provide empirical data about the different needs of Human Resources Management undergraduates and the use of English in their field, in return, can be utilized as an input to feed the larger structure of the ESP context of higher education in Sri Lanka

## **MATERIALS AND METHODS**

This section presents the research approach of the study and discusses the methods used to conduct the needs analysis. The participants in the present study were 124 second year Business

Management undergraduates who are specializing in Human Resources Management at University of Kelaniya, Sri Lanka. The sample was selected based on a convenience sample system. The targeted students were exposed to a one year certificate course in English at their first year of university career. This indicates that they were likely to be aware of their needs.

To achieve triangulation and thereby reach valid results about the needs analysis of the participants, the current study utilized two different yet interrelated instruments: a questionnaire and a semi-structured interview protocol. Brown (1995) suggests that in order to produce a stronger and more valid information gathering process, a variety of instruments should be used to conduct the needs analysis. According to Tashakkori and Creswell (2007), mixed-method which is a combination of both qualitative and quantitative measures offers multiple perspectives to examine a research problem, expands the understanding of a complex issue, and leads to better interpretation of the findings.

A structured questionnaire comprising 18 items was developed in order to collect quantitative data for the study. The first section of the questionnaire gathered personal information about the participants. The second section elicited their English learning experience. The next sections elicited their level of competence in English language proficiency based on a five-point Likert scale, their learning strategies, and interests and needs respectively.

The researcher has conducted semi-structured interviews with eight randomly selected students. The interviews were used to support and explain the results obtained from the questionnaire. The participants were asked four open-ended

questions to discover the present situation needs and the target situation needs of the participants. The semi-structured interviews were audio taped, transcribed and coded. After coding the data, the prominent themes and recurring ideas were identified which were later interpreted to draw meaning from it. Thus, the study applied thematic analysis whereby data gathered were categorized into themes and sub-themes so as to be comparable.

## **RESULTS AND DISCUSSION**

This section presents and discusses the results of this study. Part one presents the quantitative analysis of the first research instrument, namely, structured questionnaire. This part will cover participants' English language learning experience, perceptions of their English language proficiency, learning strategies, and their linguistic needs at the target situation. Part two is about the qualitative analysis of the second research instrument. Within this part, the importance of English for Human Resources Management undergraduates and suggestions for a practical ESP course will be presented.

### **Quantitative Analysis**

Quantitative data can be categorized under four subcategories.

#### **Undergraduates' English learning Experience**

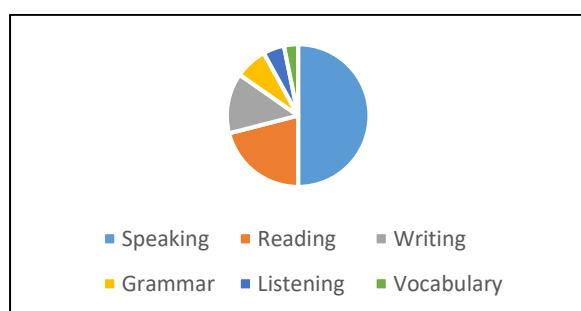
For the question "for how long you have been learning English?", 60.5% participants stated that they have been learning English for more than 15 years. In the Sri Lankan context, students are exposed to English since grade three and when they enter to the university, they have been learning English for at least more than ten years. However, though the situation is such, 4.8% of the participants

stated that they have been learning English for 5 years only.

When the participants were asked the reasons for learning English, three recurrent themes were identified from the responses; 1. English is important for academic purposes, 2. It is important for professional purposes, and 3. It is essential for communicative purposes. Most of the participants find English as a very important language where they talk about its "universality". In a recent research, Wijewardena, Yong, and Chinna (2014) support this idea by explaining the need of English in every sphere such as "social, political or cultural, and opened unmatched opportunities in every sphere, and the English language plays an important pivotal role of lingua franca in this uniting process" (p.138).

As the next question, participants were asked to mention the most important skill for them out of reading, writing, speaking, listening, grammar, and vocabulary. 50% found speaking to be important whereas 21% stated that it is reading. 14% identified writing as the most important skill for them. For 7%, grammar was the most important skill whereas only 5% found listening to be important. An effective speaker can gain the attention of the audience and hold it till the completion of his/her message (Qureshi, n.d.). Since the participants are HRM undergraduates who are dealing with humans, they might view speaking as the most important skill for them.

**Figure 1.** The most important skill

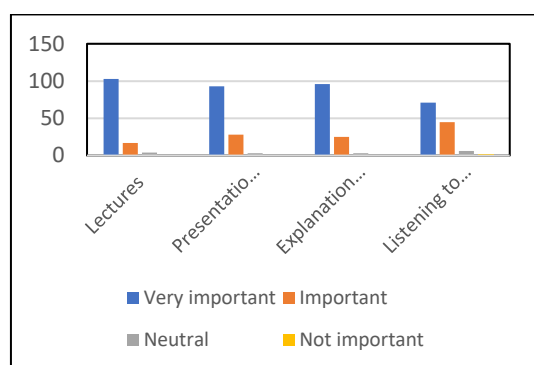


On the other hand, when they were asked to select the most challenging skill for them out of the above mentioned skills, 50% stated that it is speaking. Thus, the participants find speaking important, yet challenging. Though grammar and vocabulary are not main skills of English, 21.8% and 17.7% of the participants find it challenging. Receptive skills such as listening are given less prominence by the participants.

### Language Skills

As the next question, the participants were asked to identify the importance of listening skills according to the given situations. The figure below shows that most of the participants find listening important in lectures, presentations, to understand the explanations given by the lecturer, and to listen to their peers. This was similar for all the other skills. The participants' responses were based on the importance they give to each area in the given skills.

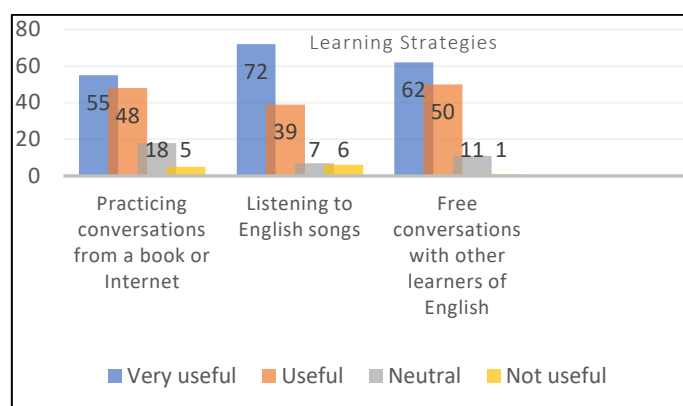
**Figure 2.** Importance of listening skills



### Learning Strategies

Under this category, the participants were given ten options and asked whether they have followed those strategies to learn English. After that, they had to indicate how important those strategies were in order to learn English. The first option was practicing conversations from a book or internet. 55 participants found it very useful and 48 found it useful. 3 participants stated that it was not useful to learn English. The second option was free conversations with native speakers. 61 participants found it very useful and 43 found it useful. 3 participants have selected the "not useful" option. 50 participants stated that free conversations with other learners of English is useful whereas 62 participants found it very useful. 45 participants stated that memorizing bilingual vocabulary lists is important whereas 47 found it very useful. According to the opinion of 9 participants, this strategy is not useful. 51 participants found studying English textbooks at home is useful while an equal number of participants found it very useful. Out of all the strategies given, using English movies to learn English was popular among the participants and 84 participants found it very useful.

**Figure 3.** Learning strategies



### *Interest and Importance*

The final section of the questionnaire was based on participants' interest and the importance of learning English. As the first question, they had to rate their skills in the given areas of business English; reading, writing, vocabulary, listening, and speaking. The options provided were almost perfect, adequate, need some help, and I am really struggling. 43 participants stated that their reading skills are almost perfect, 66 stated that it is adequate, 13 participants need some help with regard to reading, and 2 participants stated that they are really struggling. In terms of writing, 24 participants stated that their skills are almost perfect, 69 accepted it as adequate, 26 seek some help in the area of writing, and 5 participants are struggling with it. 20 participants claimed that their knowledge of vocabulary is almost perfect, for 50, it is adequate, 46 need help and 8 are really struggling. In terms of listening skills, 25 claimed that their skills are almost perfect, 74 stated that it is adequate, 20 need some help and 5 are really struggling. When rating speaking skills, 20 stated that their speaking skills are almost perfect, 42 stated that it is adequate, 48 need help, and 14 are struggling. Compared to other skills, speaking can be regarded as the skill which needs help and it is the skill that most of the participants are struggling with. Overall, it can be summarized that most of the participants need assistance in all these skills.

The next question focused on participants' opinion regarding English language. Out of the given options, 67% stated that English is a language with rich vocabulary. 47.6% accepted that English is a language where pronunciation is very important. 67.7% claimed that it is an amazing language to learn. According to 29.8%, it is a language with a lot of grammar. Although almost all the participants accepted the need of English in their lives, 12.1% stated that

they find English as a difficult language to learn. On the other hand, 4.8% accepted that English is a boring language to learn. It can be concluded that people have different attitudes towards learning English.

As the next question, the participants were asked the time limit they would like to spend in order to learn English. Yet again, though they understood the importance of English, 41 participants (33.1%) do not want to spend more than two hours to learn English. 48 participants (38.7%) stated that they would like to spend only two hours per week to learn English. The number of participants who would like to spend two hours per day is less than the other two categories and the percentage is 38.7%.

Finally, almost half of the population (56.5%) stated the need for a Business English course. 70 participants stated that they are very much interested in a Business English course whereas 36.3% are interested. Nine participants (7.3%) are not much interested in following a Business English course.

### **Qualitative Analysis**

Qualitative analysis of data included all the results elicited from the questions of the semi-structured interview.

### *Importance of English*

Question 01 sought their response about how important they thought English was for Human Resources Management undergraduates academically as well as professionally. All the participants believed that English is very essential for them and they provided following rationales for it.

- Their medium of instruction is English
- Their lesson materials and reading materials are written in English.

- They have to conduct research in English
- They need English to interact with the professionals in the field
- They need English to perform better in their jobs.

#### *Perceptions regarding the most important language skills*

The second question elicited the participants' perceptions regarding the most important language skill for them. Speaking was identified as the most important skill and they stated they need English in instances such as delivering presentations, participating in conferences, and asking questions from the lecturers and answering to their questions. Receptive skills such as listening and reading were given less prominence by the participants.

#### *Perceptions regarding the teaching of field-specific terminology*

Question 3 elicited participants' perceptions regarding the teaching of Human Resources Management terminology in ESP classes. Almost all the participants recommended that it should be included in English syllabus.

Through these results, the researcher attempted to identify students' present needs and future needs and came into conclusions based on that.

### **CONCLUSION/S**

From the research results, it could be drawn conclusions that analyzing students' needs especially before designing syllabus is extremely important. The needs would be the basic information to state the goals and objectives of learning. After that, the materials, teaching method and evaluation could be decided based on the learning objectives. After knowing the students' needs, it is needed to know students' problems before teaching.

A redesigned ESP curriculum for the undergraduate students of HRM is recommended, in which more attention would be devoted to the students' needs and wants. These needs are mostly related to an integration of skills together with especial attention paid to speaking. In addition, students' technical English needs, especially in terms of writing, have to be the main focus of the courses. At least one or more extra ESP courses could be added to the curriculum in order to prepare the students for their technical English and their future careers. Some extra-curricular courses could be offered at the university to satisfy the students' demands and to compensate for the existing inefficiencies due to the lack of time in ESP courses.

Contacting the students for interviews and managing time to include all of them in the schedule was one of the major limitations. Therefore, the number of the participants in the interviews decreased. In addition, if there was a chance and time to observe some of the English classes at University of Kelaniya, there would have been more appropriate and tangible data about what was happening in the classes.

However, these results can be useful for researchers, instructors, and course designers for future studies as well as to create learning materials and syllabi where the learners would find useful.

### **ACKNOWLEDGEMENT**

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## A Comparative Analysis of the Impact of Audiobooks and E-Texts on Comprehension in SLA

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### ABSTRACT

The objectives of the study are to assess the impact of the input derived through audiobooks and e-books on comprehension and the retention level in second language learners. Forty Engineering undergraduates in their first term at CEFR (Common European Framework of Reference) B1 level in proficiency were randomly divided into two comparison groups: E-Text Group (EG) and Audiobook Group (AG). Data was gathered via two parallel zoom sessions conducted at different intervals in the learning process. The participants were exposed to the short story: *The Lottery Ticket* by Anton Chekhov through an E-text (pdf) and Audio respectively. They were instructed to understand the context of the story under minimal teacher intervention. First, the students' general perception towards reading was examined via a Likert scale survey; afterwards, similar immediate tests and posttests were administered in groups via quizzes created in Google forms to check the effectiveness of comprehension. The findings showed that both the E-text and Audiobook modes have significantly improved student comprehension. While the mean of the E-text group was higher than that of the Audiobook group in both tests, the difference is not statistically significant in immediate and long-term retention. Neither of the modes has been demonstrated superior to the other at the immediate test and the post-test levels. Therefore, both E-texts and audiobooks of literary texts are recommended as supplementary material in facilitating students' comprehension and retention in Second Language Acquisition.

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## INTRODUCTION

Second language education aims to facilitate the learner in using the target language effectively through skill development in reading, listening and speaking in language classes. The former being receptive skills, Brown (2004) recognizes them as prerequisites for good production skills. Hence, effective methods to teach these skills have been a concern in SLA. Therefore, independent reading and listening could be suggested in literacy skill development. However, student engagement and motivation in the independent mastery of these skills have been the concerns in modern language classrooms.

Moreover, millennials are more increasingly interdependent on technology than prior generations and have developed a learning style that relates to their digital upbringing. As technology progresses and attitudes change in society, education should evolve rapidly to remain relevant to the digital literacy preferences of the future generation (Waite, 2018). Printed books have been replaced by electronic sources such as e-books and audiobooks due to technological inventions in tablets, smartphones, e-readers, computers, i-pads. Therefore, technology-infused avenues in literacy development in reading and listening: audiobooks and e-books have emerged, which could be used across all skill levels in the mastery of the target language.

The input of e-books and audiobooks could contribute to language learning differently. A digital equivalent of a printed book is known as an e-book

whereas an audiobook is a book that has been recorded in sound. It might be on a cassette tape, a CD, or an MP3 file. Hence, e-books provide visual stimuli whereas audiobooks provide auditory stimuli. Audiobooks are defined as adaptations from books, which are in origin published in the written form, either as print or e-publication or with a narrative layout. These books can be either fictional or non-fictional (Best, 2020). It has been found that students who thrive at the comprehension of sentences and the entire reading text (Perfetti, 2007) differ from listeners who build comprehension as they listen, and they frequently leave with a general comprehension of concepts (Absalom and Rizzi, 2008).

In addition, audiobooks and e-books have been the focus of extensive language research. Since the recording of books, audiobooks have been employed as a realistic intervention approach for struggling adult students (Gilbert, Williams & McLaughlin, 1996; Wolfson, 2008; Whittingham, Huffamn, Christensen & McAllister, 2013). Advantages of audiobooks include affordability, easy accessibility to resources and exposure to the auditory aspect of language through native speakers (Cartal & Simsek, 2017). On the contrary, e-books contribute to vocabulary development as they often enable definitions of difficult words, hence, the opportunity for rereading independently and to master the spelling of unknown words. In one of the studies, Stephen claims that e-books have motivated students in reading due to accessibility of accessories that support comprehension, functionality in providing

definitions and facility of note-taking (2012, as cited in Zeidler, 2015). Furthermore, multiple studies demonstrate the value of e-book reading for enhancing children's literacy abilities, particularly reading comprehension (Korat, 2009; de Jong & Bus, 2002; Grimshaw et al., 2007). E-books, according to many instructors and experts, assist in reading comprehension and literacy acquisition for both ordinary students and students with learning difficulties (de Jong & Bus, 2004; Korat, 2009; Shamir, 2009). Both e-books and audiobooks have positively impacted second language comprehension.

The current study analyzes how far audiobooks and e-books could contribute to comprehension in second language literacy skills development. Therefore, the primary objective is to assess the input derived through audiobooks and e-books on comprehension in a second language learner. The secondary objective is to examine the impact of input derived through audiobooks and e-books, on the retention of contents. Even though the impact of audiobooks and e-books in comprehension and literacy development in second language learners has been separately studied in previous research, the comparative effectiveness of these two input modes is an area that requires careful consideration. Therefore, the outcome of this research could provide guidelines in using audiobooks and e-books effectively as an independent mode of literacy development and also study how they could assist in teaching pedagogy in modern language classrooms.

## **MATERIALS AND METHODS**

### **The sample**

The participant sample consisted of 40 first-year undergraduates who follow a BSc degree in Engineering in a private university in Sri Lanka. This sample

included male and female students at the B1 level of proficiency in English according to the Common European Framework of Reference. The B1 class consisted of 40 students determined through a placement test administered at the beginning of the academic year.

The permission to participate in this study was obtained from the Faculty of Graduate Studies. Then, an Informed Consent Form was presented to the participants and their approval was obtained. The researcher detailed that participation was optional and the data was taken anonymously for analytical purposes. Subsequently, the selected sample was randomly assigned to one of the two conditions mentioned in grouping students. One group was assigned to the E-book Group while the other group was assigned to the Audio-book Group. These two Groups used the E-text mode and the Audio-book respectively. For referential purposes, groups will hereafter be introduced in the text as the (EG) E-text Group and (AG) Audiobook Group.

### **Materials**

The participants in the EG used a pdf based on the short story: *The Lottery Ticket* by Anton Chekhov whereas the participants in AG used the audio based on the short story: *The Lottery Ticket* by Anton Chekhov. The material was selected to match the proficiency level of the sample. Quantitative and qualitative data were collected through immediate tests and post-tests held individually at different intervals in the learning process. As the first step of data collection, a Likert scale survey was conducted in which students were examined on the perception of their reading skills, concern in reading and whether they found reading to be a gratifying pursuit.

Under these differentiated learning strategies used, both the classes received

the same testing materials during the immediate test and the post-test. Afterwards, students were given an immediate test which comprised of 9 multiple choice questions and one open-ended question based on the short story and the post-test consisted of 3 True or False questions, one multiple choice question and 4 open-ended questions based on the short story. Both tests were given marks out of 10.

## Method

Two parallel zoom sessions were scheduled for EG and AG groups to obtain data both at the immediate test and the post-test. Zoom links were emailed to randomly allocated participants in each group. The EG was given 40 min to read the pdf material while the AG group was given 40mins to listen to the material based on the short story: *The lottery ticket* respectively. Students were constantly monitored during the learning process to avoid disturbances. An immediate test was administered thereafter to verify the immediate comprehension level in each class through a quiz in Google forms. After instructions, data was obtained separately in EG and AG classes using separate links. Each participant was given 30 minutes to complete the activity after which the *Accepting Responses* option was disabled.

After two weeks, long term comprehension of participants in each group was obtained through similar post-tests conducted in each class. Each group was given separate zoom links to participate in the post-test assessment and the post-test was administered after instructions. Each participant was given 30 minutes to complete the quiz on Google form and data was separately obtained in EG and AG classes and after the stipulated time *Accepting Responses* option was disabled. Students were requested and monitored during the process to avoid referencing, any reading or audio material

related to the study. The results obtained at the immediate test and the post-test in EG and AG were subjected to an independent sample t-test to verify whether there was a statistically significant difference in comprehension levels under each mode.

## RESULTS AND DISCUSSION

### The results of the immediate test

Students were separately exposed to E-text and Audiobook mode based on the short story in respective classes and the following results were obtained concerning their comprehension under each mode at the immediate test (Table 1).

**Table 1.** Summary Statistics of the Immediate Test

Group	Mean	SD	Min	Med	Max
E-Text	6.6	1.46	4	7	9
Audio book	6.4	2.16	2	7	9

SD = standard deviation, Med = median

Results in Table 1 indicate that the marks of the immediate test in the E-text group varied between 4 and 9 with a mean of 6.6 and a SD of 1.46. The marks of the Audiobook group varied between 2 and 9 with the mean value of 6.4 and SD of 2.16. Furthermore, the median value in both classes stood at 7. It was noted that both modes have contributed to student comprehension of the text.

Moreover, an independent sample t-test was conducted to verify whether there was a statistically significant difference between the means of the E-text Group and the Audiobook group. The results of the independent sample t-test at the

immediate test are as shown in the Table 2.

**Table 2.** Results of the T-test

<b>Immediate Test</b>	<b>E-text Group</b>	<b>Audio-book Group</b>
Mean	6.6	6.4
SD	1.46	2.16
SE	0.33	0.48
DF	38	
T-Value	0.34	
P-Value	0.367	

Under the assumption of equal variances between two groups, the observed test statistic was 0.34 and the corresponding P-value was 0.367 which is higher than the standard significance level of 0.05. As the P-value (0.367) was over 5%, it can be concluded that the mean marks of the E-text group and Audiobook Group were not significantly different. Therefore, it is recommended that the E-text mode and the Audiobook mode have equally contributed to student comprehension in the context and neither of the modes has been demonstrated superior to the other.

### **The results of the post-test**

Post-tests conducted after two weeks aimed to determine the long-term comprehension among students who were exposed to E-text mode and Audiobook mode. The basic statistics of the post-test between the two groups are shown in Table 3.

**Table 3.** Basic statistics of the post-test

<b>Group</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Med</b>	<b>Max</b>
E-Text	6.42	1.63	3	6	10
Audio book	5.70	2.09	2	6	9

The marks of the post-test of the E-text group varied between 3 and 10 with a mean and SD of 6.42 and 1.63 respectively. On the contrary, the marks of the post-test

in the Audiobook group varied between 2 and 9 with a mean and SD of 5.7 and 2.09 respectively. The Median in both the groups stood at 6. Furthermore, an independent sample t-test was conducted to ascertain whether there was a statistically significant difference in the mean values in the E-text Group and the Audiobook Group. The results of the independent sample t-test are as shown below.

**Table 4.** Results of the-test for Post -Test

<b>Post Test</b>	<b>E-text Group</b>	<b>Audio-book Group</b>
Mean	6.42	5.7
SD	1.63	2.09
SE	0.37	0.47
DF	38	
T-Value	1.22	
P-Value	0.114	

Under the assumption of equal variances between two groups at the post-test, it was found that the mean marks of post-test between the E-text group and Audio-book group depict no significant difference (Test statistic = 1.22 and P-Value = 0.114). Since the P-value was 0.114 which is higher than the standard significance level of 0.05. Therefore, although the mean value of the E-text Group was numerically higher than that of the Audio-book Group, student comprehension under the E-text group has not been statistically significant over the comprehension under Audio-book mode. Furthermore, it was evident that E-texts (Visual) and Audiobooks (auditory), irrespective of their differences, have contributed to student comprehension of the context.

The application of the independent sample t-test both at the immediate and the post-test confirmed that although the numerical difference was higher among

students in the E-text group over the Audio-book Group, it was not statistically significant. Thus, the participants of both the groups have effectively understood the context of the short story irrespective of the differences in the visual mode (E-Text) and Audio mode (Audiobook). It is also noted that neither of the modes has been demonstrated superior to the other at the immediate test and the post-test.

## CONCLUSIONS

At present, due to the delivery of English language lessons online, the incorporation of electronic content for reading comprehension in SLA allows the learner to read the material while listening to it or execute each distinctly. The present research compares the two modes of comprehension: reading e-texts or audio texts, first via an immediate understanding of the text, followed by the level of retention of the same text, after 2 weeks. As per the present study, it is evident that both modes: reading e-texts and listening to audio texts, provide immediate comprehension of the content. The same indifference is noted when examining the students' retention of the text after two weeks. As the key findings of the study, there are no substantial variances on whether the text is read as an e-text or audio text. Undergraduates have comprehended the context regardless of the variances of the two modes. None of these modes depicts significantly effective over the other at both the tests conducted.

This finding also conforms to the study conducted in 2019 and 2016 by Leroy & Kauchak, and Rogowsky respectively. Leroy & Kauchak (2019) compared text versus audio for information comprehension with future uses for smart speakers. This study showed that information comprehension is very similar in both presentation modes (53% accuracy for text and 55% for audio) in the

multiple-choice questions. The second study which consisted of free recall questions showed that information retention is greater with text but similar in comprehension.

Moreover, in another study, one group listened to sections of *Unbroken*, a nonfiction book about World War II by Laura Hillenbrand, a second group read the same parts on an e-reader and a third group read and listened at the same time. Afterwards, a quiz was administered to verify their comprehension of the material. The findings revealed no important variances in comprehension between reading, listening, or reading and listening (Rogowsky, 2016, as cited in Heid, 2018). Therefore, it is noted that the current study conforms to the findings with these two studies which depict no significant variance in comprehension concerning audio and e-text modes.

Thus, in brief, it can be concluded that the reading comprehension and the retention of a text, among undergraduates, who learn English as a second language, occur irrespective of whether the text is being read as an e-text or as an audio text and thereby could be equally recommended for additional language support in Second Language Acquisition.

However, the findings of the current research could be validated by using non-fiction material and using a diversified sample of participants in the forthcoming studies. Moreover, the effect of each intervention is proportional to the amount of content, length of exposure and nature of the content which could be a limitation of the current study so as the sample size which impacts generalization.

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## Short Films: A New Way of Teaching and Learning English as a Second Language (ESL) On Digital Platforms

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### ABSTRACT

With the growing emphasis on developing 21<sup>st</sup> century skills among today's youth, the increasing access to networked technologies for encouraging them to become involved in online learning has become a major factor. Even during a global emergency, learning on digital platforms assumed a central role in the world's educational process. Lack of motivation, engagement, and interaction are the major challenges that teachers and learners encounter in online teaching-learning environments. This study presents a guide for English as a Second Language (ESL) teachers' interactions with learners using networked technologies. Thereby, the current study portrays short films as a new method of teaching and learning ESL on digital platforms. Semi-structured interviews with twenty ESL learners (aged 10 -17) and five teachers (both government and non-government) were conducted, as well as observations of five zoom classes were used to investigate perceptions of the use of short films in teaching and learning ESL on digital platforms, and to determine the best way to integrate short films into ESL remote teaching. The findings of the study indicated that the integration of short films in teaching and learning ESL had positive effects on both the teachers and learners. Further, the results demonstrated that short films can be used to foster not only linguistic competence but also interactional competence of learners. The study offers pedagogical implications for ESL educators to integrate short films in their remote teaching to improve the learners' language skills.

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## INTRODUCTION

Teaching and learning English as a Second Language via online platforms has become a new trend in the 21<sup>st</sup> century during a global emergency. Currently, the emergency of the COVID-19 pandemic, as a massive international concern, has forced educators to transform into online versions by reshaping education according to the digital learning environments. The transition from the traditional classroom to remote teaching provides a unique situation for educators in which they consider teaching as a challenge in order to the lack of learners' interaction, engagement and motivation in learning the language. It requires the need to adopt different learning strategies that help to carry out a curricular renovation where new teaching methodologies can be introduced to reach their learning objectives (Johnson and Johnson, 1999). Therefore, contrary to the traditional approaches to ESL teaching-learning, technology in today's world presents innumerable opportunities for the teachers as well as the learners. As a new method of teaching ESL remotely, the use of short films can be introduced, which has a great impact on increasing the motivation, engagement, and interaction of all the participants in the teaching and learning process on online platforms.

Existing literature points the importance of using multimedia to create a collaborative and more meaningful learning environment, in addition to the use of short films in teaching English as a Second language. Therefore, Berk (2009) explains the process a video undergoes in a student's brain facilitating his learning. As Berk (2009) emphasized, the process of integrating video covers

four core intelligence, as verbal/ linguistic intelligence, visual/ spatial intelligence, musical/ rhythmic intelligence and emotional intelligence. Furthermore, Donaghy (2014) indicates that the use of films is an excellent teaching and learning tool as it is motivating and enjoyable. In addition, it provides authentic and varied language along with a visual context, and it creates variety and flexibility in teaching.

Even though the scholars stress the use of short films in teaching ESL in the physical classroom, their use and effect in teaching ESL remotely has not yet been addressed. Therefore, the present study aims to promote the use of short films in teaching ESL remotely and also to convey its effect in creating and maximizing learners' motivation, engagement and interaction in learning ESL in digital environments.

Based on the aforementioned objectives, this study attempted to answer the following two questions,

- What are the ESL learners' perceptions towards the integration of short films in learning ESL on digital platforms?
- What are ESL teachers' perceptions towards the integration of short films into teaching ESL remotely?

## MATERIALS AND METHODS

To study the use of short films in teaching and learning ESL remotely, a qualitative approach was adopted with two triangulated sources as interviews and observations. First, five different types of short films (a short sequence film, animation film, silent film, feature-

length film, an advertisement) were given to five teachers and asked them to conduct their remote teaching based on those films. In fact, the five different films were used in the study to find out how a film can act not only as a springboard for follow-up tasks but also as a resource in the process to bring further variety to an online language learning setting.

### **Participants**

The participants were five government and nongovernment ESL teachers in Sri Lanka.

The participants were diploma holders and graduates in English. The ESL classes of three female teachers and two male teachers were observed. The participants were aged between 32 and 50 years old. Two teachers had more than ten years of experience in teaching English to secondary school students, and three teachers had more than five years of experience.

In addition, twenty Sri Lankan ESL learners from different age groups (aged between 10 and 17) also participated. According to the age of the learners, they belong to primary and secondary levels and all of their performances were observed during the class.

### **Data collection**

The information was gathered through two triangulated sources: interviews and observations. The observations were conducted via online zoom classes. The researcher observed five classes to explore how ESL teachers use short films in teaching ESL remotely and to study the students' reaction upon learning ESL using short films.

Furthermore, the teachers and students were interviewed to collect data

regarding their understanding of the real experiences of using short films in teaching and learning the language remotely.

Each interview took between 10 to 15 minutes and all were audio-taped. For the interview, six questions were designed to find out how and when the teachers used short films in teaching the language through digital platforms. Furthermore, considering the different levels of the learners, 10 students were randomly selected for the interview. The interview for the learners was designed with three questions.

### **Data analysis**

The collected data for the study was analyzed qualitatively according to the findings of the following interview questions and the online class observations.

#### **Interview questions for ESL learners**

1. Do you like to learn ESL on digital platforms? And why?
2. Do you like to learn ESL using short films on digital platforms? And why?
3. How does the use of short films affect your language skills when learning online?

#### **Interview questions for ESL teachers**

1. Do you have prior experience in teaching online?
2. What are the challenges that you have experienced when teaching ESL on online platforms?
3. Have you ever used short films to teach ESL learners in a traditional classroom?
4. Did you find any difference in teaching ESL with and without using short films?

5. What can you mention about the students' reaction to using short films?
6. What do you think about using short films to teach ESL on digital platforms?

Data from online classes were gathered by observing how the teacher taught the language using short films, creating interactions with various activities, and recording the learners' responses and engagement in the lesson.

### **The ESL learners' perceptions towards the integration of short films in online learning.**

The interviews were analyzed to reflect their perspectives on learning English remotely with the use of short films. All the participated students agreed that the short films made their learning effective and interesting, and they were motivated to engage in the lesson, which is a challenge when learning online. Three of the participants commented,

*S1: "the biggest problem I had in learning online is I feel bored to learn, but I think the use of films is the best solution."*

*S2: "watching movies helps to learn the language effectively and interestingly with many fun activities"*

*S3: "... than listening to teacher's explanations films motivates a lot to learn English".*

The participants revealed that the use of short films in their online ESL learning provides more opportunities to improve all types of language skills (speaking, writing, listening, and reading), including vocabulary acquisition.

*S4: "listening to the conversations between native speakers helps us to improve listening skills."*

*S7: "group discussions about characters, settings and events developed our oral skills,"*

*S5: "...reading the subtitles and later the scripts improved my slow reading ability."*

*S6: "films is the best way to learn grammar, because it shows real examples"*

*S8: "a great way to learn many new words and the film makes me remember all quickly than reading long passages."*

The learners found the films provided more opportunities to interact with others, even though they learn on digital platforms. Furthermore, they emphasized the interest in engaging the activities based on the film.

*S2: "... today's lesson was fun. We talked a lot than any other day."*

*S4: "I love to do group activities in breakout rooms. It is really interesting"*

The majority of the surveyed participants welcomed the idea of using short film to learn English remotely, as follows,

*S7: "Earlier, I hate online learning but now I really like to learn English in this way."*

*S9: "I really think this method is useful and it gives us more chances to use the language during the class."*

*S10: "learning with movies is fun. Every day I want to learn English like this"*

According to the findings of the study, the learners indicated that short films are valuable authentic materials for improving language skills as well as increasing the motivation of the learners which is much needed in the online learning environment. Further, the learners found themselves more interactive and engaged in the lessons with short films than with any other textbooks or learning materials. The

participants also reported that through the short films they were able to learn the language with the native speakers' accent and further they believed it may help them to communicate in a better way. Thereby, as Katchen (2003) suggested, the textbooks usually do not teach communicational and interactional skills; thus, movies can be an effective way to motivate learners to develop their interactional skills.

### **The ESL teachers' perceptions towards the integration of short films in online teaching.**

According to the interviews of the ESL teachers, it shows the use of short films is a good method in teaching English on digital platforms and a good resource for improving students' language skills.

*T1: "short films are a good method to create more interactions."*

*T1: "all were very active and responded very well"*

*T3: "it increases creativity and flexibility in designing activities and it leads to effective remote teaching"*

*T5: "it is interesting for all students and films to promote and foster learning as they cater for diverse learning and intelligences."*

*T2: "films offer great authentic materials and it exposes students to real use of language"*

The majority of the teachers responded that the major challenge that they encountered in remote teaching was students' lack of motivation, engagement and interaction. However, the teachers agreed that the use of films was the best solution to their challenge.

*T2: "my students are well motivated and engaged throughout the lesson doing written and oral activities"*

*T1: "they were so interactive and willing to interact with each other in group discussions"*

The teachers in the current study believed that short films can improve learners' language skills, vocabulary, grammar, fluency and pronunciation because they designed written activities such as fill in the blanks, cloze questions, summary writing and speaking activities such as discussions, presentations, conversations and listening and reading activities. Further, they felt that films create an actual environment with many interactions and engagements as they learn in a physical classroom.

*T4: "Students were actively involved in all types of activities based on the film than any other activities they did earlier"*

*T3: "majority liked to have group discussions via breakout rooms and most of them were willing to express their opinions and it stimulated their thinking and imaginations"*

*T2: "I think films help not only for language skills but grammar, vocabulary and pronunciation also, because I saw how my students learned a wide range of vocabulary and expressions and grammatical structures"*

Moreover, the use of short films in primary classes also affects the teaching and learning process effectively. As the teacher said,

*T4: "the film helped me a lot to gain my students' attention during the online class"*

When teaching a language for primary learners on digital platforms, lack of students' attention becomes a major challenge that most of the teachers encounter. Thus, as the teacher stated,

the use of short films can boost the concentration and motivation of all the learners. Furthermore, when a film is used as a warm-up, filler, or closer in a primary class, it encourages the learners to attend the class willingly and it causes them to feel better mentally and physically. Thereby, the surveyed teachers believed that short films should be integrated with the syllabus design and used in the online teaching environment. However, the drawback they mentioned was the selection of a film which is suitable for the learners' language level and their needs. Overall, the findings conveyed that integrating short films in ESL remote teaching was an effective pedagogical tool that can improve the learners' language skills in terms of speaking, listening, reading and writing skills and vocabulary acquisition, colloquial slang, pronunciation, fluency, accuracy and interactional skills.

As the scholars (Young, 1997; Burdman, 1998) identified the most noticeable condemnation of online teaching-learning environment is the complete absence of vital personal interactions, not only between the teacher and the learners but also among colleague learners. However, as Ismail (2013) conveyed, using films in teaching makes the class livelier and leads to more teacher-student discussions, as the current study identified.

## CONCLUSIONS

As a twenty-first-century skill, learning online becomes a central factor with the need of a guide for network designers who are concerned about the quality of online learning. According to the ESL

context, the integration of short films into teaching and learning on digital platforms can be identified as a new essential method that is considered significantly effective and addresses twenty-first-century learning goals. The results of the current study conclude that short films are a vital resource that can be integrated with remote ESL teaching to achieve effective goals by developing the learners' language skills. Further, the results convey that the integration of short films in online learning has significantly increased the learners' motivation to learn the language. The teachers stated that short films enhanced learners' participation and engagement in the lessons which have become major challenges in online teaching. Thereby, short films can be used as a method of using authentic materials as well as a pure source of enjoyment and entertainment.

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## Understanding Reticence and Ambivalence Towards Speaking English: The 'Problem' of Limited Capital Yielded by English in a Sri Lankan State University Context

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### ABSTRACT

The use of English for communicative purposes among Sri Lankan state university students has been a topic of concern for many decades as it has generally been observed that these undergraduates are either reticent or ambivalent in terms of using the target language (TL) for oral communication irrespective of their proficiency in the TL or the fact that they are enrolled in an English Medium Degree Programme (EMDP). This paper, having been informed by the contradictions implied above, offers a response to understanding the reticence and ambivalence towards speaking English through an exploration of the notion of 'capital' yielded by English in a state university context in Sri Lanka. This study employed a narrative case study with 5 first-year undergraduates studying for two profession-oriented EMDPs offered by one academic department. Through a discussion of the positioning of English in the context explained by three main themes, this paper highlights how English use is discouraged by the hegemonic sociocultural factors that are operative in the context whereby limited opportunities for the learners to use English that ultimately enable them yield 'capital' are provided. This paper concludes with an emphasis on how 'capital' has direct implications to investment in using English in the reality of a state university in Sri Lanka and a call to instigate institutional-level support to foster a supportive academic environment that creates legitimate opportunities for the learners to yield 'capital' in using English.

## INTRODUCTION

The use of English for oral communication among Sri Lankan state university undergraduates has been a topic of concern for many decades. Despite the general acknowledgement of TL use as part of the language learning process, English language learning and English language use in Sri Lanka can be referred to as two reasonably inconsistent phenomena. This is because the expanse of English language and learning does not necessarily mean the use of English for oral communication in the post-colonial setting of the country where English is surrounded by numerous socio-political and socio-cultural tensions, including the co-existence of English as a Second Language (ESL) and English as a Foreign Language (EFL) and English learners with socially deprived access and opportunities to learn and use English (Nagahawatte, 2016). While it seems that, in Sri Lanka, learners use English in the development of listening, reading, and writing skills, they are often identified as being reticent and ambivalent in terms of the speaking skills, irrespective of their proficiency in the TL. Further, notwithstanding the fact that there has been a rising shift from mother-tongue-based undergraduate education to EMDPs, especially in the fields of Science, Technology, Engineering, and Maths (STEM), the limited use of English among undergraduates still becomes apparent and the ELT field is often blamed for producing graduates who are unemployable in the corporate sector where English is typically the language of communication (Attanayake, 2007; Gunesequera, 2005). In such a backdrop, the status-quo regarding prospective graduates' English-speaking abilities becomes problematic and worthy of exploration through an approach that considers the socio-political and socio-cultural factors associated with English language use among the Sri Lankan

learners. A sociological approach to explore English language use is thereby based on an understanding of language as a complex social process founded on the approach that perceives language as "a set of ideologically-defined resources and practices constructs language as a fundamentally social phenomenon" (Heller, 2006, cited in De Costa, 2016, p.19).

In the backdrop associated with the sociolinguistics of English in Sri Lanka, English is known as "the language of the westernized elite", and a resistance to English could be identified in the linguistic landscape of Sri Lanka (Gunesequera, 2005, p.33). Theorising the term '*kaduwa*' (sword in Sinhala) used by non-English speakers in Sri Lanka to refer to the frustration and oppression they feel by English that excludes them, Kandiah (2010[1984]) notes how the non-English speakers were denied the opportunities to learn English yet were acutely made aware of the need for English for social mobility. However, in recent Sri Lankan scholarly work exploring English language learning and use, '*kaduwa*' projects itself with lesser degrees of strength and resistance attached to the term along with varied nuances (Ratwatte 2011; Widyalandara, 2009).

Furthermore, the use of English in Sri Lankan universities is highlighted by a distinction between the users of English and those who are not, 'us' versus 'them', creating a distinction with unequal power between the two parties, marked by English (Gunesequera, 2005). This difference holds currency within the so-called state university subculture which is a crucial aspect inhibiting the English use in the Sri Lankan universities (Nagahawatte, 2016; Wijesinghe, 2020). Driven by the fear of sustaining an upper elite social class inside the university, a

prohibition to use English (*'kadda'*, as it is colloquially referred) can be identified a key characteristic of the 'batch fit' which is colloquially normalised as what supposedly reduces the "feelings of isolation and homesickness of the students" (Wijesinghe, 2020, p.5). Inequal power relations between the junior students and the senior students that discourage the learning and use of English, viewing English as a subject and not as continual skill development, and involving in student politics are cited as key causes of the issue (Wijesinghe, 2020). Overall, this succinctly portrays the linguistic landscape surrounding English in Sri Lankan universities that forms part of the background of the present study, without an exploration of which a precise understanding of the many socio-political/socio-cultural complexities around English use in Sri Lankan state universities would not be possible.

The present study aims at exploring the problem of reticence (i.e., the state of being reserved and silent when having to use English) and ambivalence (i.e., the state of having mixed feelings or contradictory ideas about English and its use) towards English use through an exploration of the notion of 'capital' yielded by English in a state university context in Sri Lanka. 'Capital' (Bourdieu, 1977) as a construct views language as 'symbolic capital' which can be defined as resources available to an individual through accumulated prestige, honour, and recognition. It resembles the value accorded to a language within a particular society or culture and can be converted into economic and social capital. Capital also scrutinises how language learners gain or lose power as its value alters across time and space (Darvin & Norton, 2016). Norton (1995), developing Bourdieu's notion of 'capital', presents the construct of investment where she argues that "if learners invest in a second language, they do so with the

understanding that they will acquire a wider range of symbolic and material resources, which will, in turn, increase the value of their cultural capital" (p.10). Thus, investment explains how learners may be motivated to learn a language, but it is unlikely that the learners invest in the language learning process if the social and educational contexts of language learning do not provide them with equal positionings and improvement of capital (Darvin & Norton, 2016; Norton, 1995). All things considered, exploring how capital is yielded by English in the university context under study would pave the way to understand the learners' limited investment in using English exhibited through reticence and ambivalence towards the TL. This paper argues that, although the macro language ideologies of English as symbolic capital are still present in the societies, the capital associated with English in the context under study is extensively limited, which impacts the participants' use of English.

## **MATERIALS AND METHODS**

This study was carried out with 5 first-year undergraduates of two-profession oriented degree programmes offered by the ABC department in a leading state university in the Western Province of Sri Lanka. The context of this study was this university while the case was the student community and the sub-culture found around the ABC Department.

This study employed the narrative case study design to gain an in-depth understanding of the relationship between the participants and English language use in the research setting, to explore their reticence and ambivalence in using English, generally observed in the context under study. The participants were selected using purposeful sampling, combined with the two strategies of

intensity sampling and maximum variation sampling (Patton, 2001).

The data in the form of narratives were collected using identity portraits and narrative interviews. According to Yin (2003), interviews used in case studies are likely to be fluid rather than rigid and appear to be guided conversations rather than structured queries. In line with this idea, a consistent line of inquiry—"a conversation with a purpose" (Burgess, 1984, cited in Herath, 2015), was pursued throughout the interviews. Identity portrait is a form of multimodal approaches to the study of identity-associated research such as language profiles, linguistic practices and attitudes, and sociocultural identities (Busch, 2010) which investigates into "processes that influence language use [which] tend to operate unconsciously and cannot be easily verbalized" (Busch, 2010, p. 286). Data generated from both these tools were analysed using the thematic method of narrative exploration (Reissman, 2008).

## RESULTS AND DISCUSSION

The results of the present study are discussed under three main themes below, all centralized around the positioning of English in the context to elaborate how 'capital' as a key construct enables us to understand reticence and ambivalence towards using English in the context under study.

### **English use risking the 'social capital' by facing ostracising and not having friends**

The narratives of the participants chiefly highlight how using English in this university context has direct and overt implications to 'showing off superiority'. This socio-cultural environment in the context seems to be largely discouraging learners who are proficient in English to diminish their English speaker identities.

Melani, who is a self-claimed low-proficient English learner from suburban Western Province, sums this up:

The other thing is, within our batch, there's like this idea – this was there during the school times too – even we were sometimes like that – that when people use English, it is to show off, like, superiority ['ලොකුකමට']. So even a student who can speak English doesn't use it here. Even if such a student says a few words in English, others think that the particular student is trying to be a snob. But that may be the usual habit of that student. But others don't think like that. So, the chances to use English in the university are very low.

Melani's point is also confirmed by Anuja, a comfortable speaker of English also from the suburban Western Province, who claims that 'people look at you differently' if you use English in this context. This does not seem to be the social capital anyone would need, and his narrative also highlights how using English for oral communication in the university could attract 'unwanted attention' from people around them, that could even lead to facing 'certain problems', supposedly from senior students:

I'm generally comfortable to use English but, I'm comfortable only if the other person speaks English. Here, on campus, there's no push to speak English and people sort of look at you differently [if you use English]. I don't want people to think I'm showing off, so I try not to use English here. [...] I have seen people surrounding us look at us strangely when we use English here. There are students who are not bothered by it, but I am. If people notice you're speaking English, you experience some problems. A good example for this is Ab . Unlike me, she doesn't care what others think of her. So, because she speaks English freely,

she doesn't have many friends in the batch. Nobody really approaches her and she's usually on her own.

Both Melani's and Anuja's remarks clearly highlight the positioning of English in the context and how 'limited' social capital it truly yields in the forms of allowing English speakers to be targets of ostracising and marginalising. The examples of Anuja and Ab clearly manifest how students who are proficient and comfortable in using English are indirectly presented with two options: either to conceal their English speaker identities like Anuja does or to continue using English despite the contextual challenges and be ostracised and marginalised.

More interestingly, when posed the question "Would you use English if you could speak 'perfect'<sup>1</sup> English?", almost all the participants responded negatively, for which the explanation is summed up in Daham<sup>2</sup>'s answer below, clearly implying a strong link to English use and losing social capital in this context:

What I don't like is largely speaking English, then the others (friends) won't talk to me.

### **English use challenging entry to and membership of the community of practice termed 'the batch'**

The narratives of the present study shed light on how speaking in English could be a challenging factor to gain entry into and ensure the membership of the 'community of practice' (CoP) (Lave & Wenger, 1991) called 'the batch'. In this state university context, the participants were reading for profession-oriented degrees which stressed the alleged need to always maintain 'the batch fit', which colloquially refers to the fraternity among the members of a batch of students who enrol

in the same degree programme or academic department. In this context, the 'batch fit' had strong emphasis and the students typically make a stronger investment in state university student identities which generally conform to the hegemonic subculture that prioritises the 'batch fit'. These strong desires of 'inclusion' into the CoP of the batch, with a strong 'batch fit', stood up as a major reason for such distancing from English use.

Anuja, Dilmi, and Melani mention the high value placed on 'batch fit', for example, when they talk about how everyone of the batch is almost pressurised to be there for common social purposes such as events, student meetings, acting as 'one'. The use of English, which is generally perceived as a class marker, indicates a sense of division among the batchmates, as it categorises English-speaking and Sinhala-speaking students into two groups: the privileged and the disadvantaged. Thus, in a subculture where 'unity and oneness' are valued, this 'division' caused by English use becomes problematic. Ab sums up her experience:

All through the first semester I was frustrated by the people, even my own batchmates, who asked me not to speak in English or even to use any English words when I speak in Sinhala.

Ab's quote clearly highlights how even a student's own peers (i.e., batchmates) can apply pressure to discourage English use. In this context, such efforts can be identified as attempts to ensure there are no 'divisions' in the batch caused by English use and everyone in the batch is 'equal' and act as 'one'.

Furthermore, Dilmi, a self-claimed average-proficient learner of English from

<sup>1</sup> 'Perfect English' was a popular quote from the participants.

<sup>2</sup> Daham is a self-claimed average-proficient learner of English from the suburban Central Province.

the rural Southern Province, implies how gaining access into and maintaining the membership of the CoP of the ABC Department student community (of all years/levels) is portrayed paramount for newcomers:

Here everyone listens to the seniors. They have told us that we cannot get into a good job without their help. If you're from a well-to-do socio-economic background like Ab in our batch is, then you don't have to listen to the seniors. But the majority aren't from that kind of backgrounds, so they listen to and follow the seniors forgetting what's more important.

Dilmi's remark reflects the ubiquitous power the subculture has over the university students and highlights how it fosters a 'herd mentality' or a culture of dependence. It seems that the seniors have established their power over the first-years by making the latter believe that better employment opportunities will be secured with the 'help' of the seniors, and this ultimately might lead the first-years to interweave a substantial portion of subculture into their state university student identities. This depicts how their investment lies in the current social identities within their CoP which includes group solidarity but excludes English use.

### **English use being 'mechanical' within the mandatory academic practices**

In the present context, the students are sometimes required to use English for explicit utilitarian purposes centred around academic needs such as making presentations and facing viva voce. The narratives highlight that the students use English only when the context necessitates its use, for example, in academic presentations. Most of the respondents claim that they 'manage' their English in these occasions as the required amount of English use is specific and restrained, for example, memorising a few points in the

presentation slide and reading the rest from the slides. Such linguistic behaviour within the academic scope manifests how spontaneous communication in English is hardly called for even within the academic scope, depicting how limited capital it yields in the reality of the context under study.

More importantly, the narratives depict that the students use English 'if and when' everyone else uses it, for example, in activities that are called out in front of the classes. Mena notes how they still hesitate to use English, fearing if the lecturer may ask further questions and what their peers might think of them. She recalls how they would go to a lecturer with a question, and try to speak English 'collectively', until the lecturer most probably switches to Sinhala. These examples depict how 'mechanical' English use within the academic scope can be, and how the students strategically 'manage' those. Such 'mechanical use' and 'managing' of English clearly yield limited capital in reality, thereby, disallowing the students to invest in using English in the context.

Finally, it should not be forgotten that the socio-political and socio-cultural tensions surrounding English in the context such as noticing the English-speaking students differently, ostracizing and marginalizing them, considering them a threat to the 'batch fit' would not evade the language or content classroom where the students are required to speak English. Therefore, it can be argued that the limited capital English seems to offer to the students in the realities of the present context must still be present even within the mandatory academic scope and the students would still have fears of the socio-political tensions surrounding English and its use, even within the classrooms. This could also mean that such fears may even create conflicts with student identities and investment practices in using English.

## CONCLUSION

This paper aimed at exploring the problem of reticence and ambivalence towards English use through an exploration of the notion of 'capital' yielded by English in a state university context in Sri Lanka. The paper argued that, although the macro language ideologies of English as symbolic capital are still present in the societies, the capital associated with English in the context under study is extensively limited, which impacts the participants' use of English. English-speaking does not seem to be truly necessitated by the existing academic practices and thereby receive limited capital both inside and outside classrooms. The fact that the students who confidently use English are ostracised and marginalised also mean they risk acquiring social capital as not everyone wishes to be friends with the students speaking English. Thus, in this context, English use is subdued through the labelling and ostracising practices existing in the context which seem to be delegitimising, devaluing, and ultimately discouraging the use of English. This finally leads to projecting identities non-inclusive of English and concealing students' English-speaking-selves or identities, for one's sense of self is constructed by language and discourse (Norton & Toohey, 2001). This paper concludes with a claim that if the present context had a positive and much engaging academic culture, in place of its subculture, which may truly yield capital associated with English in EMDPs, English use would be authenticated and legitimised that the students would begin restructuring identities and investment to use English freely. Finally, my role as a lecturer and a researcher should be listed as a limitation despite the many precautions I took to evade its influences on the study.

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## An Exploratory Study of the Variance in Learner Conviction in Learning English Between Undergraduates of the Two Faculties

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### ABSTRACT

This qualitative research was carried out using a sample of 72, third year undergraduates from two faculties to explore the variance(s) in learner conviction in learning English between undergraduates. LC was explored under the themes of learner ambition, English as a medium of instruction (EMI), and English language teaching purpose. Learner ambition studied through the lenses of the Goal Orientation theory projected a disparity among those students. EMI which was compulsory at the faculties of Management, and a choice at the faculties of HSS, further led to a significant variance of learner conviction among selected undergraduates of the two fields of study. The purpose of teaching in the two types of faculties highlighted a clear distinction in the use of English for Occupational Purposes and English for Academic Purposes which concludes that the learner ambition, EMI and English language teaching purpose(s) were significant determinants in creating the said variance in LC among the selected students engaged in the two fields of study. The study asserts that while learner ambition is a personal factor that affects learner conviction, EMI is a means through which university policies can influence learner conviction. The English language teaching purpose, on the other hand, signifies how a curriculum can affect LC. It is suggested that policies and curricula for learners should focus around EMI.

## INTRODUCTION

The knowledge of 'learner conviction' is a decisive factor in teaching English as a Second Language (ESL), especially in teaching undergraduates. As such, two needs analyses were conducted with a sample of third year undergraduates of the faculties of Humanities and Social Sciences (HSS) and Management at a selected State University in Sri Lanka. A needs analysis equips educators to focus on the learning needs of students, translate the same into learning objectives, form a solid basis to further develop learning activities, teaching materials, assessments, programme evaluation strategies, etc. (Brown, 2009). The findings of the two needs analyses revealed distinct and interesting variances between the selected student groups of the two faculties, and this instigated the present study.

Learner conviction in learning English as a second language was herein identified as the central distinction between the samples of third year undergraduates of the two faculties selected. The authors herein identify 'learner conviction' as a learner's belief/opinion towards learning. The needs analyses also indicated that learner conviction was shaped by the following three predominant factors: English as a Medium of Instruction (EMI), learner ambition, and the purpose of teaching English; i.e. English for Academic Purposes (EAP) and English for Occupational Purposes (EOP). Universities in particular, teach English for Specific Purposes (ESP) which stems from the larger subject area of English Language Teaching (ELT). Hutchinson et al. (1987) observe that "ESP is an approach to language teaching in which all decisions as to content and method are based on the learner's reason for learning" (p.19). As

such, ESP which emphasizes on language appropriateness captures the varying needs of the learners. ESP is further branched into EAP and EOP. EAP refers to language skills that are primarily required to pursue higher education in the medium of English. As such, its primary objective is to educate learners on the linguistics and cultural realities of operating within the medium of English in order to use language appropriately for study. (Gillett, 2011) EOP, on the other hand, devices its teaching content to assist employment-related requirements. Accordingly, it provides higher emphasis on developing specific communicative needs. (Belcher, 2004) Thereby, the present study extended its scope and explored by virtue of a white paper the variance in learner conviction in learning English between undergraduates of the faculties of HSS and Management at two selected state universities in Sri Lanka.

The academic and practical importance provides substantial purpose for the present study. It helps identify fundamental differences between the two student groups, suggestions to improve the current syllabi to cater to the goals set by the curriculum and to obtain insight to develop the curricula of the four faculties under study. Moreover, the study also contributed to the existing body of literature on curriculum and material development in teaching English within the Sri Lankan tertiary education context, with specific reference to the faculties of HSS and Management. The antecedent to the present study indicated three predominant factors affecting learner conviction among undergraduates of the faculties of HSS and Management at two selected state universities in Sri Lanka. As such, the present study examined extant

literature on the role of learner ambition, the medium of instruction and the purpose of teaching towards establishing a variance in learner conviction in learning English.

Learner ambition was herein investigated through the lenses of the Goal Orientation Theory. Locke and Latham (1984) observe that goals are the outcomes that an individual aspires to achieve, as such, it is similar to a learner's ambition. English language learners pursue different types of goals. Ames and Archer (1988) claim that there are two basic goal orientations, or learner ambitions, such as mastery and performance goals. A mastery goal is oriented on learning and understanding something better; and it focuses on improvement. A performance goal is oriented on performing, and it focuses on being the best. These goals can further be categorized as approach - oriented goals and avoidance - oriented goals. In approach-oriented goals the learners focus on receiving satisfactory judgments from others, and in avoidance-oriented goals the learners focus on avoiding failure. Therefore, mastery approach goals focus on mastering learning; mastery avoidance goals focus on avoiding not-mastering; performance approach goals focus on outperforming others; and performance avoidance goals focus on avoiding failure.

The Medium of Instruction, on the other hand, has been a topic examined extensively by academics globally; (Ryhan, 2014) and English-medium instruction is increasingly becoming mainstream even within contexts wherein English has traditionally held a foreign/second language status (Dafouz & Camacho-Miñano, 2016). In the meantime, globalization has determined that English is a prerequisite for all business students in the 21st century (Oria, 2012). However, Vidanapathirana and Gamini (2009)

highlight two decisive issues that arise when decisions are taken to follow a second language such as English, as a medium of instruction - "the issue relating to the academic merits of teaching and learning in a second language at the tertiary education level and the equity implications of offering programmes exclusively in the medium of English in a country where many are handicapped owing to the lack of competency in the English language" (p.42). It is further highlighted how socio-political, psychological and economic implications aggravate this situation as "learners who are less proficient in English compete with others who have better English language skills" (p.42).

Previous studies in relation to the English language teaching purpose were considered under the themes EOP and EAP. Wijeratne (2015) herein claims that a key motivational factor for learners to learn English is their "extrinsic need to find jobs and well paying positions" considering how English is widely used as an international language across the globe (p.43). Further, Abeywickrama (2008) highlights how a majority of the G.C.E. Advanced Level learners are enthusiastic about learning English solely for the purposes of procuring employment. Therefore, the Sri Lankan English language practitioners face the daunting task of designing curricula to address the convictions posed by the learners. According to previous studies, ESP classrooms help learners accomplish varied goals across the curricula. In Leki and Carson's (1994) point of view, in such classrooms, the learner's needs at times continuously revolve around language issues, particularly around vocabulary expansion. Therefore, the course planners of EAP fixated language classrooms ought to consider all such needs in drafting teaching content.

In this light, the present study intends to fill this gap of exploring the implications of learner ambition, the medium of instruction and the purpose of English Language teaching towards learner conviction as a comparison between two distinct fields of study - HSS and Management. As such, it investigates as a white paper the variance in learner conviction in learning English between undergraduates of the faculties of HSS and Management at two selected state universities in Sri Lanka. Thereby the objectives of the present research are as follows:

- To study the manner in which learner ambitions affect learner conviction
- To explore how EMI shapes learner conviction
- To understand how the English language teaching purpose has a bearing on learner conviction

## **MATERIALS AND METHODS**

The scope of this study warranted a qualitative approach. As such, the authors utilized the research tools - in-depth interviews (approx. 30 minutes) and focus group discussions (approx. 45 minutes) that were recorded and subsequently transcribed. Both the above were conducted in the languages of Sinhala and English due to the limitations in language proficiency of participants and took an informal and conversational approach to ease the respondents and obtain honest feedback. Additionally, the questions herein were thematically organized in line with the objectives of the study, and the ensuing discussion included extractions of the interviews and discussions held.

The profile of undergraduates selected for the present study are as follows, all participants were third year undergraduates of the faculties of HSS and Management at two selected state

universities herein referred to as University A and University B.

Both universities are situated in urban contexts, while University A is within the proximity of the capital. However, the medium of instruction at both the faculties of Management are English, while the faculties of HSS offer the option to select between Sinhala and English. The English language facilitators at all of the above-mentioned faculties possess a minimum of a bachelor's degree in English as a subject. Both universities are equally equipped in terms of the resources available for English language teaching and learning purposes. Thereby, despite the geographical disparities, both universities share similar teaching and learning environs.

The participants were between the ages of 22 and 25, and the majority were from semi-urban and rural areas of the country with limited exposure to English. The majority were predominantly from the lower-middle class. Furthermore, their mother tongue was Sinhala or Tamil.

The study utilized focus group discussions as it is an economical and efficient method to both obtain data simultaneously from multiple participants as well as to verify the details obtained through the needs analyses further. As such, the authors conducted twelve focus group discussions; three per respective faculty representing all levels of English language proficiency, i.e. high/average/low. Each focus group consisted of four participants - two males and females respectively; out of which the mother tongue of one participant is Tamil. The questions herein were thematically organized in line with the objectives of the study.

Thereafter, semi-structured, one-on-one in-depth interviews were conducted in order to tap into individual biographies and to obtain extended explanations on the findings obtained through focus group

discussions. Accordingly, by way of a cluster random sampling method - which divides the population into groups and picks a random sample from each cluster (Ahmed, 2009), the authors selected six undergraduates each from all respective faculties understudy. They were selected as male and female who were representatives of all levels of English language proficiency equally, i.e. a male and a female possessing high/average/low English language proficiency. The mother tongue of 1-2 out of the six selected participants was Tamil. The questions herein were thematically organized in line with the objectives of the study. This method was utilized for data collection since semi-structured in-depth interviews offered the authors an opportunity to be flexible while obtaining a more holistic perspective on the matters discussed.

The researchers provided the participants with the relevant information of the study and a guarantee of privacy, anonymity, confidentiality, and the security of data and information whilst obtaining written consent prior to conducting the focus group discussions and in-depth interviews. The authors were also conscious of the fact that in the direction of the questions on language use it may cause the participants a sense of unease and therefore informed the participants that they may refrain from answering questions or withdraw from the study if they desired.

## RESULTS AND DISCUSSION

The discussion is outlined under each respective objective identified for the study. It synthesizes the findings of both focus group discussions and in-depth interviews in order to offer a clear and concise perspective on the objective explored.

### Learner Ambition

Firstly, the authors probed into how the learner ambitions affect learner conviction. Accordingly, it was highlighted that students entered university with multiple ambitions; i.e. to be good citizens, to serve the society, for prestige, etc. However, as they progress in their studies and mature as individuals, and as the realities of their lives set in; i.e. becoming the breadwinners of their families, having to take care of old and feeble parents and dependents, the urge to contribute to the finances of the household, etc., the ambitions narrow down to securing a stable and well-paid job. As such, their learning of English is cemented to their ambitions. Since the learner ambitions of the undergraduates of the faculties of HSS are diverse and are predominantly related to the government sector (Ex: Archeologist, Teacher, *Grama Niladhari*, Academic, Officer at a Ministry/District Secretariat), wherein Sinhala and Tamil are generally given first preference they are not decidedly keen on pursuing the study of the English language. The ambitions of the undergraduates of the faculties of Management (Ex: Banker, Business/Financial Analyst, Economics, Accountant, Marketer, Entrepreneur, HR Officer) however drive them to focus more on excelling in their study of the English language and acquiring job-related language skills; i.e. negotiation, presentation and communication related language skills. Therefore, in line with the Goal Orientation Theory, the authors identified that a majority of undergraduates of the faculties of Management took a mastery approach and a performance approach as they were interested in truly mastering the academic task - learning and understanding the subject better while demonstrating higher competence over others. A majority of undergraduates of the faculties of HSS on the other hand, displayed a streak of mastery avoidance and performance

avoidance as their interests were in avoiding not-mastering and failure.

The results and discussion on learner ambition conclude that it is a personal factor that has a strong bearing over learner conviction.

### **English as a medium of instruction**

Secondly, the authors explored how EMI shapes learner conviction. Accordingly, it was primarily identified that EMI was made compulsory at the faculties of Management whereas the faculties of HSS provided the option between Sinhala and English as the mediums of instruction.

The study highlighted that a majority of undergraduates of the faculties of Management did not accept EMI at first- "*Igena ganna wuna*" (I felt obligated to learn). They however gradually embraced it as they progressed in their studies and matured as individuals - "*Mawa isselama belaeena wuna wage danuna, habai watichcha lin katin ma thamai neh goda enna ona. Eka nisa kohoma hari karagena giya*" (At first I felt impotent, but later I realized that I must rise from the same place that I fell down), "*Mata nang epamawuna/ Maara widihata anuna habai passe passe godata ena widihath mekamai kiyala theruna*" (I detested it/ got really stuck, yet later realized that this was my only way out). Undergraduates whose mother tongue was Tamil found EMI as a relief and a bridge to the majority student population whose mother tongue was Sinhala. Therefore, unlike the rest, EMI encouraged their conviction to learn English from the First Year - "*It was a relief because everything in university was in Sinhala and this opened to us an opportunity to communicate better*".

The context of the medium of instruction at the faculties of HSS highlighted different issues and realities. Accordingly, it was noted that having the option of selecting Sinhala medium prevented a majority of

students from following EMI - "*English ehemama maga haruna*" (I lost the touch of English). As a result, as they approached their final years of study, a majority of students were under the prevalent opinion of being "*too late*" to studying English despite perceiving its importance. This has demotivated their conviction in learning English - "*English medium karapan kiwwata kare na ne; dan therenawa ai sinno ehema kiwwe kiyala. Habai parakku wadi*" (I didn't opt for the English medium even though I was advised to; and now I understand why my seniors advised so. Now it's too late), "*English medium kara nam kohoma hari kerenawane, dan ithin parakku wadi*" (Had I opted English medium, I would've managed somehow; but now it's too late). This highlighted how the students lacked guidance and remained both uninformed and misinformed as a result. Further, learning in the medium of English was not encouraged through the faculties' cultures themselves. Rather, it remained alien and was not clearly reinforced at any given point - "*Try ekak denna hithunath passe udawwak wath ganna kauruth nathi nisa sinhalen kara*" (I wanted to give it a try, yet again I was hesitant because I don't even have anybody to support me when needed), "*Sahenna hithala danna sinhalen kara*" (I thought it through and resorted back to Sinhala that I know). Moreover, a majority of the students also highlighted how the learning context of the university was not conducive to EMI - "*Mama hostel ne, ithin ahaganna wath kenek nathi wei kiyala bayak thibuna*" (I stay at the hostel. I was scared and assumed that I wouldn't even have anyone to get things clarified from). Meanwhile, the lack of awareness over the importance of learning English has led to regret for some students - "*Dan hithenawa English medium kara nam thava opportunities wadi wenna ida thibba kiyala - dan hema ekatama English oney ne*" (Had I opted English medium, more opportunities would've come my way;

because at present English is essential for everything), *“Issarahata English nathuwama ba... Oka kalin ehema meter wela thibbe na ne ithin. Dannawanam kohomahari mona hari karagannawa. Dan ithin English class hoyo hoyo yanawa”* (In the future, English will be indispensable. It didn't occur to me earlier. If it did, I would've managed to do something about it. Now I'm looking for English classes). The lack of information had also misled some others into believing that English is not important within the working sphere of the government sector - *“Mata asa teaching - ekata ithin medium eke awulak na ne”* (I love teaching, so the medium doesn't really matter). Thus, English language learning was predominantly restricted to the ELT classroom in the faculties of HSS - *“Igena ganna oney hinda igena gannawa - ehema loku kamaththak na”* (I'm learning out of obligation; there's no passion per se.), *“Igena ganna oney kiya kiya hitha hitha hitiyata eka wune na”* (I was thinking of learning, but never actualized it).

The results and discussion on EMI conclude that EMI is a means through which university policies influence learner conviction.

### **English language teaching purpose**

Thirdly, the researchers intended to understand how the English language teaching purpose impacts learner conviction through this section. As such, the researchers noted a clear distinction in the purpose of teaching between the two types of faculties. While the undergraduates of the faculties of Management related their purposes of learning to their future occupational goals, the undergraduates of the faculties of HSS related their learning to fulfilling course requirements - thus highlighting how the faculties of Management follow EOP while the faculties of HSS pursue EAP. Therefore, while the majority undergraduates of the

faculties of Management relate to the study as a personal obligation and a vital necessity for their future success, a majority of undergraduates of the faculties of HSS perceive it as an impersonal task that must somehow be completed.

Thereby, the results and discussion on the English language teaching purpose signify how a curriculum can affect learner conviction.

## **CONCLUSIONS**

The present study explored as a white paper the variance in learner conviction in learning English between undergraduates of the faculties of HSS and Management at two selected state universities. As such, it concluded that learner ambition, EMI and English language teaching purposes were significant determinants in creating the said variance in learner conviction(s) between the four faculties representing the two fields of study. While learner ambition is a personal factor that affects learner conviction, EMI is a means through which university policies can influence learner conviction. The English language teaching purpose, on the other hand, signifies how a curriculum can affect learner conviction. The authors suggest that policies and curricula for learners should be focused around EMI as it is a significant determinant in the variance of learner conviction.

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## Compelling Reasons for L1 Use in ESL Classrooms; a Study of the Perspective of Teachers in Schools of Kegalle

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### ABSTRACT

The use of the first language (L1) to teach English as a second language (L2) has been a subject of controversy over the years. The present study aimed to identify the reasons which compelled the teachers to use L1 in ESL teaching, based on teachers' perspectives. The primary data were collected from fifteen teachers, teaching grades 10 and 11, from six government schools of the education division of Kegalle. Data were collected through interviews and were analyzed using Thematic Analysis Method. According to the findings L1 was used to facilitate students with different proficiency levels, to facilitate students from low socio-economic backgrounds, to overcome anxiety related issues and also to facilitate the teaching- learning process by making it more efficient but with the ultimate motive of meeting the demands of the authorities to make the students pass the O/L examination. According to the study, the teachers' insufficient knowledge in ELT methods is one of the major reasons that compelled the use of L1. According to the study the teachers do not always use L1 for accepted reasons in literature. For them, it was not a "strategy" but a last-minute "option". It was clear that the education authorities have a great responsibility towards the ESL teachers, to give them necessary methodological, strategic knowledge in pre – and in-service training. The exam-oriented mindset should be changed starting from higher officials. Further classroom realities such as learner diversity should be taken into consideration in making policy guidelines and making improvements in the sector.

## INTRODUCTION

Even after years of research, the use of L1 (First Language) in the ESL classroom remains a controversial topic over the world and remains to be the same in Sri Lanka. In the Sri Lankan education system, English is taught as a second language and a main subject from grade three to thirteen. The researcher believes that the use of L1 is a matter to be further investigated, firstly since there is a lack of research on the topic in the Sri Lankan context, secondly since the proficiency levels of the students being unsatisfactory after almost thirteen years of English education. Hence, the research aimed to identify the reasons which compelled the teachers to use L1 in ESL teaching, based on their perspectives.

Some researchers have established the notion of adopting only the target language to teach English as a second language. For instance, MacDonald (1993) argues that students are motivated when they are exposed exclusively to the target language as it helps them to understand the practical benefits of TL

In contrast as argued by many others such as Blackman (2020), use of L1 could be recommended for the task. According to him, once a learner passes the critical stages of language acquisition, he will naturally have a greater depth of thought in L1. Denying the use of L1 could limit the ability to translate and transfer these thoughts to L2. Further, the reasons for using L1 could vary according to distinctive learner needs. De la Campa and Nassaji (2009) conducted a study with two instructors teaching German at a university in Western Canada and found them to be frequently using L1 for pedagogical and social reasons. Atkinson (1987) lists the appropriate uses of L1 for the L2 classroom such as eliciting language, checking comprehension, giving

complex instruction to basic levels etc. Auerbach (2016) identifies the following uses of L1; classroom management, language analysis, presenting rules that govern grammar, discussing cross-cultural issues etc. Miles (2004) conducted two different experiments which revealed the use of L1 to foster confidence. Thus, it is evident that the use of L1 depends on the need of the learners as well as the circumstances in the classroom.

Yet according to Tang it is the “limited and judicious” use of L1 that “does not reduce students' exposure to English”, but rather would “assist in the teaching and learning processes” (Tang, 2002). Thus, according to literature L1 could be employed to enhance L2 learning, yet only if it is used with a limit and judiciously (Tang, 2002).

## MATERIALS AND METHODS

A total of fifteen ESL teachers, teaching for grade 10 and grade 11 classes (students aged between 15-16) of six different government schools in Kegalle education zone participated in the study. The schools were selected according to the convenient sampling method. All the schools are provincial schools (as categorized by the Ministry of Education). The participants were all female and aged between 23 and 31. They had teaching experience varying from 1 to 6 years.

The primary data were collected through semi-structured interviews conducted over the phone of which the duration was from 15 to 20 minutes. The calls were recorded and later were put to paper. Data were analyzed using the Thematic Analysis Method. Secondary data were gathered through books, eBooks, websites, articles, and research papers.

## RESULTS AND DISCUSSION

This section is organized under separate themes which became visible from the analysis of data.

### **Catering to all the students in the classroom with different proficiency levels.**

73.3% of respondents stated that they use L1 to cater to students with different levels of proficiency in the same classroom. The followings are excerpts from three of the statements given by the respondents regarding the matter at the interview.

*"There are students from all levels. So, to cater to everyone we use Sinhala also...If we use exclusive English without thinking about the learner level that will not be effective to the majority."*

*"In my class, we have both good and bad students...they are different. Some of them easily follow me and most of them don't. If I use only English, the poor students might not understand the lesson, and only the ones who are good at the language would"*

*"If I don't use Sinhala at least a little, it would be hard for some students because not all of them are equal in their language knowledge."*

According to the data it was clear that the teachers had a sufficient understanding of the differences in language proficiency of the students who are in the same classroom and of the fact that despite the differences, she needs to cater to them all. The practical realities of the classroom have urged them to find ways on their own to deal with these differences. Thus, to cater to students with different levels of language competency, they incorporate L1 to their teaching. As reflected from the findings the reason for employing L1 into teaching is a result of lack of ELT methodology, a crucial part of teaching

and not for the acceptable reasons explained in the literature.

### **Addressing the students from a background of lower socio- economic status.**

According to the teachers, most of the students come from rural and suburban backgrounds. Thus 60% of the teachers stated that they use L1 to facilitate the learning process of these students considering their socio-economic background. The followings are few excerpts from the interview related to the issue discussed here.

*"Yes we use Sinhala too. Our school is in a village. Therefore if we use only English, they will not understand....most of the students come from such families that do not have good jobs and money. They have no exposure to English..."*

*"Well, the students in our school actually come from poor families. I mean most of them. I have met their parents and they do not seem to know any English. I am sure that the children are not getting any help from their families to improve English. They are not bilingual at all. Without using some Sinhala it is hard to make them understand the lessons."*

*"The students are coming from different backgrounds. Some of their parents might have some knowledge in English but I am sure most of them do not. So, the exposure that should come from their family, they do not have it. If we use only English they will have a really hard time understanding what I say. If I add some Sinhala, they easily follow."*

The teachers have made an effort to use a "humanistic approach" which takes the "emotional wellbeing" (Drew, 2019) of the student into account. Further according to Atkinson, student's background is an important aspect to be taken into

consideration when employing L1 to teach L2 (Atkinson, 1987). According to the data the teachers have understood the importance of planning their teaching styles and methods according to the different contexts students are coming from. Thus, L1 is used to facilitate these students.

The teachers further stated that since they do not come from “English speaking backgrounds”, they find it difficult to make the students achieve the desired level of proficiency in language. Thus, they use L1 to facilitate these students. Apparently, the teachers believe certain amount of language knowledge should be brought to the classroom by the student from the background and this entry level English language proficiency is essential for them to achieve the target level of competency. This lack of competency caused by the socioeconomic background compels them to use L1 in their teaching.

#### **Using L1 for Primary classes resulting in detrimental effects on the L2 learner.**

According to the respondents, the teachers of primary classes have been using L1 for a long time to teach English. As they believed that, if the learners were already exposed to an environment that used English exclusively when they come to secondary classes they find no difficulty in it.

*“In primary classes, the students get used to English easily, but in higher classes it is difficult. Therefore, we should make them get used to a setting which uses only English starting from the primary classes.”*

*“This is the way they are used to do things since they were in primary classes. So, I cannot suddenly change everything. If I do they will get scared. Therefore, I am using a little bit of Sinhala too. But I think if the primary class teachers used only English things will be different...better.”*

According to the excerpts if the learners were exposed to an environment which used English exclusively, since they are already used to it, when they come to secondary classes they find no difficulty in it. Since this has not happened the teachers have chosen to continue incorporating L1, the way they are “used to” doing things. Accordingly, as the respondents believed that primary classes should be the starting point to make the students get used to a total immersion. This could further be related to the “Critical Period Hypotheses” (Lenneberg, 1967). These ideas also might have been aroused from methods such as “Total Immersion” which advocate instruction only in target language. Hence according to the respondents it is important to give full immersion to the students in the TL during their critical ages of language acquisition for successful acquisition of TL.

#### **Facilitating the O/L exam.**

According to the majority of the respondents (80%) L1 is used to meet the authorities’ demands of making the students pass the exam “somehow”. Thus, the teachers follow any strategy that they feel would suit the purpose, and L1 too is one of them. The followings are some excerpts from the interview.

*“If we want them to pass it is essential that we use Sinhala so that at least the ones who are working can pass. Otherwise they will just get tired and give up...Besides we have to get them practice quickly, covering syllabus, doing papers and all that. We have very week students; I am talking about my school, in other schools it may be possible”.*

*“If we are going to use English only, even to explain the meaning of a word it will take lot of time. But we have the exams also no? I use a little bit of Sinhala to explain sometimes because it is quick. It saves time and effort both.”*

The issue here is the teachers are not using L1 for the accepted purposes. This shows how being exam-oriented can have a detrimental impact on the teaching-learning process. According to Cook (2010) there is no harm in L1 use if it is used as a facilitator to increase the efficiency of the teaching learning process. This shows that use of L1 can save time and effort. Yet there is a question whether this is the right attitude a teacher should have about teaching learning process and also about selecting the appropriate teaching methods and strategies.

### **Addressing issues related to anxiety.**

53.3% stated that they use L1 to lower the affective filter, creating a low anxiety learning environment with motivation.

*"When we incorporate Sinhala they don't become alienated."*

*"If we use totally English some students appear to be just watching with confusion. When I switch to Sinhala they respond."*

*"When I use Sinhala to explain things they actually show some enthusiasm and try to understand what I said, try to continue. But when I use only English I have felt that they are kind of ... they get confused, scared and they stop trying to respond, they just sit and stay without telling anything. Only few students respond."*

According to Atkinson the students who are less proficient in L2 tend to have more and more issues related to anxiety compared to the proficient students (Atkinson, 1987). According to Harbord employing L1 can help overcome these anxiety related issues (Harbord, 1992).

### **Using L1 not as a strategy but since there is "no other option".**

80% of the respondents stated that they do not agree with the use of L1 but they use it since there is "no other option".

*"If they are really good at English I will not use Sinhala. But I have no choice. We don't have an option other than using Sinhala".*

*"We must recommend use of Sinhala to a school like ours because they are very... very weak. If they don't understand anything, no point no..."*

They believed that the correct method is the exclusive use of English. This shows a serious lack of knowledge of ELT methods. They do not view the use of L1 as a strategy at all.

Despite the guilty use of L1 the limited use of it where necessary was in the policy guidelines. In the Teacher's Instruction Manual published by National Institute of Education in 2009, it is stated that *"...target language should be the language of the classroom and mother tongue could be used sparingly, where necessary to make meaning clear..."*

Despite research which suggest that the use of L1 to be considered *"no longer the doctrine of compromise"* but *"acknowledged as a pedagogical tool"* (Atkinson 1987; Harbord 1992), the authorities are still not open to the idea of using L1, thus there are no policy guidelines yet, which advocates using L1 as a tool in Sri Lankan education system.

## **CONCLUSIONS**

According to Tang, "limited and judicious" use of L1 "does not reduce students' exposure to English, but rather can assist in the teaching and learning processes" Tang (2002). This means though many studies have shown that L1 can contribute to acquiring a second language, it could happen only if the teachers use L1 for accepted, justifiable reasons in a "limited and judicious" manner. According to the findings of this study, the situations and reasons which compel teachers' use of L1

are vastly varied. As data suggests, L1 is used to address the students from low socio-economic backgrounds and also to lower the affective filter. These reasons are justified and accepted in much of the literature. Yet the rest of the reasons found, appear to be questionable and need to be taken into account as serious issues. As data suggests L1 is used to cater to students with different competency levels who are studying in the same classroom. How far is this justifiable? As it appears more than as a strategy, the teachers use L1 because they lack the knowledge of ELT methods. L1 is further employed because the students are not "used" to a setting that operates exclusively in L2 because L1 has been always incorporated into teaching ever since they joined primary classes. Therefore, the teachers have concluded that they should continue in the way they are "used to". Another shocking revelation is using L1 to facilitate the students who are taking up the GCE Ordinary Level exams since they are forced by the authorities to make the students obtain good scores despite the methods used as long as they can make it possible. This revelation is a reflection of the mindset and the attitude the teachers and authorities have towards education which proves to be exam-oriented. And finally, they are employing L1 since there is "no other option". This was another important revelation and requires further investigation. This shows a serious lack of ELT methodology.

These reasons for using L1 arouse the question of whether the teachers are using it for the advocated and accepted reasons in literature, like Tang suggest, in a "judicious" manner. They do not see it as a "strategy" that could be taken use of to facilitate the process.

The aforesaid highlight the fact that the government and the education authorities have a great responsibility towards the

ESL teachers to give them necessary methodological, strategic knowledge for teaching, and adequate knowledge of policy guidelines. Both should be updated. Thus, the quality of pre – and in-service training should be ensured and improved. The training should address the domain of attitudes and mindset towards the teaching and learning process. The exam-oriented mindset should be changed from the top to the bottom, starting from the higher officials of the education sector. Further the learner diversity, especially in terms of their socio-economic background has not yet been taken into sufficient consideration. Teachers should be introduced with more socio-culturally, socio- economic sensitive approaches to apply in teaching. Reflective practice should be inculcated among the teachers. The realities of the classroom should be taken into sufficient consideration in making policy guidelines as well as any change or improvement in the sector for that matter.

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## The Most Productive Morphological Processes in Selected Sri Lankan English Literary Texts

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### ABSTRACT

Morphological processes in a variety of English is a core area as it constitutes the process of word-formation. It contributes to the enrichment of the lexis of that particular variety. Sri Lankan English morphology is influenced by its native language i.e. Sinhala. The productivity of morphological processes is determined by the abundant usage of a process. Thus, this study was initiated with the aim of exploring the productive morphological processes in Sri Lankan English. A qualitative method was used for collecting data from thirty literary works: novels and short stories, of Sri Lankan writers. Each piece of writing was carefully analyzed. Sri Lankan English morphological terms were gathered and categorized under different morphological processes. The findings revealed that the productive morphological processes in Sri Lankan English literary texts were borrowings, affixation, and compounding.

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## INTRODUCTION

The term morphology refers to the study of “the internal structure of the words and of the systematic form-meaning correspondences between words.”(Booij, 2005) Morphological processes are changes made to a word in order to change its form and/meaning. Morphological processes include; affixation, conversion, reduplication, modification, subtraction and so on. Productivity refers to the usefulness of the word after going through some morphological process.

“Productivity is measured through various aspects such as formal generality, regularity and meaning” (McCarthy, 2002). Bauer (1983), states that, “a word-formation process is productive “if it can be used synchronically in the production of new forms.” In the context of Sri Lankan English, “the language used by Sri Lankans who choose to use English for whatever purposes in Sri Lanka” (Gunasekera, 2005), the distinctive morphological features lie in the expressive terminology, borrowed mainly from Sinhala and Tamil. As Gunasekera (2005) states, Sri Lankan English morphology represents the morphological processes of Standard English morphology- borrowings, affixation, acronyms, abbreviations, coinage, blends, and compounds. Plag (1999) argues that, “productivity is the property of an affix to be used to coin new complex words.” Though Plag focuses his productivity on inflectional and derivational processes, Bauer holds contradictory opinions. Bauer (2001) states that productivity does not solely depend on affixes but all morphological processes in general. This research study was undertaken with the objective of investigating the most productive morphological process in English literary texts authored by Sri Lankan novelists. The research study aims at exploring the influence of Sri Lankan identity and the

creativity in the language use of the authors.

Thus, this study addresses the following research questions:

1. What morphological processes are found in the selected literary texts?
2. Out of the discovered morphological processes, which is the most productive?

## LITERATURE REVIEW

The review of literature is categorized in two subsections; Productive morphological process in English and varieties of English. In a broader aspect, English language uses a varied number of morphological processes. Lieber (2005) has identified compounding, affixation and conversion as the major productive processes of word-formation. In terms of the different varieties of English, Trudgill and Hannah (1994) state, Indian English has an “extended use of compound formation.” Meanwhile, Owolabi (2012) in his research on Nigerian English states, “Compounding is the most common process, leading to new forms that go beyond the forms permissible in Standard English.” Renner, Maniez and Arnaud (2012) state, “lexical blending is a relatively productive process in Late Modern English.” Finally, Gunasekera (2005) states, “The most productive morphological processes in Sri Lankan English are borrowing, compounding, and affixation.” Considering previous studies, the current study explores the use of morphological processes in a selected famous novels written in Sri Lankan English.

## MATERIALS AND METHODS

The study follows a qualitative method for data analysis.

## Population and sample

Printed English literary texts authored by Sri Lankan writers who used Sri Lankan English were used to gather data. Thirty (30) literary texts, i.e. Twenty-five (25) short stories and five (5) novels were selected.

The novels that were selected:

1. Giraya by Punyakante Wijenaike
2. The Jam Fruit Tree by Carl Muller
3. Bringing Tony Home by Tissa Abesekara
4. Change of skies by Yasmin Guneratne
5. Disobedient Girl by R. Freeman

The short stories that were selected:

1. Professional Mourners by Alagu Subramaniam
2. The Awakening of Doctor Kirithi  
The Doughty Men of Purantota  
The Man under the Tamarind Tree by James Gunawardane
3. The Harvest  
The Visitor  
The Tree Spirit  
The Sun  
The Retreat  
Monkeys by Punyakante Wijenaike
4. Going Home by J.S Tissainayagam
5. Metta  
Nayika  
A Pause in Time  
Cicada Cry  
The Long Road  
The Tower  
Meeting with James Taylor  
Masks  
The Expense Account  
The Diary  
The Gulf by Parvathi Arsanayagam
6. Action and Reaction by Chithra Fernando
7. Reunion by Maureen Senevirathne

The texts used in the study are widely popular in Sri Lankan literature thus contributing to a rich source of data.

## Processing of data

Data was collected through careful analysis of the selected literary works. An identification of the common categories, its data and relationship between data were constructed with reference to scholarly articles. Subsequently, gathered data were categorised and analysed based on scholarly articles to acquire a better classification. As the final summarizing, links between the findings and the research aim were developed using the findings and hypothesis as guidelines.

## RESULTS AND DISCUSSION

The productive morphological processes found in the analyzed samples were borrowings, affixation and compounding. Each process is described as follows.

### Borrowings

In the process of borrowing, one language acts as the recipient while the other acts as the donor. In the context of Sri Lankan English, Sinhala or Tamil (the first languages of native Sri Lankans) act as the donor languages and English acts as the recipient language. It should be noted that no Tamil borrowings were found during data analysis.

According to Thomason and Kaufman's (1988), classification of borrowings, the collected data can be segregated into three sets as:

1. Non-core borrowings (Direct Borrowings)
2. Core borrowings
3. Loan translations

## Direct borrowings/ Non-core borrowings

**Table 1.** Personal/place names

<b>Personal / place names-</b>	
Gunapala- /gʊn əpʌ:lə/,	Piyatissa- /pijəθɪssə/,
Magi Nona- /mægi nɔ:nə/,	Sonali- /sɒnə:lɪ/,
Kusum- /kʊsʊm/,	Avanthi- /ʌvʌnθɪ/,
Wijewardana- /widʒeɪwʌrdʌnə/,	Sunil- /sʊnɪl/,
Pelick Signo- /pi:lɪk sɪnə/,	
Kamini- /kʌmɪni/,	Edirisinghe- /eðɪrɪsɪŋhə/,
Girigoris- /ɡɪrɪɡɔ:rɪs/,	
Colombo- /kələmbʊ/,	Kandy/kændɪ/,
Kadugannawa- /kʌdʊɡʌnnʌwə/,	
Galaha- /ɡʌləhə:/,	Panadura/ pʌ:nəðʊrə/,
Nuwara Eliya. /nʊwərə elɪjə/,	Sirimalwatte- /sɪrɪmʌlwʌθθə/,
Peradeniya- /peɪrʌ: ðenɪjə/,	
Polhengoda-/pəlhe:ngəðə/,	
Kirulapane/kɪrʊləpənə/,	
Pamankade/pʌ:mʌnkədə/,	Wellawatte- /wəlləwʌθθə/

**Table 2.** Traditional food

<b>Traditional Food-</b>	
Samosa- /sʌmɔ:sʌ/,	Goraka- /ɡɔrəkə/,
Kurakkan- /kʊrʊkkʌn/,	Kevum- /kæʊm/,
Kokis- /kɔkɪs/,	Aluwa- /ʌlʊwʌ/,
Exclamations- Apoi!- /ʌpɔɪ!/,	Ayiyo!- /ʌjɪjɔ:!/,
Apoi no!- / ʌpɔɪ nɔ:/,	Amme- /ʌmme:/,
polanga!- /pələŋʌ:/,	No no ayiyo- / nɔ: nɔ: ʌjɪjɔ:!/

**Table 3.** Traditional items

<b>Traditional Items-</b>	
Padikkama- /pʌdɪkkəmə/,	Bulath heppuwa- /bʊlʌθ heppʊvə/,
Killotaya- /kɪllɔ:təjə/,	Mal bulath thattuwa- /mʌl bʊlʌθ θʌttʊwə/

**Table 4.** Traditional terms/rituals

<b>Religious terms/ rituals-</b>	
Poya day- /pɔ:jə deɪ/,	Poya fair- / pɔ:jə feɪjʌ:/,
Dhamma- /ðʌmmə/,	Pooja- /pʊ: dʒʌ:/,
Bodhi- /bɔ:ðɪ/,	Pinkama- /pɪnkəmə/,
Devale- /ðe:vʌ:le/,	Manthram- /mʌnθrəm/
Vihara- /vɪhʌ:rə/,	Bhikkus- /bɪkkʊs/,
Kattadiya- /kʌttʌdɪjʌ:/	

**Table 5.** Chunks

<b>Chunks-</b>	
Rosalin nonage Kade- /rɒsəlɪn nɔ:nʌge kʌde:/,	
Pitagam Karayo- /pɪtəɡʌm kʌ:rəjɔ:j/	

## Core borrowings

Core borrowings (morphemic substitution) are the words that duplicate the elements that recipient language already has in its lexicon yet replaced by the first language of the speaker (Thomason and Kaufman, 1988). They are considered unnecessary because the recipient language has viable equivalents for those words. Several core borrowings were found in the analyzed samples are given below.

**Table 6.** Core borrowings and meanings

<b>Core borrowings and their meanings</b>	
Achchi- / :t t /	Grandmother
Amma - / mm :/	Mother
Putha- /p :/	Son
Duva- /ð v /	Daughter
Vihara- /v h :r /	Temple
Aluth- / l /	New
Loku- /l k /	Big
Mudda- /m ðð /	Ring
Parippu- /p r pp /	Dhal

## Loan Translations

In the process of loan translation, the morpheme is substituted without direct borrowing or phonological shape

(Thomason and Kaufman, 1988). Here, a term taken from L1 is literally translated. A loan translation might contain more than one word.

**Table 7.** Loan translations

Noon meal
Yellow rice
Rice and curry people
Yellow Robe
Parrot like

The process of compounding is influenced by the cultural hybridity and the bilingual identity of the author.

### Affixation

Adding bound inflectional or derivational elements such as prefixes, infixes and suffixes to a stem to form a new or different word form is defined as affixation. Only the process of suffixation could be found in the observed data sample. Adding an affix to the end of a word or a stem, serving to form a new word can be defined as suffixation (Walker, 2009). The use of prefixes and infixes could not be found in the collected data sample.

**Table 8.** Affixation

<b>Nouns-</b> Gathas- /g :s/, manthrams- /m n r ms/, Piriths- /p r s , Danes- /ð :ne s/, Vihares- /v h :r s/, Huniyams- /h :n j ms/
The suffix “s” has been added to pluralize the nouns.
<b>Adjectives-</b> Kandyan- /kænd j n/, Sarid- /s :r d/

The use of a native Sinhala word as the stem shows the cultural blend in Sri Lankan English literature.

### Hybrid compounding

The process of combining two free morphemes to create a new word is compounding. A word composed of elements from two or more different languages can be defined as hybrid compounding. Under Muysken’s (2000) typology of code-mixing, hybrid compounds are identified as a part of Congruent Lexicalization (CL). CL is frequent in post-colonial settings where code-mixing is employed in the process in creating new vocabulary and to nativize foreign elements into Sinhala (Senaratne, 2009). Following are instances where new codes were mixed in the explored literary texts. According to Kachru’s (1983) classification of hybrid forms, the findings show that an English item functions as a head. As in the example, *Sala door* – The English noun door acts as the head that determines the meaning of the word *Sala*. The use of these terms captures the creativity Sri Lankan bilinguals. Thus, the authors have made use of these compounds to show the creativity and bilingual identity.

**Table 9.** Hybrid compounding

<i>Pan box-</i> /p n b ks/, <i>Sala door-</i> /s :l d :/, <i>The Walauwa-</i> /ð w l /, <i>Old hiranmanaya-</i> / :ld h r m n j /, <i>Kitchen amma-</i> /k n mm :/, <i>Kubuk tree-</i> /k b k tri:/, <i>Mukunu leaves-</i> /m k n li:vs/, <i>Vas season-</i> /v s si:s n
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### CONCLUSION

According to the key findings, the most productive morphological processes found in Sri Lankan English literature were borrowings, affixation and compounding. Amongst them borrowings were mostly found as the most productive morphological process due to lack of required words in the recipient language – English. In addition, the abundant use of

borrowings show that culture plays a dominant role in these literary texts. These morphological processes are results of language contact and linguistic repertoire in postcolonial Sri Lanka. Furthermore, the findings reveal the creativity of the bilingual communities that use English in Sri Lanka and the new words that have integrated into the Sri Lankan English lexis and how these morphological processes balance the cultural blend. This study reveals how the identity of Sri Lankan English writers is depicted through the morphological processes prevalent in their writing.

The researchers recommend further studies to be conducted on the areas such as, genre-based research using literary texts, the use of productive Sri Lankan English morphological processes in print media and social media. In addition, the same literary texts could be used to analyse other morphological processes that have not been analysed in this study.

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## The Depiction of Post-Independence Sri Lankan Social Dynamics in Punyakante Wijenaike's *Giraya*

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### ABSTRACT

In the aftermath of the three decades following the independence in 1948, post-colonial Sri Lanka as a nation has witnessed drastic political shifts, socio-economic development and violent ethnic conflicts that directly impacted Sri Lankan society and its citizens. The colonial social hierarchy was coming to a standstill, transferring social power from the colonizer to the local aristocracy and eventually to the middle class. Post-independence economic and social reforms empowered the rural middle and lower classes providing them with the opportunities of social mobility and advancement. This study aims to qualitatively explore the trajectories of post-independence Sri Lankan social dynamics depicted in Punyakante Wijenaike's novella, *Giraya* (1971), in relation to its character and incident portrayal. As a Sri Lankan writer of English fiction, Wijenaike subtly captures the submerging feudal authority in post-colonial Sri Lanka. The *walauwe*, once a symbol of prestige and privilege in its decay, symbolizes the shift of social power from the Sinhalese aristocracy to rural middle and lower classes. The study, stemming from a detailed textual analysis of *Giraya*, its character and incident portrayals explores the social dynamic nuances based on post-independence decline of traditional Sinhala *walauwe* feudal system, its property ownership, post-independence religious reforms and emergence of the rural middle class in power. The analysis of the novel unveils that the denial of the transitioning post-colonial social systems, industrialization and educational empowerment of middle and lower classes of the society is fostering the downfall of the Sinhalese aristocracy.

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## INTRODUCTION

The preface of the discussion on post-independence Sri Lankan social dynamics depicted in *Giraya* is centered around the lives of the inhabitants of a rural Sinhalese aristocratic household. The demarcation between the feudal family and the village peasantry represented through the novel resulted in a greater socio-economic change stemming from disparate living conditions experienced by the people belonging to each social stratum. A realistic image created by Lakshman and Tisdell (2000) of post-independence rural elite who occupied the position of power through birth, the rural middle class engaged in government jobs and the peasantry leading a miserable life having limited access to nutrition, clothing and shelter resonates with the social conditions pictured through *Giraya*.

The study explores the nuances of social dynamics depicted through the decline of Sinhala *walauwe* feudal tradition, its property ownership and the emergence of the rural middle class to positions of socio-economic power and post-colonial religious reforms. These social changes are textually analyzed through character and situational descriptions of the novel. The retrospective diary entries of Kamini, a graduate who becomes the daughter-in-law of a Sinhala elitist family (Mohan, 2015) provides insights of the *walauwe* and its inmates. In the preface of the 1997 edition, Wijenaike gives the reader a glimpse of the Sri Lankan society in the early 70s and of “an upper middle-class feudal family with roots set in a dilapidated, crumbling *walauwe*.” In the year 1971, when *Giraya* was written, “Land Reform was knocking like a wolf on the door of people accustomed to living on inherited wealth” (Wijenaike, 1997). The Land Reform Law,

enacted in 1972, ensured that no person owns agricultural lands in excess of the ceiling and the Land Reform Commission was vested in “taking over agricultural land owned by any person in excess and to utilize such lands in a manner which will result in an increase in its productivity and in employment generated from such land” (Land Reform 1972, Cap.297). Thus, this study investigates the social dynamics in the Sri Lankan society resulted on par with the Land Reform Law, fostering the decline of Sinhala aristocracy centered around the *walauwe* and its property ownership. The emergence of the middle class empowered by employment through industrial work opportunities created in the aftermath of Land Reform will also be addressed through the study.

## METHODOLOGY

This study investigates post-independence Sri Lankan social dynamics in Punyakante Wijenaike’s *Giraya*, written in the early 70s. A qualitative textual analysis of the character and situational descriptions of the novel captures the post-independence social nuances of the decline of Sinhala feudal tradition, the rise of the rural middle and lower classes to socio-economic power and post-colonial religious reforms.

## DISCUSSION

In order to understand the decline of the feudal system, it is necessary to be familiar with “postcolonial social formation, particular political and social circumstances under which the transition from the colonial to post-colonial state is crafted..... the nature of the elite leadership to whom the power from the colonial rulers was transferred” (Hennayake, 2019). According to Dananjaya (2020), Sri Lankan post-

independence feudal system released an excessive pressure on middle and lower classes in which one family had been enjoying the luxuries through many generations. “This high cast and the properties imposed them a hollow dignity of themselves that they were honorable than anybody in the set up” (Dananjaya, 2020). Adelaine, the matriarchal power in the *walauwe* represents the last generation of Sinhalese *walauwe* ancestry, a system which faces a downward spiral. She is hostile to the changing society and the power shift as “she ignores the changing world defiantly” (pg.7). Adelaine’s father-in-law, held the “traditional honorary ‘aristocratic’ title” (Rösel, 2017) the ‘Mudaliyar.’ It was the custom of the British to appoint aristocrats who had sided with them into the top positions of the Mudaliyars and “with the Mudaliyarship they acquired prestige” (Rösel, 2017). Adelaine and her son Lal, having links to this old Mudaliyar ancestry, would talk to each other in English (pg.15) and Adelaine bears her English name as it was the custom of the people at the time when the British ruled Ceylon (pg.16).

The *walauwe* is showing the decayed reminiscence of the British colonial era through the “old, worn English carpet” (pg.8). Even though the inhabitants of the *walauwe*, Adelaine’s children Manel and Lal, her servant and confidante, Lucia Hamy and old Loku, the gardener belong to “one of the oldest but now dying, aristocratic families in the village (p.6), Adelaine is refusing to let go of the power vested in the English-speaking, Sinhalese aristocracy by the colonizer. Lal, lacking man’s firmness and maturity and Manel, never blossomed bodily or mentally (pg.7) as the successors of the *walauwe*, are depicted to be fragile personalities signifying the frailty of the aristocratic power in post-independent

society. Despite the apparent decline of the rural feudal system, Adelaine regards the villagers as mere peasants and laborers who work in the estates of the *walauwe* as they belonged to a class below herself and her family (pg.7). Even though Lucia Hamy is a servant in the *walauwe* household, her authority over Kamini, Manel and Lal overpowers her social status as she considers herself as a part of the *walauwe*, refusing to believe its decline like Adelaine. The image of the *walauwe* in decay, having “trellis rotted away, rusty gutters, peeled off distemper and broken windows” (pg.17) stands as a metaphor to symbolize the degeneration of the feudal social power. The “closed doors and padlocked gates” of the *walauwe* desperately attempts to ward off the social resistance against the aristocracy. On the day of the New Year the entire village celebrates it with merriment but “within the *walauwe*, silence reigns” (pg.10), suggests the melancholy atmosphere of the manor, albeit the inherited wealth and luxuries. Wijenaike draws a parallel between the *walauwe* and the peasantry households in the village, revealing that “with all its status, the *walauwe* is still like the village homes beyond as it has no electricity” (pg.11). The feudal house lit by kerosene lamps suggests that it holds no overarching power over the peasantry in the village.

It is inevitable for the middle and lower classes that were not born to aristocracy to invent alternative forms of economic and social capital to empower themselves. The new textile mill signals the emerging industrialization in the village periphery. These alternative methods of economic empowerment provide job opportunities to the villagers, as a result, the *walauwe* is losing its labor force. As Rösel (2017) claims, Mudaliyars used to invest in coconut sector and when land market

emerged, the aristocrats profited from it by traditional right, through arbitrary control and forgery of land. It had been the way of life for Mudaliyars to build up “vast alleys of coconut trees and residing in the midst of them in old-fashioned Kandy-style manors, *walauwas*” (Rösel, 2017). When the government decides to build a new road by dividing the *walauwe* estate in half, Adelaine who experiences the luxuries of the coconut plantation of the *walauwe* was forced to agree to the decision and to let them cut down the coconut trees. The gradual decline of the *walauwe* property ownership is evident when Manel reveals, “we had a house in Colombo. It was sold to pay off father’s death duties and some debts. We have little left of what we once owned....” (pg.103). The signs of urbanization depicted through the textile mill challenge the overarching power of the *walauwe* over the village peasantry as the *walauwe* gradually loses its power over the inherited property ownership of generations. Under the guise of the decaying *walauwe*, the rise of the middle and the lower classes to power is symbolized by Kamini.

The post-independence Sri Lankan society witnessed some democratization of the social structure derived from upward social mobility for subaltern castes and free education policy as the lower classes of the society were enjoying the fruits of modern education that broke the class barriers to social upliftment (Lakshman & Tisdell, 2000). In the novel, Kamini personifies the lower middle class of the rural society who values the educational empowerment and seeks solace in education as the sole means of social mobility against the power of aristocracy. Kamini’s education made her “a proud lion walking in dignity and strength.....as there is nothing more

noble in this word than knowledge” (pg.11). As stated in Wijenaike’s preface to the 1990 edition of the novel, Kamini is propelled into a marriage of convenience with Lal. Even though, Kamini’s education as a university graduate permits her to access the upper class, she feels repressed and frustrated in the old feudal manor. Nonetheless, Adelaine deprives Kamini from her domestic responsibilities of a daughter-in-law as she belongs to a farmer’s household. Adelaine treats Kamini as she would treat the village peasantry. On the contrary, Kamini does not remain silent and docile in the face of Adelaine’s insults as she confronts both Lal and Adelaine saying, “you and your mother have made a mistake in thinking that because I came from a poor home and I can be forced to the background.....merely being a wife in name only” (pg.57). Kamini’s education grants her the power to critically analyze, challenge and question the authoritative dominance of the inhabitants of the *walauwe*. She was born to a different generation taught her to “think, speak, read and write in the mother tongue” and she vehemently challenges her husband Lal, “who had been born in a generation where he had been trained to think, speak, read and write in English” (pg.100). In fact, Kamini takes pride in her humble upbringing as a farmer’s daughter and how they fended themselves without exploiting the servants (pg.24). Her perspectives signify self-pride of the lower middle classes as opposed to the superficial lifestyles of the elite.

The estate superintendent Perera, despite his social status, is having a secret affair with Manel, the daughter of the feudal manor. While Lal remains as the subdued heir to the *walauwe* property and Manel appears to be mentally unstable, Kamini and

superintendent Perera represent the rural middle class who foresee the prophetic downfall of the *walauwe*. Kamini perceives the impermanency of power held by the inhabitants of the *walauwe* over the peasantry as she predicts of the day when Lal must step down from the *walauwe* and walk among the common people (pg.110). She once witnesses a young man from the *walauwe* estate laborer's family wearing a nylon shirt, a brightly colored silk sarong and wrist watch with a gold strap instead of labor rags. The young boy of the peasantry smelt of lotion that Lal used after a shave (pg.21). His arrogant and fair appearance defy the stereotypical image of a malnourished village peasant. The shift in social power dynamics represented by the young man signifies the young generation, unlike their elders, who would challenge and resist the traditional power bestowed on the aristocracy. The defiance of the peasants is apparent as they would not fear to snigger and laugh, boldly and rudely in the presence of Adeline (pg.9).

The Buddhist revival of post-independence social reforms under Sinhala-Buddhist nationalism represented a rural fundamentalist reaction to the city's worldly ways and a lower-class protest against the wealthy and influential elite who had been educated by a foreign curriculum away from Sinhalese social ways and religious practices (Wriggins, 1960, pg.120). The young Head Priest of the village temple and his ideology to educate young men and women in the village through evening classes in the temple premises represent the reconstruction of traditional religious role performed by the temple. The perspectives of the young Head Priest defy the opinions of Adeline, the chief *dayaka*, contributor and trustee of the temple. Adeline was given a special room by the old Head

Priest to observe the precepts in the temple premises (pg.22). The young Head Priest foresees the deterioration of the rural elites and their wealth, hence claims that the temple should begin to be self-supporting. With the emerging materialism, the young priest sees no difference between the frustrated struggling of layman and priest for survival. The temple shifts its role from a sacred religious entity to a center of education and social welfare supported through youth empowerment. Nevertheless, Adeline denies the change and yearns the old traditions saying that temple should be kept for religious purposes and young people are not worth helping (pg.28).

The novella closes at the tragic death of Adelaine by her faithful servant, Lucia Hamy. It is ironical how Adelaine, the stronghold of the *walauwe* was killed by a servant who belongs to the peasantry. "No sign of weeping relatives or friends" and "no decorations, no white flags being hung by old Loku" (pg.127) signify that Adelaine's death which symbolizes the death of the Sinhalese feudal system which was not mourned by the villagers of the working class. Adelaine's death unveils the dark secrets of the family that Lal is an illegitimate child of her husband and has no inheritance for the *walauwe* or its properties. The inner conflicts of the family masked by Lal pretending to be of noble birth, fearing even to walk among the villagers (pg.26) manifest the ostentatiousness of traditional elite. Thus, it is apparent that the lives of the feudal are no exception from the peasantry.

## CONCLUSION

The qualitative textual analysis of Punyakante Wijenaike's novella *Giraya* paints a realistic portrayal of how the stronghold of the Sinhalese aristocracy

centered around the *walauwe*, gradually loses its power over the peasantry, as a result of Land Reform Law and rural industrialization. The depictions of post-independence religious reforms and emergence of the rural middle class in power in the novel embody the decline of traditional Sinhalese aristocracy in the era of post-colonial social transitions, industrialization and educational empowerment of middle and lower classes of the society resulted in the aftermath of independence in Sri Lanka. Thus, *Giraya* as a novel, stands as an authentic account which depicts post-independence social dynamics in Sri Lankan society in the early 70s.

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## The Role of Poetry in Bringing out Sexual Diversity and Gender Construction

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### ABSTRACT

The paper focuses on the role of poetry in bringing out sexual diversity and gender construction. Furthermore, the paper discusses how trans poets use poetry to form the trans identity while female poets and male poets use poetry to construct female gender identity. The objective of this study is to explore the way these poets employ gender, body, power and identity politics to contest the normative and dominant ideologies centered around them in the society. The data for the study is based on the selected poems about women by three poets, Carol Ann Duffy, Lakdas Wikkramasinha and Sylvia Plath and trans poets, Lee Mokobe and Shilok Mukkati. In order to portray how poetry supports in the construction of gender in detail, poets from different backgrounds have been selected. Trans theory has been used as a theoretical basis to give a detailed analysis of trans gender poetry. At the same time, feminist theory is used to analyze poems written on women. Incorporating these theories, this study demonstrates that the trans poets and other poets who have written about women are successful in constructing gender identity by using the so-called politics to contest the hegemonic and normative norms and ideologies.

## INTRODUCTION

In the evolution of poetry, it has been dealing not only with the themes such as death, love, sadness, nature etc. but themes pertaining to sexuality and gender identity. As Nawaz (2019) states, “political poetry revolutionizes society and makes shackles of poetry. It stirs the conscience of the people leading them to speak aloud for their rights”. In relation to this fact, many poets have dwelt on writing back to the hegemonic ideological framework. In this regard, the grimly marginalized groups in the society especially the transgendered people and women have sought the refuge from the genre of poetry to find freedom and space. Foucault says, “Where there is power, there is resistance” Foucault, 1972 (as stated in Bashir, 2017). According to him, the poets stay alarmed of the social injustices generated by normative and socially accepted norms and ideologies. In this regard, to support how poets use the politics of class, gender, power, race and religion in contesting the normative and dominant norms and ideologies in the society would be discussed in the paper. Based on that, this study aims at seeking how poetry brings out sexual diversity and gender construction.

## METHODOLOGY

The data for this qualitative study are based on the selected poems of trans poets and several other poets who have written on behalf of women. The aim has been to elucidate whether the selected trans poets are successful in constructing their gender identity while other selected poets who have written about women are successful in constructing female gender identity. The poems by trans poets are analyzed by using Trans theory and poems by other

poets are analyzed by using Feminist theory.

## RESULTS AND DISCUSSIONS

The data for this study are some selected poems written by trans poets and poets who have written about women. This section is discussed under two main headings: how trans poets use the politics of gender, power and religion to challenge hegemony, how some other poets use the politics of gender, how poets employ class, gender and power politics to question the accepted normative ideologies. Under the first heading, poems written by Lee Mokobe and Shilok Mukkati are employed and under the second heading, poems written by Carol Ann Duffy, Lakdas Wikkramasinha, Sylvia Plath are brought into discussion.

### **How trans poets use the politics of gender, power and religion to challenge the hegemony**

#### **Lee Mokobe**

Lee Mokobe’s “What it feels like to be a transgender” comes under Trans poetry which attempts to stand against the social injustice done to transgendered people and challenges the hegemony created by the religion which became an obstacle for the transgendered people. Aurura, (2019) asserts, “Religion, specifically Western religion has always been a threat to trans-identity”. In this light, Mokobe attempts to dismantle the power which is centralized in the religion. With, “I asked Jesus to fix me, and when he did not answer me, I befriended silence in the hopes that my sin would burn”, he highlights how his god neglected his identity as a trans-boy. Supporting this view, (Aurura, 2019) opines that Christianity and church refuses the existence of trans-community.

In this way, the poet endeavours to raise the consciousness of the readers regarding the oppression and injustices done to them by the church and the religion. In this regard, the power politics of religion is shunned through the depiction of the way they are ignored by the religion.

Once again, Mokobe writes against “the prejudice which religion has regarding the gender norms” (Aurora, 2019). As viewed by her “ideologies are associated with power structures”. With regard to this fact, the power and the hegemony has been built around male and female genders and so- called power and hegemony has been inaccessible to the people from other genders like trans-boys and trans-girls. At the same time, the negligence by his own religion has led him to look himself as a sinner. “I asked Jesus to fix me, and when he did not answer me, I befriended silence in the hopes that my sin would burn” Here, as viewed by Aurora (2019) trans gender people are the ones who do not accept the sex or the body which was given by the God. On this reason, the prejudice which is held by the religion on the gender norms has been shunned by the poet through the portrayal of the atrocities and brutalities which were caused by the hegemonic powers of gender and religious practices.

Furthermore, in the poem, he tries to construct his identity by challenging the stereotypical norms centered around identity as Mokobe is not ready to accept him as a girl. He mentions, “Who reminds me that my kind of attitude could never bring a husband home that I exist for heterosexual marriage and child bearing. And I swallowed their insults”. Here, he demolishes and rejects the femininity and the roles that are to be performed by a woman one day. By shunning the accepted norms of being a lady, he stays away as a

boy and the crisis of gender identity of Mokobe becomes no matter. Though for Stone (as stated in Murib, 2015), “the transsexual body is a battlefield” Mokobe manages himself to let go off the things around himself. In this manner, Mokobe in his poem writes against the normative and acceptable identity politics in the society though it became a problem in the outset.

### **Shilok Mukkati**

Shilok Mukkati is a transwoman who has undergone with many bitter experiences of being a transwoman. She in her poem, ‘Kinnaras of the Dark World’ questions the conventional family unit as he was rejected by her own family. According to Parental theory of Acceptance and Rejection (PAR theory) the parents in both ‘Hostility-aggression’ and ‘Indifference neglect’ dimensions show hostility, anger, aggression and indifference towards their transgendered children. And due to that, they experience low-esteem and low interpersonal skills. Rohner et al (as cited in Rule, 2021). As viewed in this, Mukkati in his poem, suffers from same low esteem and low interpersonal skills. In her poem, she proves this idea by saying,

“My mother loves me, but never understands me. As for my father, I am not the one he wanted. For the siblings we are ghastly speech, Forget the relatives, it’s a far speech at all.” (*“Kinnaras of the Dark World”* n.p)

Through these ideas, she questions the conventional relationship that should be maintained between a child and parents. At the same time, according to Ehrenshaft, 2011(as cited in Rule, 2012) “When a child that does not define him/herself as the gender they were born with, they may face cultural judgement by their families”. He opines the idea that it occurs a negative

impact on a transgendered child. The same thing is experienced by Mukkati as he describes how she was encountering psychological trauma because of the denial of her family towards her. Moreover, she questions mutual understanding that should be there in a family which has been completely lacking in her life. Here, in her poem, Shilok Mukkati tries to construct her identity as a trans person by questioning the family unit and the relationship that one has to develop with parents.

### **How poets employ class, gender and power politics to question the accepted normative ideologies**

#### **Carol Ann Duffy**

“Standing Female Nude” written by Carol Ann Duffy is a poem which challenges the male-dominated ekphrastic poetry. According to, Al-Wattar (2019) “Women poets refuse to adhere to the gendered ekphrastic tradition and the under-representation of women in Ekphrastic poetry”. In this view, Carol Ann Duffy challenges the male-dominated Ekphrastic poetry tradition and changes the shape into “feminist ekphrasis”. As Uzundemir (2013), states, “Standing Female Nude” challenges the binary that, “the female image is objectified and gazed while the male author is the subject and the gazer” and gives the voice not to the artist but to the female model. According to what he says, the nude in the poem stands as a viewed object to the bourgeoisie. Conversely, by going against this, she herself becomes the viewer. Here, though she is made to stand in a single pose as an object, the poet makes her speak and raises the consciousness of the reader reminding that she is not an object. It is clear through, “Both poor, we make our living how we can. I ask him, “Why do you

do this? Because I have to. There's no choice. Don't talk.” In this way, Duffy dismantles the conventional relationship of the painter and his model.

As the female nude in the poem is depicted as a woman from a lower class the power politics are questioned by the poet and the ideology, Marxist feminism comes as a challenge to the framework of capitalism. Stefano (2014) acknowledges, “For Marxist feminists, empowerment and equality for women cannot be achieved within the framework of capitalism”. According to what he says, the poet holds a critical idea about capitalism for promoting the exploitation of labour and women. It reinforces the inability of women to have liberation under the power of capitalism. Stefano further elaborates that capitalism promotes the class division and the alienation of human beings. In the poem, it is understood that, this female model is supposed to work both as a model and a prostitute because she is deprived of money. On this reason, it is capitalism which has led her to suffer under the fetters of gender inequality, class inequality. Through the line, “both poor, we make our living how we can. I ask him Why do you do this? Because I have to. There's no choice” ( Standing Female Nude, Duffy, 1985).

It becomes clear how both the artist and the model have been fallen on one group to earn a living under bourgeoisie. In this regard, class politics are challenged and Marxist feminism is brought into light in order to question the existence of capitalism.

#### **Lakdas Wikkramasinha**

To a Servant girl’ is a poem written by Lakdas Wikkramasinha and in the poem, he writes back to the power which was

held by the superiority and feudalism existed in Sri Lanka and he dwells on empowering female power in the poem. This becomes a poem by the exploited to strike back the exploiters exercised under 'walawwa tradition' in the feudal system. He directly attacks the suppression done by the superiority to the lower-class people in the society. As Perera (2015) identifies, the poem supports "the transfer of power from one class to another". Wikkramasinha writes about the servant girl who takes the master under her dominance. Here, it is understood the fact that the power politics have been used to distort the hegemony created by the superiority in order to seek the justice of the servant girl. As Fernando states, the girl in the poem, "uses the only resource available to her, her body, to empower herself and beyond this to dominate her master. In this way, the poet writes back and questions the superiority and the feudal system by highlighting how power politics and class politics have changed.

### **Sylvia Plath**

Patriarchy is another constructed ideology which is contested through the poem, 'Daddy' written by Sylvia Plath. In order to do this, feminism has been plied to write against patriarchy by using the oppression and exploitation experienced by women under patriarchy. In this regard, Ennis (as stated in Qazzaz, 2017) points out, "In patriarchy, the relationship between men and woman is a form of political dominance". According to this view, Sylvia Plath holds a hateful attitude towards marriage and marriage is considered to be a trap which causes the powerlessness of women. In the poem, 'Daddy' She resists a highly accepted construction in the family unit. In fact, Plath holds a negative idea towards her father for exercising male dominance in the guise of paternalism. In

the poem, she expresses how she is victimized by her father for thirty years. She sees her fear to communicate with her father as male dominance and feels trapped by patriarchy. "I never could talk to you. The tongue stuck in my jaw" (Plath, 1962)

This quotation clearly shows this. In this way, Plath pictures her own father as a symbol of patriarchy. So, the poet contests the politically constructed ideology, 'patriarchy' to bring justice to the women.

### **CONCLUSIONS**

Concluding this, Trans-Poetry is a newly designed genre of poetry which addresses the issues and injustices done to the transgendered people by the society. Lee Mokobe's, 'what it feels like to be a transgender' provides an ideal platform for the marginalized transgendered people in the society by writing back against the hegemonic ideological framework. Through his poem he contests the dominant ideologies that lead him to be a marginalized character in the society by using the politics, gender, religion, and power. With this, poetry has been able to play a vital role in finding freedom to trans identity. At the same time, the same normative ideologies are brought into challenge by the trans poet, Shilok Mukkati who describes her personal experience to find an identity. 'Standing Female Nude' written by Carol Ann Duffy is another poem which marks the resistance to the traditional, male-dominated Ekphrastic poetry. With the political ideology, Marxist feminism, she rejects the capitalism which had become a great support to improve the exploitation of women. As mentioned above, she writes back to Capitalism and states that women cannot achieve their liberation as long as capitalism survives in

the society. In the same way, Lakdasa Wikkramasinha strikes back to the hegemonic power which was centralized into Feudal system and the Walawwa Tradition. Finally, Sylvia Plath challenges the highly accepted construction, 'paternalism' by emphasizing its dominance over women. In this manner, the trans poets and other poets who have written about women have been able to find a kind of solace in the genre of poetry. Here, the study has shown how poetry brings out the sexual diversity and gender construction through the poetry written by trans poets and other poets. In this manner, Lee Mokobe and Shilok Mukkati are successful in constructing their gender identity with the help of poetry. Through their poetry, they use politics of gender, power and religion politics to write back to the center. Poets like Carol Ann Duffy, Lakdas Wikkramasinha and Sylvia Plath are successful in constructing female gender identity through the way they have used the politics of power, class politics to challenge the accepted ideologies. Finally, the role of poetry is amazing, that it gives space for the marginalized and discriminated people.

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## A Study on the Importance of Native Indian Presence in American Literature

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### ABSTRACT

A study of the use of the image of the Native Indian, for almost two hundred years on both sides of the Atlantic being traced, the reason for the sudden prominence given to the Native Indians in American literary works after the war of 1812 and for almost half a century on, is revealed through the present study. The works of Washington Irving, James Fenimore Cooper, and Nathaniel Hawthorne are used to strengthen my premise. Hawthorne uses a technique different from the other authors who focus directly on the Native Indians to prove their importance in American literature. Hawthorne's novel *The Scarlet Letter* is used to understand his method. For this, a basic understanding of the plot being required, the storyline of the novel is concisely unfolded through a narrative analysis deriving from a qualitative approach. The presence of the Native Indian in *The Scarlet Letter* being examined it explains Hawthorne's unique method used to establish the significance of the Natives Indians in American literature thereby illustrating their surge in status in the American literary domain.

## INTRODUCTION

Native Indians have been visible in American literature since the Europeans invaded their territory. They were portrayed by Mrs Mary Rowlandson as 'atheistical, proud, wild, cruel, barbarous, brutish, (in one word) diabolical Creatures... the worse of heathen.'<sup>1</sup> (Berkhofer, 1979) while others described them as the 'Noble Savage'.<sup>2</sup> (Berkhofer, 1979) The Native Indians were termed as 'Noble' by the Europeans because they were considered as humane people living in serene settings and hence, could be used as a foil in the politically and religiously troubled European environment. The Europeans used the idea of the Noble Savage 'to criticize existing social institutions and to propose reform.'<sup>3</sup> (Berkhofer, 1979) This resulted in the Native Indian image being used as a tool for political and economic reasons in Europe. Berkhofer states "The American and French revolutions marked the turning point of the Noble Savage as a political device.... Thus, the Noble Savage, although he continued to figure in literature and imaginative works, was displaced by the events of modern history in the arguments and polemics of social philosophers and political reformers."<sup>4</sup> (Berkhofer, 1979) Though displaced from Europe he gained importance in America. Prior to the American war of 1812,

according to Benjamin T. Spencer "In almost any version of a national culture before 1815 he [the Indian] assumed an unheroic and antinational guise".<sup>5</sup> (Spencer, 1957) Following the rupture with Europe, the Native Indian gained much significance in American art and literature until the end of Civil war, in 1865. The reason for this is explored in this research. The works of Washington Irving, James Fenimore Cooper and Nathaniel Hawthorne which have been used for this research, indicate the different methods through which these authors portrayed the 'glory' bestowed upon the Native Indian in American literature and art for almost half a century.

## MATERIALS AND METHODS

A persistent interest in the subject of Native Americans led to the gathering of information on them, from books, journal papers as well as online reading and thus, stumbling upon the reason for the sudden rise in their status in literature and works of art for about half a century following the Anglo-American war of 1812. Concerning the works of Irving and Cooper the Native Indians figure very conspicuously in their works and the narratives evolve around them. On the contrary, in *The Scarlet letter* the Indian is rarely visible, and this makes the examining of the novel in detail an

<sup>1</sup> Berkhofer. R.F. (1979) *The white man's Indian*, Vintage Books p 84

<sup>2</sup> Ter Ellingson, for example, whose in-depth study highlights the problematic nature of the very concept of the myth of the Noble Savage, suggests that it may have originated in Marc Lescabot's ethnological studies of the Indians of eastern Canada first published in 1609 (Ellingson, 2001, 12-13). Still, as Berkhofer points out, "In the English

colonies the literary and ideological use of the Noble Savage came on the scene only during the Revolutionary era" (Berkhofer, 1979, 76).

<sup>3</sup> Berkhofer. R.F. (1979) *The white man's Indian*, Vintage Books p 76

<sup>4</sup> Ibid pp 78

<sup>5</sup> Spencer B.T. (1957) *The quest for nationality: an American literary campaign*, Syracuse University Press

interesting task so as to find out the significance of the Native Indians in Hawthorne's work. Qualitative methodology is used for this purpose to conduct a textual analysis. The narrative analysis done on *The Scarlet Letter*, a classic of this period, gives the reader an understanding of the story of the novel as well as its characters.

### **The propulsion of the Native Indians in American literature**

The European explorers who discovered the Native Indians linked their perceptions and life to Primitivism,<sup>6</sup> (Sanford, 1961) a concept which 'dreams of a paradise on earth that does or did prove that an alternative to the present age could exist....in a myth of lands lying far away to the west or long ago in the past whose citizens dwelt in an ideal(ized) landscape and gentle climate in harmony with nature and reason.'<sup>7</sup> (Berkhofer, 1979) The Europeans, notably the French, fashioned the *bon sauvage* on these lines of thought as well as on their idea that the Native American Indians had traits in common with the ancient people who were thought to have lived peaceful lives. This Noble Savage who was later baptized as the Noble American Indian served as a foil for European society and culture. The revolution in France, sounded the death knell for the Noble American Indian in Europe. On the contrary, following the American revolution and for almost half a century beyond, the American Indian maintained a prominent place in American literature and Art. The main reason being

the rise of cultural nationalism<sup>8</sup> (Honour, 1975) following the separation from the British colonizer after the war of 1812 and the second yet equally important reason being the advent of Romanticism to the United States. The birth of a fledgling nation meant it needed an identity of its own, quite distinct from its colonizer in every sphere including literature and art. Spencer states, that this quest for pure American material resulted in the American forests and the Indians being chosen as indigenous subjects to promote literary independence.<sup>9</sup> (Spencer, 1957) The reason being that they were unique to the United States. Although these subjects were unanimously opted for, as markers of difference they were unable to integrate American literature and art as the neo-classical perspective of the time deemed them unworthy of literary and artistic respect. With the arrival of Romanticism, where emotion and intuition were of crucial importance, 'The romantic writers and artists sought to evoke feeling and sentiment in their readers or viewers throughout the whole range of emotions.'<sup>10</sup> (Berkhofer, 1979) Indeed, emotions being in abundance in the nature and behaviour of the Native American Indian, this made him a distinctive candidate for a unique place in American literature. Hence, in the United States around this time with its 'emphasis on indigenous traditions, folk customs, and the glorification of the national past dovetailed with the drive toward cultural nationalism in the newly independent nation.'<sup>11</sup> (Berkhofer, 1979) the Native

<sup>6</sup> Sanford C. L. (1961) *Quest for paradise: Europe and the American moral imagination*, University of Illinois Press, Ch3-4

<sup>7</sup> Berkhofer. R.F. (1979) *The white man's Indian*, Vintage Books p 72

<sup>8</sup> Honour H.(1975) *The new golden land: European images of America from the*

*discoveries to the present times*, Pantheon, Ch 3

<sup>9</sup> Spencer B.T. (1957) *The quest for nationality: an American literary campaign*, Syracuse University Press

<sup>10</sup> Berkhofer. R.F. (1979) *The white man's Indian*, Vintage Books p 87

<sup>11</sup> Ibid pp 86-87

American Indian was propelled to the forefront of American literature and art although this status was short lived.

## DISCUSSION

Among the fiction writers of the first half of the 19th century, Washington Irving figures among the first American literary writers who drew positive and often romanticized portrayals, which could be even considered as a strong defense of Native Americans. *Phillip of Pokanoket: An Indian Memoir* published in 1819, as the title of the work itself denotes is solely dedicated to the Native Indians. *A Tour on the Prairies* (1835), *Astoria* (1836) and *The Adventures of Captain Bonneville* (1837), his subsequent works, all of them travel narratives, were written on his return to America following a seventeen-year stint abroad. These narratives explicitly indicate his sharp imaginative skills and his unambiguous presentation of the Native Indians. James Fenimore Cooper, another renowned writer of the period being considered, authored *The Leatherstocking Tales*, a famous series of romances, which include *The Pioneers, or the Sources of the Susquehanna*; *A Descriptive Tale* (1823), *The Last of the Mohicans: A Narrative of 1757* (1826), *The Prairie; A Tale* (1827), *The Pathfinder: or, The Inland Sea* (1840) and *The Deerslayer: or, The First War-Path* (1841), in them the author exposes the Native Indian characters with much prominence. Concerning these works where in which the Native Indians are overtly present it goes without a saying that the Natives played an important role in the literary works of the first half of the 19<sup>th</sup> century.

On the contrary, it could also be deduced that even the rare appearances of the

Native Indians as observed in *The Scarlet Letter* too, could prove their importance in literature. To illustrate how the insignificant becomes significant, a close study of *The Scarlet Letter* is required. *The Scarlet Letter* being written from an omniscient third-person perspective in which the narrator describes the thoughts and feeling of the main characters as well as the general sentiments of the townspeople, shows how the characters function in their larger community. Since the characters are often reserved and secretive, the narrator's commentary on what they experience internally at any given time is very important to the unfolding of the story and shaping of the reader's perception. After the initial framing device of the introduction, told from the point of view of two hundred years following the taking place of events in a Puritan context, the entire story is told as a fictionalized re-creation of happenings.

The novel being a deep expression of the passion of the main characters, Hester Prynne, the Reverend Dimmesdale and Roger Chillingworth all caught up in a love triangle, this mode of a third person omniscient narrator's point of view is very appropriate to demonstrate all facets of these characters and the opinions that all the other characters have formed about them. The author uses this tool to its fullest when according to Heath, "he speaks in several voices -Puritan, Victorian, Tragic, Subversive, etc."<sup>12</sup> (Heath, 1995) with the ultimate goal of revealing this emotionally laden story which is the story of Hester Prynne, a young European woman who marries an elderly scholar, crosses the Atlantic and lands in New England intending to found a family in this new land when her husband arrives from Europe. Following a long and vain wait for

<sup>12</sup> Heath, W. (1995). *The irreverent imagination; Hawthorne and The Scarlet*

*letter*, Conference: American Studies Lecture Series, Emmitsberg

him, she is attracted to a young pastor, and accused of having committed adultery with him, and given birth to Pearl, a daughter. Condemned and disgraced in public for her act, the novel evolves around the life story of Hester, who is sentenced by the Puritan authority to perpetually wear the red-letter 'A' which is supposed to stand for adultery, on her bosom.

Examination of *The Scarlet Letter* reveals the presence of the Indians which seems few and far between. Hence, they do not play a major role in the text. The author does not judge them and he 'refers to them throughout the novel in their stereotypical role of outcast, heathen, healer or romanticized dweller of the primordial forest'<sup>13</sup> At each entrance of the Native Indians the reader is enlightened more about them.

During Hester Prynne's exposure to the public, for the crime she had committed, Hawthorne says 'An Indian in his native garb was standing there; but the red men were not so infrequent visitors of the English settlements'(Hawthorne, 1994, p 51) the external appearance of the Natives and their relation to the Puritan society is illustrated here.

The narrator wondering why a crowd has gathered in the square renowned for public punishment in the marketplace, guesses that it could be for the purpose of chasing back to the forest, 'an idle and vagrant Indian whom the white man's firewater had made riotous about the streets (Hawthorne, 1994, p 42). In no way does Hawthorne try to conceal the

colonizer's vices nor the fact of it having been transmitted to the Natives and their resulting addiction to alcohol. This drunkenness of the Native Indians was observed quite some time ago even by Nicholas Noyes.<sup>14</sup>

The Native Indians are not necessarily simpletons, their knowhow is exposed when Roger Chillingworth while trying to administer some medicine to Hester admits "but I have learned many new secrets in the wilderness, and here is one of them – a recipe that an Indian taught me, in requital for some lessons of my own, that were as old as Paracelsus...."(Hawthorne, 1994, p 62) exemplifying thus that some of the Natives are on par with the white Anglo-Saxons which thus enables an exchange of knowledge.

Further on, towards the end of the novel, the author says that Pearl 'ran and looked the wild Indian in the face'(Hawthorne, 1994, p 208) when he had come to witness the procession. The adjective 'wild' implies that the Indian was part and parcel of the wilderness. This idea is reinforced when it is said that the curious Indians approached Hester 'gliding through the crowd, fastened their snakelike black eyes on Hester's bosom, conceiving, perhaps, that the wearer of this brilliantly embroidered badge must needs be a personage of high dignity amongst her people' (Hawthorne, 1994, p 208). The comparison of the Indians to the snakes in appearance and movement makes them one with the wilderness, their abode. In addition, it could be assumed that Hawthorne wished to exhibit their

<sup>13</sup> Eaton C., and Modugno R., [Http://www.hawthorneinsalem.org/page/11412/](http://www.hawthorneinsalem.org/page/11412/)

<sup>14</sup> Noyes N.(1698) In the appendix of *New England's Duty and Interest* affirms that “

Indian drunkenness which had been sadly remarked before came regularly to be denounced in a kind of ritualistic Puritan breast-beating.”

<http://name.umd.umich.edu/n00704.0001.001>

naiveness and innocence because they seemed to believe that the downtrodden and disgraced Hester was an important personality in society.

Hawthorne's impartial treatment of the Native Indian is to be admired. The author, in his presentation of the Natives is ready to call a spade a spade even if it meant blaming the colonizers.

Considering the plot of *The Scarlet Letter* the inclusion of the Native seems unnecessary in the development of the story. During certain instances the Native Indians and their society could stand as a foil to that of the Puritans, but this does not really seem essential or relevant to the story line. One understands that the natives are an adjunct to the story but then the question arises as to why a brilliant author incorporated the natives into a classic of American literature where they really do not find their place. This being the period where the Native Indians were at the pinnacle of their glory as singular representatives of a national cultural heritage, it is quite possible that Hawthorne would have surmised that excluding them from his work would dilute the status of his novel. Hence, to be on par with the literary norms of the period he felt it necessary to include the Native Indian Image in his work. The very action of the author of embedding the Native Indian into his classic, focusses the importance of the Native Indians in American literature during the period leading to the stabilization of nationalism and all this through the Romantic era.

## CONCLUSIONS

The words: decimation, disrespect, expropriation, exploitation and manipulation have become quite commonplace when describing the life and history of the Native Indians subsequent to their meeting with the European explorers who ended up as usurpers of

their land. The sudden prestige bestowed upon the Native Indians after the American war against British in 1812 was a 'not that I love Caesar less but that I love Rome more' strategy. The Native Indians being unique to the United States they were declared a national symbol for the sole purpose of distinguishing American writing and art from that of the Old Continent. This change in status did not in any way alter the conditions of the Native Indians for the better. In reality, it was for the worse because ironically, the 'Trail of Tears' too took place during this time. The significance of using their image did not benefit the American Native Indians as a group of people in any special manner. They were purely and simply manipulated in the whole process so that American works of literature could distinguish themselves from those of other continents. Thus, revealing another egoistic move of the White Anglo-Saxon rulers.

In conclusion, though pessimistic, it could be imagined that the Native American Indians will continue, as the oppressed 'Other' in the United States for generations to come, as they missed to make use of a great opportunity which lasted for almost half a century from 1812 onwards, of globally improving their conditions. I believe they were unable to make use of this 'thrust to fame', situation because the submissiveness imposed on them, by the political leaders from day one, made them reticent and hence, voiceless, and powerless to come forward and negotiate terms for redressing their conditions.

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## Student Engagement in Online ESL Classroom: A Tale of Teachers

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### ABSTRACT

Online education /e-learning has become an integral part during the Covid 19 pandemic. This study aims to explore the teachers' perceptions on online learning and student engagement, strategies and tools used in online classes to obtain high level of student engagement and the barriers they face in achieving these goals. A case study research design with five ESL teachers as the sample is used in this study. One-on-one interviews are used as the research tool and based on the data three themes are identified. They are student engagement in an online learning environment, techniques used to gain student engagement and the barriers for gaining student engagement in an online environment. There are several major findings. The novelty of teaching in an online setting and lack of exposure to online interactive tools are prominent in the selected context. Despite this, all the participants have expressed fairly a positive attitude towards online teaching even though they have faced several difficulties in gaining maximum student engagement.

## INTRODUCTION

Online learning or e-learning has gained more prominence in society than ever before due to the Covid 19 pandemic. Subsequently, teachers had to undergo a transformation from their familiar face-to-face (f2f) classroom to an unknown virtual classroom. This transformation poses several challenges and concerns to both teachers and students in terms of operational aspects of technology, instructional design, and student engagement among others. Studies relating to e-learning fulfills not only the current needs but also future needs of the educational system as the world moves forward with continuous development in the field of Information and Communication Technology (ICT) and this particular generation of students being named as millennials.

E-learning can be defined as “the utilization of electronically mediated asynchronous and synchronous communication for the purpose of thinking and learning collaboratively” (Garrison, 2017, p. 2). This definition facilitates the study as it addresses engagement. Among the numerous definitions on student engagement, Barkley (2010) defines it as “a process and a product that is experienced on a continuum and results from the synergistic interaction between motivation and active learning” (p. 8). Christenson, Reschly, and Wylie (2012) summarizes several theories and research related to student engagement in order to identify its different elements. Accordingly, student engagement comprises “academic, social and emotional outcomes; academic environment (e.g., positive adult-student and peer relationships); and active student behavior (e.g., attendance,

participation, effort, prosocial behavior)” (Christenson, Reschly, & Wylie, 2012, p. v). Considering the breadth of the aspects of student elements, online learning, teacher’s role in the online classroom and the technological tools used during the lesson can be considered as variables of student engagement.

A considerable number of research has been focused on the use of a particular technological tool as a means of obtaining high student engagement. For instance, microblogging (Esposito, 2013) and text messaging (Sundararajan, Sheehan, & Gilbert, 2013). Meanwhile, Sri Lankan studies have been focused on the relationship between student engagement and their academic achievement (Glapaththi, et al., 2019) student engagement in e-learning (Ekanayake & Weerasinghe, 2020), use of a particular technological software or a tool in view of gaining student engagement (Dassanayake & Senevirathne, 2018), (Jayarathna & Fernando, 2014). Considering the above mentioned literature, it is evident that there is a research gap in studying online student engagement from teacher’s perspective. Thus, this study seeks to explore ESL teachers’ perceptions, experiences and practices with regard to student engagement in an online classroom. The objectives of the study are (1) how ESL teachers perceive e-learning, (2) how ESL teachers perceive the student engagement in an online setting, (3) how ESL teachers negotiate their teaching practices to gain student engagement in an online setting and (4) how ESL teachers overcome issues related to student engagement in an online setting.

The theoretical framework of this study includes scaffolding theory, multiple intelligences theory, student-centred learning and collaborative learning.

## **MATERIALS AND METHODS**

This study is based on qualitative research design and the case study method is selected in order to gain an in-depth understanding of the research problem and the subjects. A single embedded case study (Yin, 2018) design is selected as the sample contains five ESL teachers from a non-state university in Sri Lanka from the population of ESL teachers in Sri Lankan universities. This sample is drawn using convenience sampling method. One on one structured interviews are used as the research tool and the participants are given pseudonyms to keep their identity anonymous.

## **RESULTS AND DISCUSSION**

The demographic data (table 1) of the five participants has revealed slight differences in terms of the age group and educational qualifications. All five teachers are female whereas their age range spans between 30 to 45 years old. All of them have a bachelor's degree in English and have at least one post graduate qualification in the fields of education, English language and literature and or linguistics. All the participants have a considerable amount of experience in teaching English at tertiary level, 8 years being the lowest and 16 years being the highest. These differences may reflect in the findings.

Three themes have emerged from the interviews conducted namely, student engagement in an online learning environment which corresponds to the first and second objectives of the study, techniques used to gain student

engagement and the barriers for gaining student engagement in an online environment which relate to the third and fourth objectives of the study.

### **Student engagement in an online learning environment**

Exploring how ESL teachers perceive e-learning is one of the objectives of the study. Ms. Nayani claimed that "E-learning is a completely novel thing" to her and she has started using online teaching due to Covid 19 pandemic as she is "unable to meet them in a lecture hall and that means we are now using electronic media to have the same experience as much as possible". Ms. Gayani has mixed feelings about e-learning as she has had "horrendous experiences during very first online sessions" while Ms. Jayani feels a lack of social interaction in online learning. Ms. Rayani also holds a similar viewpoint on online education and student engagement. Although this is her first-time teaching in an online setting, she has acknowledged the benefits so "it is beneficial for the students rather than staying at home without doing anything". In contrast, Ms. Wayani claims that "E-Learning has become the lifeblood of today's education and has a lot to do with teachers and learners. They are equal stakeholders in this whole teaching learning process and online education is effective if you want it to be effective. I personally believe, it's quite challenging".

Compared to the varying viewpoints and experiences on online education, all the participants have expressed fairly similar views on how they perceive student engagement. Accordingly, they have identified active participation of the students, showing interest towards the lecture, asking questions, and responding to the teacher as elements of student engagement. Ms. Nayani claims that students are not engaged as much as she

wanted them to be due to not knowing “what to do in online lectures because there are so many people. They are unable to attract attention to themselves, as it would be in an actual lecture hall. They can't raise their hands...We won't know if the students are there in the session and also sometimes the same thing happens to them, I suppose”. Ms. Gayani “craves for the participation, contribution that occurred in physical classes because I believe there is more student engagement in the physical class”. Moreover, she values the actual feedback she receives when “you observe, their body language and at the end of the day you get some feedback, either verbally or non-verbally”. Ms. Jayani also shares a similar view that she misses the social interaction in online classes as “when you see the students you like working with them”. Ms. Rayani highlights the importance of gaining active participation of the students during the lecture in terms of student engagement. Ms. Wayani claims that the student engagement depends on the student cohort. For example, as far as the IT students are concerned, the “levels of engagement would be very high because we are using digital tools, but I still feel this is no different than what we actually do inside the classroom. It has a lot to do with individual students.”

### **Techniques used to gain student engagement**

It is vital to understand how ESL teachers gain student engagement in online classes. This includes whether they use different types of online tools and functions available on the video conferencing tool. As mentioned in the previous section, online teaching is a novel experience for Ms. Nayani and she has experienced

difficulties conducting online lectures at the beginning of the pandemic. She describes her very first online lectures as “quite boring because there was nothing for me to hold the students’ attention. It was just like talking to a wall”. In the following semester she has “accidentally come across the annotation tool in Zoom<sup>1</sup>” and subsequently she has started using different online tools which were introduced to the staff members such as Mentimeter<sup>2</sup> and Kahoot<sup>3</sup> which “make it somewhat bearable now”. She uses Kahoot games to check whether the students have been paying attention to the lecture and she sometimes check the feedback report of Kahoot for this purpose. In addition, she uses Jamboard<sup>4</sup> for writing activities as it provides evidence that the students are engaged in the lesson. Moreover, if the class is small, she tries to talk to individual students and ask them to switch on their camera or to type their name or an answer on the chat box available on the video conferencing tool.

On par with Ms. Nayani, Ms. Gayani also claims that “when we were conducting physical classes, we were not much aware of these online games that we can do like Kahoot”. During the physical classes she has not used technological devices and software as it was cumbersome to carry laptops and or set the computers and other devices in the lecture halls. In contrast, during the pandemic she could use her own laptop which enabled her to use PowerPoint presentations, online games, and Google docs<sup>5</sup> in her online classes. Moreover, she believes that “audio visual appeal of the presentations and videos makes the lesson more interesting than just doing a lecture with a printed tutorial”. She asks questions if “there is

<sup>1</sup> <https://zoom.us/>

<sup>2</sup> <https://www.mentimeter.com/>

<sup>3</sup> <https://kahoot.com/schools-u/>

<sup>4</sup> <https://jamboard.google.com/>

<sup>5</sup> <https://docs.google.com/>

dumb silence in the class” and she uses the strategy of giving a task to complete each day via Google docs so that the students engage in the lesson and are motivated.

Ms. Jayani professes that she uses online interactive tools like Kahoot, Mentimeter, Jamboard, Padlet<sup>6</sup> and break-out rooms function available on the video conferencing tool in her online classes. Ms. Wayani uses Slido<sup>7</sup> and Zoom whiteboard in addition to the tools mentioned by other participants. Ms. Rayani claims that she uses different online tools to get maximum student engagement. They are Kahoot, Mentimeter, Edmodo -Jump start Academy<sup>8</sup>, Slido, Padlet, Jamboard, Dotstorming<sup>9</sup> and break-out rooms. She claims that she uses mainly Kahoot for Multiple Choice Questions (MCQs), Padlet and Jamboard for written activities and the ‘Word cloud’ option available on Mentimeter for warm-up activities. Further she claims that she uses these online tools during the session to check the students’ understanding and whether they have been paying attention and whether they are in the class as she cannot see their presence visually. In addition, she uses these tools in a warmer at the beginning of the lesson or an activity to motivate the students. It is noticeable that she uses the highest number of online tools among the five participants.

### **Barriers for gaining student engagement in an online environment**

Ms. Nayani states that both teachers and students face barriers during the online classes. For instance, the students do not know how to use the student engagement tools used by the lecturers and she has experienced such issues with Jamboard where the students do not know how to

move to a new frame and type their answers. Moreover, some students complain that the links provided for such activities are not accessible through their devices mainly mobile phones. In such instances, she asks the students to type the answer on the chat box. Moreover, she claims that she was not aware of the break-out room option available on the video conferencing platform which resulted in omitting group activities and speaking activities. Further, she expresses the difficulty in conducting online lectures for the subject English for four hours at a stretch as the timetables have not been changed to suit the online environment. Most of the time she encourages the students to speak out despite students using the chat option to convey their messages. Apart from these issues, she identifies the issues with the computer devices and internet connection as common barriers to gain maximum student engagement.

Ms. Gayani and Ms. Jayani too have experienced similar barriers in their online classrooms owing to technical issues (issues with devices), connectivity issues, lack of experience and knowledge on the use of software, online tools and video conferencing. Ms. Wayani explained the issues that occurred during break-out room activities. For instance, in “some large classes, yes, so we have logistics issues... you try to get them into groups but sometimes they go missing ... sometimes just one kid is left in the allocated break-out room... some of them are stranded in the main meeting”. Moreover, it is difficult to observe all the rooms by one teacher “say you have ten groups and by the time you take rounds in the ten groups and then you join the main meeting then you realize some people are

<sup>6</sup> <https://padlet.com/>

<sup>7</sup> <https://www.sli.do/>

<sup>8</sup> <https://new.edmodo.com/>

<sup>9</sup> <https://dotstorming.com/>

there. By that time, it's too late for you to reassign them”.

Ms. Rayani also explained issues with the break-out rooms such as the inability to operate them using the web browser, difficulties in monitoring each room and inability to stop the students leaving the break-out rooms. She specifically, mentioned that some of her students leave the meeting when she assigns break-out rooms, and she feels helpless at such times as she cannot keep them in the online class as she does in a physical class. Moreover, she claims that “some students speak in their vernacular during the break-out room activity even though they are instructed to use their L2” which is English and some students “leave the meeting when there's a productive skill...I mean when speaking or writing is tested... if it's on an on campus lecture, we can force them to speak, but since they have the option of just leaving and the identity is not clear, we just see the name and the ID number”. Similar to the other participants, Ms. Rayani also acknowledged that she has faced issues with students complaining about their connectivity issues, issues with microphone and video camera. In addition, she explained issues with device compatibility. For instance, students seem to have faced issues in joining some of the online tools from their phone or web browser. In such instances, she has asked them to type their answers on the chat box of the video conferencing tool and she has published that on the particular tool on behalf of the student. Further, Ms. Rayani explained an issue with Jamboard. That is, the inability to identify the student who has written an answer due to the anonymous login option which hinders her from giving individual feedback or identifying the competency level of individual students. Finally, Ms. Rayani revealed the difficulties associated with using the free version of the online tools which limits the number of participants

and type of activities. She recalled a recent incident in which she has created some activities on an online tool sometime ago and when she tried using it during the lecture that particular site had not been in operation anymore.

Considering the data analysis, it is evident that the participants of the study are novel to online teaching and learning process. Despite their lack of experience in online teaching, online tools, and technological devices, they have handled online classes and tried to gain maximum student engagement to the best of their ability.

## CONCLUSIONS

This study has explored the student engagement in online ESL classes from the teachers' perspective. Student engagement in an online learning environment, techniques used to gain student engagement and the barriers for gaining student engagement in an online environment are the three themes emerged from the data analysis. In concluding the first theme, it is evident that the teachers need more training and orientation towards online teaching in order to achieve maximum level of student engagement. Moreover, it has been noted that the participants of this study are novice users of online teaching environment and online educational tools. In the sense of the second theme, although the teachers are using several online tools to obtain student interaction, it is noted that some of the participants lack exposure to different interactive tools. Due to this fact they have encountered several issues during their online classes. Considering the third theme, it is evident that both teachers and students have faced several difficulties associated with the affordances of the digital tools.

Finally, this study opens the research into student engagement in online classes and

**Table 1.** Demographic data

	Ms. Nayani	Ms. Gayani	Ms. Jayani	Ms. Wayani	Ms. Rayani
Age	40-45 years	30-35 years	30-35 years	40-45 years	30-35 years
Educational qualification	Bachelors Post graduate diploma Reading for masters	Bachelors Masters	Bachelors Masters	Bachelors Masters	Bachelors Masters
Teaching experience	16 years	8 years	8 years	15 years	8 years

the strategies that can be used by the teachers in achieving a high level of student engagement.

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## To Comment or Not to Comment: Exploring the Engagement Levels of ESL Learners in Facebook Groups

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### ABSTRACT

Phenomenal changes have taken place in English Language Teaching (ELT) in the last few decades. With e-Learning being the norm, Technology has become an integral part of education and Computer-Mediated Communication (CMC) has revolutionized human communication. Proving to be a very useful tool with its abundance of input, authentic materials, and interaction opportunities the positive influence of CMC has been documented. Lately, the immense popularity of Social Networking Sites (SNSs) such as Facebook and Twitter have reshaped the pedagogical landscape of ESL as more ESL practitioners are adopting SNSs as learning platforms. Its potential as a learning tool in L2 is being widely researched. Facebook has become the way the 21st century communicates and especially the young adults worldwide whose primary medium of communication is Facebook. The advantage of using Facebook as a tool is its unchallenged popularity and the array of options such as uploading, tagging, comments, personal information sharing, connecting with other users, creating groups with common interests offered. This paper examines the impact a Facebook group has on the engagement levels of a class of young adults in a General English Course at a private institute. In a one-year course, the researcher who is also the teacher created a private Facebook group for the students. Incorporated with the regular classroom activities, the students were assigned scaffolding activities, which could be done online. Further, this paper discusses the levels of engagement and the features of interaction observed in the participants' Facebook Page behavior. In addition, the study provides insights for ESL practitioners regarding the usage of Facebook activities in order to enhance their learners' engagement levels.

## INTRODUCTION

In Sri Lanka, English Language research paradigms have shifted, and pedagogical and andragogical approaches have been revised, restructured, and transformed by different national initiatives like *“English as a life skill”*. Many students attend private institutes for English Language education and most of these are young adults. These ESL (English as a Second Language) learners experience several challenges when learning English. The target group joined this private institute after G.C.E. Advanced Level. The researcher cum the teacher observed a severe lack of response and interaction among the learners in the General English course. It was observed that they struggled for better vocabulary and grammatically correct sentence construction. Therefore, the researcher introduced a pedagogical novelty to the teaching learning process of the institute by experimenting with a Facebook group in order to enhance their engagement.

### Significance of the study

CMC is hailed as the 4<sup>th</sup> milestone in the medium of linguistic communication after language, writing and print (Crystal 2011). It became progressively popular as it offers a variety of interaction and has unique linguistic and interactional features (e.g., interactive text-based discourse / turn taking competitions). Chun (1994) found that CMC facilitates high level of language complexity, and a CMC language classroom generates motivation in the learners. Lately, considerable level of interest and dialogue is seen in the implementation of Web 2.0 tools such as blogs, wikis, podcasts and social networking in language teaching (Sturm, Kennell, McBride & Kelly, 2009).

Today, Social networking sites (SNSs) like Facebook and Twitter are an integral part of online learning. Facebook is the most

popular SNS in the world with 2.85 billion users (<http://www.statista.com/> 2021) and there are 3-3.5 million Facebook users in Sri Lanka. These statistics prove that Facebook has become a powerful platform and its use is widespread and its dominance has penetrated spheres such as e-Commerce, Health, Finance and Education in particular.

### Literature review

Many language teachers across the globe have recognized the potential of Facebook as a pedagogical tool (Cook et al., 2008). Furthermore, a significant number of studies have established the positive impact Web 2.0 technologies and SNSs have on L2 learning and learner engagement (Buzzetto-More, 2012; Wang & Vasquez, 2012). It is the participatory features such as commenting space, spontaneous discourse space that motivate Facebook users to engage in socialization and interaction. This participatory atmosphere can be exploited by Second Language teachers, especially ESL teachers to motivate learners to use L2 among themselves via incorporating Facebook based teaching / Learning activities that are not traditional classroom activities like drills and composition writing. In fact, according to Sigala (2007) schools and universities have a potentially effective platform with Facebook and all the Web 2.0 technologies which can be utilized to educate their cohorts in unorthodox learning spaces that are more learner centered. In addition, these SNSs are exceptionally popular among the young learners as they enjoy free access, opportunities for collaboration, personalization, and customization all at once.

Even though Facebook is a highly informal space for interaction, it has been effectively utilized by academics as a pedagogical tool via open or closed groups feature available on the platform (Minocha

2009). Furthermore, Minocha explains how Facebook private groups can be effective as Feedback platforms where learners feel more encouraged to express themselves concerning their peers' work and the teachers have a more learner-friendly environment to provide feedback as well. Most importantly, this kind of stress-free platform may lead to reserved and reticent learners becoming vocal and collaborative, hence more engagement.

Social constructivist theory developed by Vygotsky (1978) has been the corner stone for several learning theories formed to conceptualize language learning. In brief, what lies at the crust of social constructivism is how individuals learn in response to their interaction with their respective cohorts. As Vygotsky illustrates, individuals construct knowledge more via social interaction than any passive reception of information. "Through collaborative elaboration, learning takes place in meaningful contexts in negotiation and collaboration with others" (Bruner, 1999). Therefore, it is evident that learning is more meaningful and effective when corroborated in shared learning spaces as provided by Face book groups.

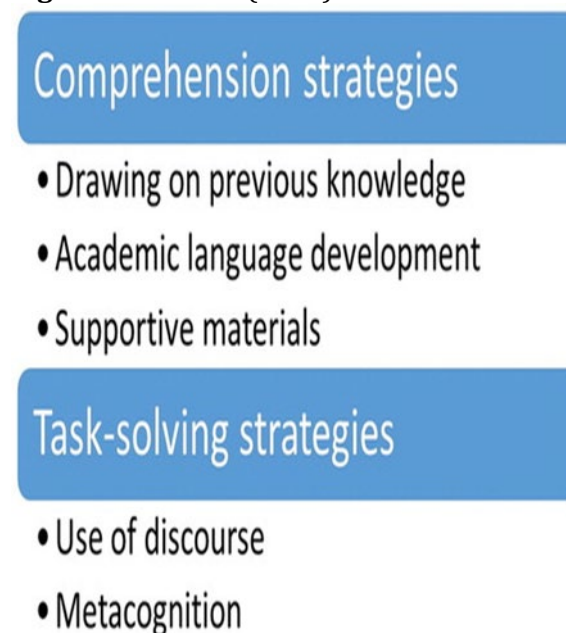
### **Scaffolding**

Scaffolding as a concept was introduced by Bruner in 1970's and has been subsequently reshaped over the years by many linguists and teachers alike. For example, its primary goal is claimed to be learner autonomy (van de Pol, Volman and Beishuizen 2010) and scaffolding is said to prioritize the learner's role in the overall teaching/learning process as opposed to the conventional teacher-centered equation (Lin et al. 2012). In fact, Maybin, Mercer and Stierer (1992) define scaffolding as "a type of teacher assistance that helps students learn new skills, concepts, or levels of understanding that leads to the student successfully

completing a task; a specific learning activity with finite goals".

It can be used by ESL teachers to support learners and facilitate the learning process (Berk & Winsler, 1995). Scaffolding activities can be multifarious and may be determined by a teacher's cohort and the specific nature of that cohort's linguistic needs and repertoire . As illustrated in Figure: 1 Mahan (2018) modifies the initial classification of Scaffolding formulated by Maybin, Mercer and Stierer in 1992.

**Figure 1.** Mahan's (2018) modification



As illustrated in the above figure, scaffolding approach provides a variety of verbal and academic supportive materials, from both the teacher and more competent peers, in order to boost learners' motivation and confidence levels so that they can become autonomous.

### **Research Objectives**

1. To find out how the Facebook group facilitates ESL learning
2. To study the learners' response / feedback to the scaffolding activities

3. To explore the engagement levels of the learners in responding to the Facebook Group activities

## **MATERIALS AND METHODS**

This study was conducted in a one-year General English program at a private institute. The research was conducted after 6 months in the course for a group of young adult learners who joined the institute after their Advanced level Examination. 30 participants were the sample. Convenience Sampling was used to determine the participants for the research. Their first language is Sinhala and all of them had passed the General English paper at GCE A/L. The main research instruments were observations of their Facebook group behaviors and focus group discussions.

### **Research Procedure**

1. The teacher created a closed Facebook group for the students
2. Scaffolding activities were posted on the Facebook group
3. Students respond to the activities via comments
4. Members of the group share ideas and comment and give feed back
5. Teacher provides consultancy only if solicited by the learners.

After creating the private group, teacher posed scaffolding activities and the students were asked to provide answers on the Facebook group and they were required to post comments on their classmates' posts. The teacher got involved only if the students reached out for Feedback and direction. The teacher used the following scaffolding activities.

1. A chain Story: The teacher provides a prompt for a narrative and the students continue adding posts and narrating while extending and commenting on classmates' posts

2. Sentence race: The teacher provides a set of vocabulary items with which they make as many sentences as possible within a deadline and the winner gets the chance to provide the next set of vocabulary items.

## **RESULTS AND DISCUSSION**

Even though these activities were blended into the classroom activities, the actual classroom was not inside the physical classroom as Nunan (2005) redefined it as a learning environment. Use of technology should promote learning and the online interactions were meant to be holistic and autonomous.

The researcher made the following observations aligning with the research objectives.

### **Pedagogical Observations**

#### **Chain Story**

1. All the students were highly motivated in responding to the chain story
2. The student who has the lowest proficiency and the one who responds least in the class was the first to respond
3. Their reaction to classmates' posts was almost 100%

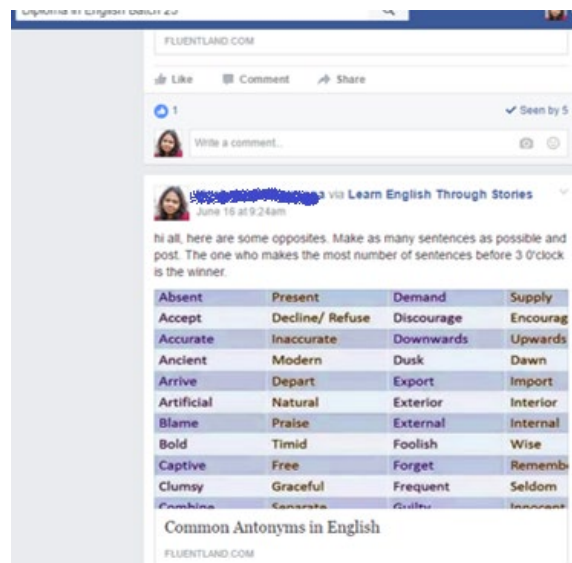
Figure 2



### Sentence Race

1. Everyone did not respond.
2. First the more proficient students responded
3. Students reached out to the teacher for grammar and vocabulary scaffolding

Figure 3



Subsequent to the observations regarding the sample's Facebook group interaction and behavior, the researcher was able to identify a few interesting behavioral patterns with regard to their engagement. The researcher was able to see significant improvements in the classroom interaction levels and the frequency of response in all the students after the Facebook Group activities were created. It was evident that an activity that was interest-driven such as the Chain Story elicited responses from everyone in the sample and they continued to add several

comments as the story was created by their contribution. This activity was self-sustaining as the participants were given adequate time to work on the story. One other crucial observation was the participants' interest in their peers' comments and their willingness to provide feedback which was not the case during the in-person sessions. Their engagement levels were high as they were engaged voluntarily without the teacher's constant stimulation which is the real time class scenario. The participants created content in collaboration, especially in the Chain Story activity and they even continued to add comments after a few days too, as the researcher allowed a flexible window for comments.

However, another observation made by the researcher was that the second activity "Sentence Race" had neither equal participation nor the same degree of engagement in comparison with the Chain Story. At the initial stage, only the more competent students responded to the activity as it required them to construct a sentence using the adjectives given in the grid on their Facebook group wall. Nevertheless, students consulted the researcher/teacher more often as they required certain words' meanings clarified and the accuracy of their sentences verified. Moreover, it was also noted that all the 30 participants did not respond to this activity whereas all of them responded to the "Chain story" activity with considerable enthusiasm.

### **Focus group discussions**

These discussions were used to corroborate the observations made by the researcher by studying their Facebook Group Behavior and levels of engagement. The participants had positive attitudes towards using Facebook and agreed that Facebook can be utilized to facilitate English language teaching and learning. They further explained that they felt

relaxed and less pressurized when they were interacting online with the teacher and the peers, especially as Facebook is an integral part of their lives and commenting on Facebook is only natural for them. 10 participants explained that they got to know their teacher better and they felt more comfortable thereafter even when getting clarifications from the teacher.

On the other hand, 8 participants felt that they needed more confidence to comment publicly, and it will take some time. However, the same participants mentioned that they enjoyed liking their friends' comments and posting motivating emojis and highlighted that they felt being a part of the Facebook learning community.

### **CONCLUSIONS**

Therefore, based on the researcher's Facebook group observations and the focus group discussions with the participants, it can be concluded that the Facebook group activities were able to facilitate ESL leaning by providing the leaners with a safe space to express their ideas; writing comments using adjectives/narrative tenses/constructing sentences. These activities were able to enhance the learners 'engagement levels in the General English class while a noticeable increment in the engagement levels of the leaners with low English proficiency was observed. Facebook activities seemed to promote interaction and the learners got actively engaged in the learning process and seemed to enjoy English learning and their inhibitions seemed to be diminishing. It not only created a space for learners to interact with each other, learn from each other but provided an opportunity for the teacher to develop a more engaged rapport with the learners which can have a positive impact on teaching in the long term.

However, these Facebook activities need to be longitudinal in addition to being consistent and systematic regarding the language components incorporated online. In addition, further research is required to examine the aspect of academic distraction created by Facebook engagements and the need for ESL teachers to be adequately tech-savvy.

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## Gathering Transition Perspectives: Views of Undergraduates with Low English Proficiency (LEP) in the First Year of English Medium Instruction (EMI)

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### ABSTRACT

This paper reports on the qualitative and quantitative data gathered from a sub group of first year undergraduates in a faculty of Management and Finance, the students with Low English Proficiency (LEP). These students were in the second semester of their first year. This data captures the students' expectations and impressions of their first year EMI experience. The main objective of this data collection and analysis was to identify the students' perspective on the importance of the four language skills of reading, writing, listening and speaking related to their academic tasks. Thus, it was used to identify the language needs and motivations according to the first year undergraduates. These students identified comprehension of content lectures, reading and comprehending lecture notes and other subject related reading material, reading and comprehending exam questions, writing exam answers and assessed assignments. However, the students' views need to be triangulated with the hindsight views of senior students to gather a more comprehensive understanding of their real English language needs. Such insights have the potential to guide needs based tailor-made English language interventions.

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## INTRODUCTION

There is a great interest in broadening the scope of EMI in the local universities. This would inadvertently call for a strong English for Academic Purposes (EAP) support for students with Low English proficiency and who have to transition from education in the local languages to EMI. Designing such EAP programs calls for comprehensive analysis of student English language needs.

English medium instruction (EMI) poses many challenges to undergraduates in Sri Lanka, who have completed their school education in Sinhala or Tamil. Of these challenges, EMI can especially be an obstacle to academic success for students of limited low English proficiency (LEP). These students of limited English proficiency are identified and documented every year through the English placement test conducted by local universities for new entrants. As some of these students opt to follow English medium degree programs and since certain institutes follow an open or no language proficiency screening policy for new entrants who opt for EMI, low English proficiency (LEP) students become a cause for concern to the local universities in Sri Lanka. Even though a proportion of such students do manage to complete their degrees, due to their limited English proficiency, they have to deal with poor comprehension and face challenges in their learning. As a consequence, they fail to achieve their optimum academic performance and fail to secure high grades.

Dissanayake and Harun's (2012) quantitative research into students' language needs in an EMI tertiary setting in Sri Lanka had revealed a mismatch between learner needs and current language support. De Silva and Devendra

(2015) had gathered students' views using a qualitative tool through a timed essay writing exercise which provided insights into students' views on their language needs. The present study aimed to use a questionnaire followed by a semi structured interview to identify the students' needs. This paper reports the findings of the questionnaire.

The objective of this research is to promote needs analysis in EMI contexts in local tertiary settings especially in settings which admit students of a range of language proficiencies including those of low English proficiency. Further, it aims to promote design and development of instructional material and interventions that address the unique needs of such students. The research was part of a larger study conducted to gather insights and develop interventions that will best address the needs of low English language proficiency in EMI.

This research was conducted in the Faculty of Management and Finance of a national university of Sri Lanka. This Faculty is an exclusively EMI Faculty in which all academic tasks such as conducting lectures and assessments are conducted in the English medium. It awards students the Bachelor of Business Administration (special) degree, also known as the BBA degree, at the end of four years of study.

## MATERIALS AND METHODS

The group of participants selected for this inquiry was a group of first year students who had scored in the lowest range of marks in the English placement test that is below 40%. The questionnaire was administered in the second semester of their first year studies. This was a part of a

larger study to identify students' language needs based on students' and subject lecturers' views and by analysing the students' academic subject content and teaching learning process in their faculty. This paper focuses on identifying the English language needs from the perspective of the first year students based on their first and second semester experience in EMI.

Thus, research question this paper explores is: What are the English language needs identified by the first year (LEP) undergraduates following the English medium BBA degree?

One of the main research tools employed for this purpose was the questionnaire. In the questionnaire, the students were mainly required to select their language needs and grade their language needs according to the order of importance for their academic studies. However, open ended questions too were employed to gather in depth information on their language needs.

The questionnaire employed both closed ended and open ended questions to capture the range of possible answers which cannot be collected with pre-prepared response categories' (D rnyei & Taguchi, 2010, p.36). Therefore, to capture data that may have been missed by the closed ended questions, an open ended question was placed at the end of the questionnaire (D rnyei & Taguchi, 2010).

The questionnaire items inquired into the English functions necessary for the successful completion of their degree studies and some of their linguistic characteristics. For each item selected, the students were also allowed to evaluate the item in a gradable manner through a Likert scale. This helped the students to express both their needs and wants. 'Needs' as explained by Jordan (1997) are

the language functions, skills and knowledge that are relevant in their English medium academic work. 'Wants' are the extent to which the items are required during the limited time period of the semester or academic year (Jordan,1997).

### **Pilot study**

An invitation to design content and teach English language skills to LEP undergraduates following an exclusively English medium course in Economics provided the opportunity to pilot a questionnaire to identify English language needs for English medium academic study. Needs analysis was conducted with the students using a questionnaire which included both quantitative and qualitative questions as well as semi structured and unstructured interviews. The student questionnaire was made available in both Sinhala and Tamil languages.

### **Structure of the student questionnaire**

The questionnaire for the first year students mainly focused on identifying the immediate English language needs and wants pertaining to the present context which is the first year studies in the BBA program. The students were instructed to rate each skill as either 'Essential', 'Very important', 'Somewhat Important' or 'Not important.' The language skills selected were the ones that were thought to be the most needed in the first year of the English medium BBA degree.

The questionnaire inquires into micro skills related to the main four skills. For instance, the micro skills of reading it inquires into are namely, reading textbooks, research articles, magazines or newspaper articles, lecture notes/ handouts and exam or assignment questions. This was in order to identify the specific English needs of the students and this practice was evident in similar questionnaires designed for the purpose

of judging the relevance of the academic functions (Kittidhaworn, 2001; Kaewpet, 2009; Spence and Liu, 2013; Adzmi, Bidin, Ibrahim & Jusoff, 2009 Berman and Cheng, 2001; Alharby, 2005).

The items included in the questionnaire were also founded on the researcher's general observations and perceptions gathered from discussions with senior students, lecturers and observations of live first year lectures. This implies that prior to designing the instruments for gathering data, the researcher needs to familiarise themselves with ground situation to pose well targeted and effective questions.

The third part of the questionnaire inquired into the students' perception of their difficulties in carrying out the tasks in the English medium (mentioned in the second part of the questionnaire). The fourth section inquired into what students' *want* from an ESP/EAP course.

For the present study avoided detailed questions related to language features such as suffixes as well as syntactic structures such as passives, aspects, and modality and the importance of logical connectors and chronological sequencing to name a few, as followed in Kittidhaworn's study (2001). It was felt that eliciting accurate information on such linguistic details will not be productive given the subjects 'low English proficiency. Since the students had a stronger awareness of the language functions needed in their English medium academic work, the student questionnaire of this present research aimed to identify these functional needs.

Given the students' low English proficiency, a Sinhala and Tamil translation of the questionnaire was used to ensure comprehension on the students' part. However, only Sinhala translations

were used as there were no students requiring Tamil translations among the participants. Two open ended questions were also included in addition to the close ended questions. The students' responses to the closed ended questions and the open ended questions were compared to establish and to identify the students' language deficiencies and arising academic needs.

A group of 11 students who were identified as possessing low English proficiency (LEP) by the English placement test for new entrants, agreed to participate in this survey. There were challenges in locating such students as they were distributed among other students in a batch of about 400 first year students. From a group of over 100 'LEP' students (so identified through the English test for new entrants) only 11 students responded favourably to the request to participate. All eleven students had completed the Ordinary Level English examination successfully securing A, B, C and S grades. However, the students' proficiency of English had dropped over the years with six out of the eleven students failing Advanced Level General English and only four students having secured S grades (ordinary/simple pass). The students' responses were converted to percentages and compared for interpretation.

## RESULTS AND DISCUSSION

### Tables and figures

Some of the tabulated questionnaire data are shown in Tables 1-5.

**Table 1.** Importance of writing

	Frequency	%
Very important	3	27.3
Essential	8	72.7
Total	11	100.0

**Table 2.** Importance of Reading

	Frequency	Percent	Cumulative Percent
Somewhat important	2	18.2	18.2
Very important	3	27.3	45.5
Essential	6	54.5	100.0
Total	11	100.0	

**Table 3.** Importance of listening

	Frequency	Percent	Cumulative Percent
Somewhat important	3	27.3	27.3
Very important	8	72.7	100.0
Total	11	100.0	

**Table 4.** Importance of speaking

	Which do you have to read?	How important is it to your first year studies? The activity is .....			
		Not important	Somewhat Important	Very important	Essential
Text books	45%	9%	36%	36%	
Research articles	54%		64%	9%	9%
Magazines or news paper articles	82%		36%	27%	27%
Lecture notes / handouts	91%			18%	73%
Exam or assignment questions	82%			36%	69%

**Table 5.** Required reading material and degree of need

	Frequency	Percent	Cumulative Percent
Very important	3	27.3	27.3
Essential	8	72.7	100.0
Total	11	100.0	

### Combined results from students' questionnaire

The combined results of the students' questionnaire are listed below. By their responses, the students identified the skills they need to follow their BBA studies in the English medium.

They should be able to

1. read lecture notes/handouts and exam and assignment questions
2. listen and comprehend lectures
3. write long essay answers
4. participate in oral exams
5. write essay type assignments
6. ask questions during a subject lecture
7. answer questions posed by the lecturer orally during a subject lecture class
8. use correct pronunciation
9. speak fluently
10. speak with grammatically correctness
11. Take notes during lectures
12. Identify and use of knowledge of word classes, phrases and sentence combining

The above results can inform the curriculum and activity designing process for an EAP program for the first year 'LEP' students following the BBA degree.

### **Findings and analysis of open ended questions items No. 11**

The first open ended question requested students to refer back to item 8 and select three tasks which they identified as being the most difficult and explain the reasons for this identification. All eleven students had attempted questionnaire item No. 11.

Most of the students mentioned reading exam answers, listening to lectures and reading subject related content to be the most difficult tasks. The common reason for this situation is their poor vocabulary and grammar. The extent of the challenge is well captured by the last comment. Here the student says that he or she has to depend on a dictionary to decode and understand examination questions. This would certainly only add to the frustration and helplessness felt by these students who were the high achievers during the time of their school education. In fact, one student commented that all the course tasks that were challenging to them are actually achievable if the medium was Sinhala. This thought implies that English functions as a barrier to academic success.

Only two students had attempted the second open ended question which requested for any other comments. Their responses are shown below

#### **Student 1**

1. organize different activities to master English
2. provide books and literature and necessary relevant videos. This will be very useful

3. programs to help us lose our fear of English
4. organize yearly programs that are designed to make students learn
5. provide books and videos before the commencement of the English programs

#### **Students 2**

I would like a spoken English training program. It should not be for large numbers of students but for small groups of just ten or a few more students. Any teaching activity should be done in small groups. Then I will participate. Constant English language learning will help me to learn the language.

Both students request more exposure and resources and instruction for English language learning.

#### **Triangulation of data gathered**

When comparing the two types of data namely quantitative data and qualitative data collected from the students' questionnaire the following four tasks stand out as being most important and for academic success and most challenging in the first year:

1. Comprehending content lectures
2. Reading and comprehending lecture notes and other subject related reading material
3. Reading and comprehending exam questions
4. Writing exam answers and assessed assignments

The reasons why the students find the above tasks to be challenging were identified as:

1. Poor knowledge of subject related vocabulary
2. Poor knowledge of English grammar
3. Inability to organise information into sentences and paragraphs in English.

## CONCLUSIONS

The students are clearly aware of their English deficiency and have a desire to overcome their deficiency and have a real readiness and interest for useful English language assistance. It is felt that this interest can be maintained and satisfied if the language interventions are well aligned with the student immediate needs, in other words the ground situation of the students as undergraduates in a exclusively EMI context. The following are suggestions based on the above findings.

The most productive solution would be to develop adequate knowledge and practice of vocabulary and grammar that is for comprehending lectures, reading material and exam questions as well as to practice writing examination answers and assignments.

To help students meet their immediate language and academic needs would be the best way to maximise the limited time available for the first year students. In order to do that, the language learning and teaching endeavours mentioned above should be oriented towards the academic tasks of first year BBA program, that is lecture comprehension, content reading material comprehension and writing exam answers and assignment writing all specific to the first year BBA program.

Further, the timing of this intervention can also influence the students' success at coping with EMI. The subject or BBA

program specific EAP assistance should be provided at a time prior to the commencement of their BBA program as well as an ongoing program during their first year undergraduate studies. That way the intervention will both prepare them for the above mentioned challenging tasks well in time and as well as to cope with these challenges as they come.

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**Table 6- Students' responses to questionnaire item No.11**

- <b>Reading text books and short notes</b> is difficult as there are new words which I cannot understand. It is difficult for me to <b>formulate a question to ask during lectures</b> .
-I do not know <b>subject specific specialized vocabulary</b> . Certain lectures are not clear.
- <b>Reading textbooks</b> - It is difficult since my understanding of grammar is poor and my vocabulary is poor. <b>Writing essay type answers</b> - I cannot translate the answer I have in my mind into English and cannot <b>understand the exam question</b> <b>Note taking</b> -I cannot write fast in English.
-I have a poor understanding of grammar <b>Reading exam or assignment questions</b> - When they are longer than 2 or 3 sentences I take a considerable time to read and understand <b>Listening to lectures</b> - difficult to understand to a great extent <b>Writing essay type assignments</b> -I cannot form sentences
- <b>Writing essay type assignment, writing exam answers</b> : less than one paragraph, writing exam answers longer than two paragraphs- I find it difficult to organise my points into paragraphs. So I simply keep writing the same points again and again
-I find these tasks to be very difficult- <b>writing research articles, writing more than two sentences as answers for exam questions, doing oral presentation</b> . This is due to my inability to write or read and understand complex sentences. When doing oral presentations I find it difficult to form sentences.
- <b>Listening to lectures</b> - due to not knowing the needed vocabulary and difficulty in understanding. So I take time to comprehend. This makes this task challenging. I find lectures too fast to understand <b>Writing answers in paragraphs</b> - due to not knowing how to form grammatical sentences. I do not know appropriate words. So I spend much time on this and find this task difficult. <b>Listening to instructions</b> - due to not knowing the meaning of the words
- <b>Reading lecture notes</b> - The notes contain difficult words. This makes reading and understanding difficult. The use of passive voice makes reading understanding sentences difficult.
- <b>Writing essay type answers</b> - due to inadequate vocabulary, inadequate grammar knowledge to form sentences. <b>Reading newspapers and magazines</b> - due to the use of subject specific words and short forms.
-I find it difficult to read English sentences and to understand. I possess poor English proficiency. This affects my performance at <b>exams and lecture comprehension</b> . So I face big problems. <b>Writing research articles</b> - because I can't write. The main reason is my low knowledge of English. I can do everything in Sinhala
- <b>Reading lecture notes</b> - due to small print, slides not being clear, due to the colours used, unattractive yellowish paper used for printing handouts. The paper is not long lasting <b>Reading exam questions</b> - my low English proficiency, I have to frequently use a dictionary to read and understand one question so I spend a long time on one question



## Gender Differences in The Preferred Learning Styles Among STEM Undergraduates in Learning ESL

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### ABSTRACT

The identification of distinct learning styles among males and females is a key in successful learning in ESL. The present study aims to understand gender-based differences in the learning styles in ESL at the tertiary level using data acquired via questionnaire from sixty undergraduates. Results showed majority of both male and female were active learners. Therefore, it is recommended to facilitate active learning preferences through group-work, and practical activities with minimal note-taking tasks. Moreover, female and male populations predominantly consisted of visual learners (over 90%). Male preferences for visual stimuli were considerably significant, but they were not prominent to the extent of disturbing internalization of concepts among female students. Hence, it is suggested to use visual aids to facilitate both genders while understanding the dominant preference of male students. 63% of male students were sensors while 60% of female students were intuitors. Thus, it is recommended to cater to male students through provision of new information and discovery under unchallenging conditions while providing female students with creative thinking opportunities. Both gender included a similar composition of sequential learners (60%) and global learners (40%) confirming the necessity of a systematic order to be implemented in the delivery plan for both genders. The findings of this study will assist educators to employ the most effective methods in the ESL classroom, catering to the preferred learning styles resulting from gender differences.

## INTRODUCTION

Extensive research has documented variables that ensure success in the complex process of Second Language Acquisition (SLA) (Ellis, 1985; Torreblanca, 2007; Ortega, 2009). In this regard, facilitators are expected to be aware of factors such as age, sex, aptitude, motivation, learning styles and strategies, and personality which can predict success or failure in language learning. Among

these factors, there is a growing concern about the students' learning style due to its role as an effective determinant in the success of SLA and the uncertainty faced by the Second Language (L2) learner in determining the suitability of a need-specific learning style.

Therefore, identification of the learning style of students could facilitate successful Second Language Acquisition but there is also a possibility that preferences in learning styles are influenced by the differences in gender.

### **Gender and learning style**

Studies have shown that gender differences, the distinction between males and females, affects one's learning style in SLA (Ebel, 1999; Cavanaugh, 2002). These variations stem from physiological distinctions, such as differences in higher-level cortical processes, and brain development (Keefe, 1982). Thus, gender-based differences could govern the learning preferences of students in Second Language Acquisition.

It has been widely debated whether gender differences could impact the learning preferences of students and some studies have ascertained this claim

(Chuang, 2009; Wehrwein, Lujan, & DiCarlo, 2007; Choudhary, Dullo, & Tandon, 2011). In Chuang's (2009) study, five variables of instructional preferences were identified using the analysis of the main components: individual, passive, active, group, and alternative learning. Active learning approaches were the most popular across both genders, according to chi-square analysis. In a gender comparison, male students preferred passive learning and group learning much more than female students. Also, according to Wehrwein, Lujan, & DiCarlo's study (2007), male students preferred multimodal education, especially four modes (Visual, Auditory, Reading/Writing, Kinesthetic - VARK), but female students chose single-mode education, with a bias for kinesthetic learning. As a result, the study concluded that male and female students prefer different styles of learning. Similarly, Choudhary et al. (2011) discovered a noteworthy variance in the learning style preferences of male and female college students. Therefore, there is evidence that gender differences influence preferences in learning style.

### **The Felder-Silverman model and the index of learning styles**

The present study uses the Felder-Silverman model and the Index of Learning Styles (ILS) based on this model. This model, introduced in 1988, and the ILS, introduced in 1991 and modified in 1994, have been utilized in a wide range of studies internationally, in Engineering education and other fields. The reliability and validity of the Felder-Silverman model and the ILS has been made evident

through several extensive research studies (Felder and Spurlin, 2005). As the sample group of the present study consists of undergraduates following STEM disciplines (Science, Technology, Engineering, Mathematics), specifically Engineering and Quantity Surveying, it is pertinent to make use of a reliable model such as the above.

The Felder-Silverman model, developed by Richard Felder and Linda Silverman, is a four-part information processing model. It aims to comprehend the learning style of a student in four dichotomous dimensions: Sensory/Intuitive, Visual/Verbal, Active/Reflective, Sequential/Global.

Based on the above categorizations, the ILS is an instrument with 44 questions created to assess the learners' preference for these four dimensions. Each dimension has 11 questions, and each question includes two answer options: (a) and (b). Each response corresponds to one or the other category of each dimension. The ILS is freely available online for self-assessment of preferred learning styles, classroom instruction and research (Felder and Spurlin, 2005).

Although research on different areas pertaining to learning styles has been conducted in the international context, studies on learning style among Sri Lankan university students, especially in relation to gender-specific preferences among STEM students, constitute a research gap that is yet to be examined. Accordingly, the current study analyzes learning styles among Engineering and Quantity Surveying undergraduates in SLA based on an information processing model. The objectives of the study are to identify whether there are gender-based differences in learning styles among Engineering and Quantity Surveying undergraduates in a private university and to analyze gender preferences in the sensory channel in processing external

information among these undergraduates in ESL classes.

## **MATERIALS AND METHODS**

In order to examine gender differences in the learning styles employed in the ESL classroom, 60 undergraduates following Engineering and Quantity Surveying degree programmes at a reputed non-state sector higher education institute in Sri Lanka were selected for the study. The sample included 30 males and 30 females, in order to get balanced feedback on the preferred learning styles. All the participants were following the same ESL course at the time of conducting the study and the consent of all these students was obtained prior to data collection.

A questionnaire, consisting of the forty-four questions in the ILS questionnaire, were sent to the participants in a Google form. The answers obtained from each participant for each question were subsequently entered into the ILS questionnaire available online in order to generate the feedback on each student's learning style according to the four dichotomous dimensions in the Felder-Silverman model.

The four learning styles generated for each participant, as a result of the answers given by them in the questionnaire, were tabulated in a Microsoft Excel sheet and the total number and percentage for each learning style was calculated separately for the male and female categories. The similarities and differences between the learning styles of each gender as identified above, were then comparatively analyzed with the available research literature to understand their implications.

## **RESULTS AND DISCUSSION**

### **Summary statistics on gender based differences in learning styles**

The data obtained through respective genders through 44 questions were statistically evaluated and students' preferred learning styles were recoded under four dichotomous dimensions in the Felder Silverman model which is as follows:

**Table 1.** Summary statistics on Gender Based Learning Styles

<b>Dichotomous Dimensions</b>	<b>Female</b>	<b>Male</b>
Active	50%	60%
Reflective	50%	40%
Sensing	40%	63%
Intuitive	60%	37%
Visual	93.30%	90%
Verbal	6.70%	10%
Sequential	60%	60%
Global	40%	40%

Under the first dichotomous dimension in the Felder-Silverman model, data depicted that 60% of the male students in the sample were Active learners whereas 40% of male students were Reflective learners. While the majority of male students were Active learners, the Female sample of students split evenly depicting that it contained an equal number of Active and Reflective learners.

The second dichotomous dimension aimed at exploring Sensing and Intuitive Learning styles among male and female participants. It was noted that 63% of male students were Sensors while 37% of male students were Intuitors. On the contrary, the female student sample composed of 60% of Intuitors and 40% of Sensors. Therefore, the majority of male students preferred a Sensing learning approach whereas the majority of female students preferred an Intuitive approach in learning.

The third dichotomous category intended to analyze distinct preferences for Visual

and Verbal stimuli in learning among female and male learners. It was observed that 90% of male students advocated visual stimuli in learning whereas only 10% of male participants preferred an Auditory mode of learning. Similarly, 93.3% of females preferred Visual stimuli in learning when Auditory mode was preferred by 6.7% in the sample of female participants. Hence, a vast majority of male and female participants have advocated the Visual mode of learning over the Auditory mode. Even though female students' preference was marginally higher (3%) over the male preference for Visual stimuli in learning, 40% of male students have scored from 9 to 11 under the Visual mode. This depicted their strong preference for the Visual learning mode, thereby depicting impediment on the learning process when Visual conditions are not provided. However, such strong preferences for the Visual mode were predicted by only 10% of female students in the sample.

Characteristics of Sequential and Global learners were analyzed in relation to respective genders in the fourth dichotomous category. It was found that both female and male samples constituted 60% of Sequential learners and 40% of Global Learners. In conclusion, there was a striking similarity in learning preferences among female and male students in this dimension.

### **Active and reflective learners**

Active learners retain and understand information through active engagement while Reflectors contemplate before committing to action. Moreover, active learners like group work while reflective learners prefer studying alone, but both active and reflective learners dislike mere note-taking sessions which are devoid of practice (Bradford University, 2018).

The majority of students in the male population were active learners (60%), yet the sample does not eliminate preference on the Reflective style of learning (40%). Therefore, classroom instruction for male students could principally include practical tasks related to lesson objectives to facilitate active learners with minor tasks which involve reflection/thinking before practice for Reflectors. Again, practical tasks could be accomplished predominantly through group work whilst occasionally allowing students to work individually. Further, instruction to male students could include minimal note-taking but adequate practice.

The Female population included a similar number of active and reflective learners. Therefore, instruction in female classes could facilitate a similar volume of both active and reflective activities alongside a combination of group and individual tasks.

### **Sensing and intuitive learners**

Sensors advocate learning new facts, prefer problem solving through acceptable methods, and are skilled in memorization, but dislike surprises; whereas Intuitors are innovative, comfortable with abstractions and mathematical formulations and skillful in grasping new concepts, but dislike repetition (Bradford University, 2018).

The majority of male students (63%) in the population advocated a sensory learning mode. Thus, male students could be facilitated through presenting new concepts/information and allowing them to discover more under unchallenging conditions. However, the male population is likely to have a minority of intuitors (37%) who are good in abstractions and mathematical formulations which could assist Sensors in group tasks. In contrast, in planning instructional strategies for female classes, the majority's Intuitive

learning preferences could be addressed (60%) by allowing creative thinking opportunities and minimal assignment of similar type of tasks while facilitating Sensors who are likely to be the minority.

### **Visual and Verbal Learners**

A striking preference for the Visual mode was evident among both the female and male population in the study. It could be noted that Visual learners could be facilitated through visual stimuli: pictures, diagrams, charts, timelines, and films, demonstrations over the Auditory mode: songs, audio recordings etc. Therefore, Visual learners require to be facilitated in instructional strategies and materials which stimulate their visual sensory channels. Provided that both males and females have shown a strong preference on the Visual mode of learning, it is also noted that their reactions could be minimal in response to the Auditory mode. In fact, due to the strong preference of males for Visual stimuli to the extent that leaning process could be hindered in absence of visual stimuli, it is of paramount importance to focus on providing them with Visual aids and materials to facilitate effective internalization.

### **Sequential and global learners**

Sequential learners internalize concepts in methodical, linear stages while Global learners are inclined to learn in a non-linear, illogical order, thereby absorbing material almost unsystematically without observing relationships. Sequential learners follow consistently phased ways in noticing interpretations when Global learners are capable of swiftly remedying intricate problems or assembling factors together in original methods upon identification of the broader view. However, they find difficulty in explaining how they solved the problem. (Bradford University, 2018).

Since both the male and female samples included a 60% of Sequential learners and 40% of Global learners, there is potential for facilitating the learning style of the majority of Sequential learners without eliminating the learning preferences of Global learners. Therefore, it is possible to follow a systematic order in the delivery plan which facilitates Sequential learners as this might not hinder the learning of Global learners.

## CONCLUSIONS

The current study, which aimed at identifying if gender differences existed among learning styles of male and female undergraduates, was able to arrive at the following conclusions. The data demonstrated that the majority of male participants and half of the female participants were Active learners. Thus, in an ESL learning environment with STEM students, it is recommended to give priority to methods targeting Active learners.

For instance, group activities such as presentations, role plays, short documentaries etc. at the end of a lesson will provide a platform for the Active learners to learn through 'trying something out' while their counterparts, the Reflective learners, will also get an opportunity to reflect on the activity and contribute with their ideas during the preparation time. Considering the Sensing/Intuitive dichotomous category, the male group was shown to be Sensing learners with a significant majority, while females took the lead in the Intuitive category.

Therefore, in a class with both males and females, it is prudent to employ methods targeting both types of learners. Practical activities involving language rather than giving priority to explanations (e.g., getting students to watch a process,

describe it, and then discussing corrections referring to their answers, as opposed to explaining how the process should be written or verbally described at the beginning of the lesson) will assist both Sensing and Intuitive learners in an ESL classroom. They will be shown how the language is used in the real world.

In relation to the third category, Visual/Verbal, a significant majority of both male and female participants (90% or more) were shown to be Visual learners. This finding is on par with previous research which showed a considerable contrast between the numbers of Visual and Verbal learners with the percentage for the Visual type being higher. Moderate differences were found between the other three dimensions: Active/Reflective, Sensing/Intuitive, and Sequential/Global (Felder and Brent, 2005; Gunawardena and Liyanage, 2018).

Moreover, it is concluded that male preferences on visual stimuli was considerably significant. Consequently, an inability to cater to these visual preferences was predicted to hinder the learning process in males. While similar visual preferences were observed in female students, they were not prominent to the extent of disturbing internalization of concepts among female students as in the context of male students. Thus, employing various visual methods in the ESL classroom, such as visual presentations, pictures, diagrams, flow charts, timelines, videos, films, and demonstrations etc., would definitely assist the majority of STEM learners. Written and verbal explanations can also be included along with the visual methods to cater to the minority of Verbal learners and as a supplement for the Visual learners (Felder and Brent, 2016).

The difference between Sequential and Global learners in this study showed Sequential learners to be the majority (60%) in both the male and female groups. Therefore, following a linear style during each lesson and throughout the ESL course will facilitate the learning of STEM students. However, it is also advisable to give an outline of the overall lesson at the beginning and to show how each lesson connects to the other and their applications in the real world, so that Global learners are able to see the big picture. Seeing the relationships will facilitate Global learners to understand and make connections between the individual parts of the lesson. Furthermore, incorporating creative activities such as presentations, posters, role plays etc. at the end of lessons would give a chance to both Global and Sequential learners to demonstrate their overall understanding of the lessons and the ability to apply them in real language use.

In summary, the present study demonstrated that differences exist between the learning styles of male and female ESL undergraduates following STEM degree programmes. In order to enhance the validity of these findings, future research related to gender differences in preferred learning styles could examine a bigger sample of males and females studying ESL. In addition, the study could be extended to other areas of STEM including Mathematics and Sciences. Furthermore, comparative studies could be conducted between STEM students and those in other fields such as the Social Sciences and Humanities to gain a better understanding of the preferred learning styles of undergraduates.

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# Law



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## A Trend Towards "Due Diligence Law": Curbing the Corporate Impunity

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### ABSTRACT

Corporate must respect human rights wherever they operate. This has been a long-standing debate to include human rights elements in businesses, to control corporate freedom in countries hosting foreign investments. For this, several attempts were made to bring a multilateral agreement at the international level, as well as some developed states introduced draft legislation to regulate their subsidiaries abroad, none of which were adopted for various reasons. Nevertheless, the argument on human rights is consistent. Consequently, the soft law; voluntary standards developed by international organisations, was adopted as internal corporate policies. Recent evidence of human rights violations in some developing countries raises the question of the adequacy of existing voluntary standards as they are most impacted in subsidiaries supply chain/ activities. The due diligence test focuses on the role of corporations to uphold best business practices, and it ensures a duty of care when large corporations do business without a strong mechanism to ensure their accountability in the event of failure. A handful of developed states – France, Germany, the Netherlands and the European Union - have enacted legislation to combat corporate freedom and take responsibility for human rights abuses in their subsidiaries, subcontractors or supply chains. This paper provides a comparative analysis of such recent laws on duty on Due Diligence and studies how they regulate human rights and business. The paper adopts doctrinal analysis that combines descriptive and analytical approaches and concludes that if the laws are effectively enforced, the corporations would be held accountable for their human rights violations by the court of the country where parent corporations are located.

## INTRODUCTION

Corporate must respect human rights wherever they operate.<sup>1</sup> The capacity to regulate the behaviour of multinational corporations is central to this discussion. The revenues of some multinational corporations are greater than the GDP of some developing countries.<sup>2</sup> Undoubtedly, this allows them to use their power in capital-dependent states to create a favourable environment for themselves. Most multinational corporations are so powerful that, developing countries are unwilling or unable to regulate the said corporations due to a lack of resources, infrastructure and other support.<sup>3</sup> At the same time, international law and the home states have done very little to ensure that these corporations do not harm the development objectives of the poorer states.<sup>4</sup> Home states are efficient actors to foreign investment, and their accountability is required to ensure that their corporations operate in accordance with the emerging standards.<sup>5</sup> In several instances, such duty of home states is stressed throughout the literature, and developing countries continue to demand binding rules to control the behaviour of multinational corporations. For instance, a group of developing countries, as part of investment discussions produced a report that proposed the WTO to examine the possibility of adopting an internationally binding regulation to regulate companies.<sup>6</sup>

Similarly, Australia brought a Bill on Corporate Conduct.<sup>7</sup> One of the main objectives of this Bill was to impose environmental, employment, health and safety, and human rights standards on Australian corporations or related corporations that employ more than 100 people in a foreign country. The Bill also highlighted other measures related to health and safety standards, employment standards and human rights standards and laid down duties to observe tax laws, consumer health protection laws and safety standards. However, it was found that a lack of practical and effective implementation and enforcement techniques jeopardised the efficacy of the Bill, a significant deficiency.

Similarly in Canada, the Parliamentary Subcommittee on Human Rights and International Development of the Standing Committee on Foreign Affairs and International Trade, adopted a report that calls for 'clear legal norms' to ensure Canadian corporations and residents were accountable for their environmental and human rights violations in developing countries. This report was based on problems concerning Canadian mining companies in developing countries. Many of the recommendations of this report were rejected because the analysis of human rights issues for corporate social responsibility is still in its early stages.<sup>8</sup>

<sup>1</sup> The Guiding Principles on Business and Human Rights, unanimously endorsed by the Human Rights Council in 2011, Principle 23.

<sup>2</sup> See generally, K Aswathappa, *International Business* (McGraw Hill Education, 2015).

<sup>3</sup> See, generally, Dawood, Shamila. *Corporate Social Responsibility and MNCs: An Appraisal from Investment Treaty Law Perspective*. *Indonesian Journal of Law and Society*, [S.l.], v. 2, n. 2, p. 197-234, sep. 2021. ISSN 2722-4074. Available at: <<https://jurnal.unej.ac.id/index.php/IJLS/article/view/24262>>.

<sup>4</sup> Sornarajah, M., *The International Law on Foreign Investment*, (Cambridge University Press, 2010) 156

<sup>5</sup> *Ibid.*, at 145.

<sup>6</sup> Communication From China, Cuba, India, Kenya, Pakistan and Zimbabwe (WTO Doc No WT/WGTI/W/152, Working Group on the Relationship Between Trade and Investment, WTO, 19 November 2002).

<sup>7</sup> Corporate Code of Conduct Bill 2000 (Bill 2000).

<sup>8</sup> The Standing Committee on Foreign Affairs and International Trade, House of Commons, Ottawa, Canada (KIAOA6) 38th Parliament, 1st Session (Bernard Patry, MP). <[https://www.ourcommons.ca/Content/Committee/381/SDEV/Reports/RP1901089/FAAE\\_Rpt14/FAAE\\_Rpt14-e.pdf](https://www.ourcommons.ca/Content/Committee/381/SDEV/Reports/RP1901089/FAAE_Rpt14/FAAE_Rpt14-e.pdf)>; See also Sara L Sack, 'Home State Responsibility and Local Communities: The Case of

Besides, a few proposals to bring in a multilateral treaty on foreign investment have been unsuccessful due to divergent views between developed and developing countries, i.e., OECD's MAI,<sup>9</sup> the UN's UNCTAD Draft Code.<sup>10</sup> Moreover, the soft law version of corporate conduct developed by the ILO<sup>11</sup>, OECD<sup>12</sup> and UN<sup>13</sup> introduce voluntary standards on corporate social responsibility as a corporate internal policy to ensure human rights and environmental protection during the business operation. Voluntary standards developed by these organisations are reflected in some investment treaties concluded recently, either direct or indirect clauses.<sup>14</sup> These voluntary corporate responsibility clauses will be helpful to safeguard host state measures as Dubin advocates - "CSR clauses could be a useful basis for counterclaims allowing host countries not to avoid their own responsibility but to actively hold investors liable."<sup>15</sup>

The USA, the United Kingdom, Australia and Europe use their extraterritorial measures or *forum conveniens* to make parent corporations accountable for their gross human rights violations providing access to justice in their courts of law.<sup>16</sup> Nevertheless, human rights aspects of businesses, developed through guidelines, soft laws and extraterritorial measures are considered inadequate due to the severity of the violence, which can affect inter and intra-generational equity.

The separate system of laws is emerging on 'duty on due diligence, a more utilitarian approach to regulate subsidiaries' conduct and ensure their responsibility and accountability in strong terms. In 2017, France became the first country to enact such a law - the *Duty of Vigilance Law*.<sup>17</sup> On 10<sup>th</sup> March 2021, the European Parliament voted in favour of the *EU Mandatory Environmental and Human Rights Due Diligence Law*.<sup>18</sup> Germany adopted *Supply Chain Act* and adopted it on the 11<sup>th</sup> June 2021.<sup>19</sup> The

Global Mining' (2008) 11 Yale Human Rights and Development Law Journal 177.

<sup>9</sup>Multilateral Investment Agreement (MAI), OECD, available at <https://www.oecd.org/investment/internationalinvestmentagreements/multilateralagreementoninvestment.htm>.

<sup>10</sup> UN Draft International Code of Conduct on Transnational Corporations, UN Doc E/C.10/1984/S/5 (1984) (1984) 23 ILM 626.

<sup>11</sup> The ILO MNE Declaration was adopted by the governing body of the ILO at its 204<sup>th</sup> Session in 1977 and amended in 2000, 2006 and 2017. See <http://www.ilo.org/empent/areas/mne-declaration/lang-en/index.htm>.

<sup>12</sup> OECD, OECD Guidelines for Multinational Enterprises (OECD, 2011) <<http://dx.doi.org/10.1787/9789264115415-en>>

<sup>13</sup> UNCTC Draft Code (n.10).

<sup>14</sup> The Reciprocal Promotion and Protection of Investments between the Argentine Republic and the State of Qatar (date of signature 06/11/2016) art 12; Agreement Between the Argentine Republic and Japan (date of signature 01/12/2018) art 17; Reciprocal Promotion and Protection of Investments between the Argentine Republic and the United Arab States (date of signature 16/04/2018) art. 17.

<sup>15</sup> Laurence Dubin, Corporate Social Responsibility Clauses in Investment Treaties, Investment Treaty

News, December, 2018, Available at <https://www.iisd.org/itn/en/2018/12/21/corporate-social-responsibility-clauses-in-investment-treaties-laurence-dubin/>.

<sup>16</sup> M Sornarajah (n.4).

<sup>17</sup> A copy of the Act can be found here at, <https://www.assemblee-nationale.fr/14/ta/ta0924.asp>.

<sup>18</sup> Corporate due diligence and corporate Accountability European Parliament resolution of 10 March 2021 with recommendations to the Commission on corporate due diligence and corporate accountability (2020/2129(INL)), P9\_TA(2021)0073,, [https://www.europarl.europa.eu/doceo/document/TA-9-2021-0073\\_EN.pdf](https://www.europarl.europa.eu/doceo/document/TA-9-2021-0073_EN.pdf); The National Law Review, (March 15, 2021) EU Mandatory Environmental and Human Rights Due Diligence Law – What You Need To Know; UNHR, EU Mandatory Human Rights Due Diligence Directive: Recommendations to the European Commission, available at <https://www.ohchr.org/Documents/Issues/Business/ohchr-recommendations-to-ec-on-mhrdd.pdf> accessed on 12/08/21.

<sup>19</sup> What the new Supply Chain Act. delivers – and what it doesn't; An analysis by Initiative Lieferkettengesetz, 11 June 2021 < [https://germanwatch.org/sites/default/files/Initiative-Lieferkettengesetz\\_Analysis\\_What-the-new-supply-chain-act-delivers.pdf](https://germanwatch.org/sites/default/files/Initiative-Lieferkettengesetz_Analysis_What-the-new-supply-chain-act-delivers.pdf), accessed on 8/14/2021.

Netherlands plans to pass a new law on Due Diligence.<sup>20</sup> Selected jurisdictions are justified under two aspects – the countries that have introduced new laws regarding "due diligence" to regulating their companies abroad. Second, the countries where many subsidiaries that operate in developing countries are headquartered. The overall objective of this research is to examine the role of home states in regulating the behaviour of corporations in light of the recent attempts to enact 'due diligence law' to curb corporate impunity and the potential benefit to the investment hosting developing countries.

## MATERIALS AND METHODS

The paper adopts doctrinal analysis that combines descriptive and analytical approaches to analyse recently enacted Due Diligence laws of France, Germany, the Netherlands and the European Union. The above-mentioned laws are analysed from the anthropological perspective of the law, which emphasises the duty to protect the weaker party against the misconduct or negligence of the stronger party. The relevant data for this research was gathered mainly from primary and secondary sources.

## RESULTS AND DISCUSSION

### Human Rights and Business

Business-related human rights may vary. For instance, Zerk finds that corporations may be the primary perpetrator/front-line contributor to gross human rights violations or the secondary participant as a conspirator or accessory – commonly

referred to as "corporate complicity cases".<sup>21</sup> Furthermore, human rights abuses occur when businesses fail to comply with laws during business operations, generally defined as development-induced human rights violations. Basically, around the world, powerful, rich multinational corporations make a profit through their controlled supply and subcontracting chains at the cost of human rights violations in developing countries where laws are considered weak or not enforceable. For instance, the ILO statistics show that around the globe, there are around 25 million victims of forced labour, 152 million victims of child labour, 2,78 million deaths due to work-related diseases per year and 374 million non-fatal work-related injuries per year.<sup>22</sup> Evidence of corporate human rights abuses affects the present generation and future generations, and environmental studies, referred to as "irreparable damage" to the environment, have a severe impact on human rights.

Home states are the most efficient actor in regulating the conduct of large corporations and are obliged with international standards of human rights and to ensure that their corporations do not act in a manner detrimental to the development objectives of developing countries. UN Guiding Principle provides that,

"...the "host" State may be unable to protect human rights adequately due to a lack of effective control. Where transnational corporations are involved, their "home" States

<sup>20</sup> A copy of unofficial translation of Bill for Responsible and Sustainable Conduct Act is available at, <https://www.mvoplatform.nl/en/wp-content/uploads/sites/6/2021/03/Bill-for-Responsible-and-Sustainable-International-Business-Conduct-unofficial-translation-MVO-Platform.pdf>, accessed on 9/5/2021.

<sup>21</sup> See for detail analysis on business and human rights; Jannifer Zerk, Corporate Liability for Gross Human

Rights abuses: Towards a fairer and more effective system of domestic law remedies – A report prepared for the Office of the UN High Commissioner for Human rights, <https://www.ohchr.org/documents/issues/business/domesticlawremedies/studydomesticlawremedies.pdf>, accessed on 09/5/2021.

<sup>22</sup> Corporate due diligence, (n.18) at Para M.

therefore have roles to play in assisting both those corporations and host States to ensure that businesses are not involved with human rights abuse...."<sup>23</sup>

This moral and legal duty of home states could justify that home states benefits through corporate activities overseas and should not receive such benefits through ill-gotten gains through human rights and environmental abuses. As a result, substantial investment treaties concluded after 2015 have at least a provision for safeguarding, health, environmental and social rights that include at least human rights values. Also, some treaties have explicit provisions on human rights.<sup>24</sup> Such legislation is crucial, emanating from host states, but home states rarely enact hard laws to prevent abusive conduct by multinational corporations abroad. A handful of developed states endeavor to adopt the most welcome appropriate due diligence law in the recent past, and France, the Netherlands, Germany and European Union have been at the forefront of bringing about such law to protect human rights.

### **The Due Diligence and the Duty of Due Diligence**

As described in UN Guiding Principles on Business and Human Rights (UNGPs), 2011, the first due diligence emphasizes that business enterprises should carry out human rights due diligence, which identifies, prevent, mitigate adverse human rights impacts. Corporations must establish best business practices by assessing actual human rights impacts and integrating and communicating how

impacts are addressed.<sup>25</sup> OECD, *Annual Report on the OECD Guidelines for Multinational Enterprises* (OECD Guidelines) 2017 includes due diligence guidelines to be followed by all the sectors. This is mainly to ensure corporate behaviours do not harm the values of human rights and the environment. Act according to due diligence is not limited to corporation alone whilst it includes host state and home state responsibility for preventing or responding to abuses committed by businesses.<sup>26</sup> In the case of cross-border investment, home states have the primary duty to protect human rights as they are approved, own and operate subsidiaries of multinational corporations.<sup>27</sup>

The recent due diligence laws as mentioned below either aligned with the UNGPs or OECD Guidelines. These laws take an "enterprise" approach, ensuring the parent company is at the top of a supply chain and responsible for designing and implementing due diligence laws covering the entire group.<sup>28</sup> The due diligence laws of certain countries include the scope, action, risk analysis plan, supervision and liability, enforcement and remedy.

#### **France**

In 2017, France became the first country to enact a law relating to the duty of vigilance/ due diligence/duty of care for large corporations comprising at least five thousand employees within it or direct or indirect subsidiaries whose head office is located in France's territory. It is mandatory to have a vigilance plan

<sup>23</sup> UN Guiding Principles, Guiding Principle 7, Commentary.

<sup>24</sup> See above (n12).

<sup>25</sup> UN Guiding Principles on Business and Human Rights, (n.1) at Principles 17,18 and 19.

<sup>26</sup> Madeleine Conway, 'A New Duty of Care? Tort Liability from Voluntary Human Rights Due Diligence in Global Supply Chains' (2015) 40(2) Queen's Law Journal 741-5.

<sup>27</sup> Jannifer Zerk, Corporate Liability for Gross Human Rights abuses: Towards a fairer and More effective system of domestic law remedies – A report prepared for the Office of the UN High Commissioner for Human rights,

<https://www.ohchr.org/documents/issues/business/domesticlawremedies/studydomesticlawremedies.pdf>.

<sup>28</sup> UNHR (n.17).

relating to activities of parents and subsidiaries that operate overseas, including human rights, health and safety, and the environment.<sup>29</sup> The plan should publicise the details of the risk map, procedures for regular impact assessment, the procedure for mitigating risks or preventing severe damages, and a mechanism for collecting reports.<sup>30</sup>

### **European Union**

On 10<sup>th</sup> March 2021, the European Parliament adopted the "EU Directive on Mandatory Human Rights, Environmental and Good Governance Due Diligence". The European Commission has now been tasked with drafting a formal legislative proposal for the Directive, to be presented to the European Parliament in Summer 2021.<sup>31</sup> The Directive requires companies to conduct environmental and human rights due diligence, including sanctions, fines and civil liability.<sup>32</sup> The Directive's scope binds companies, large and small and medium-sized undertakings established within the EU and outside the EU, to access the EU internal market. Article 1 of the Directive emphasis the duty to respect human rights, the environment and good governance and do not cause or contribute to potential or actual adverse impacts on human rights, the environment and good governance through their own activities or those directly linked to their operations, products or services by a business relationship or in their value chains, and

that they prevent and mitigate those adverse impacts.<sup>33</sup>

The Directive admits that human rights violations often occur at a primary production level, particularly when sourcing raw material and manufacturing products.<sup>34</sup> Existing international due diligence instruments have failed to provide victims of human rights and adverse environmental impacts with access to justice and remedies because of their non-judicial and voluntary nature.<sup>35</sup> This aggravates developing countries' situation and requires binding regulation to curb actual and potential human rights violations.

### **The Netherlands**

The Netherlands introduces a Bill for *Responsible and Sustainable Business Conduct Act* <sup>36</sup> to curb human rights violation and environmental abuses in value chains in accordance with the principles and standards of the OECD *Guidelines for Multinational Enterprises*, falling enterprises activities outside the Netherlands meeting at least two of the following criteria – balance sheet total euro 20 million, net revenue euro 40 million; the average number of employees during the financial year 250.<sup>37</sup> The proposed Bill makes mandatory risk analysis and action plan for negative impacts, termination of negative impacts, monitoring and application, reporting on the tackling of negative impacts, a remedial mechanism. The Bill defines the

<sup>29</sup> See Article 1 of the Duty of the Vigilance Law, (n. 16); Clerc, Christophe, The French 'Duty of Vigilance' Law: Lessons for an EU Directive on Due Diligence in Multinational Supply Chains (January 13, 2021). ETUI Research Paper - Policy Brief 1/2021.

<sup>30</sup> Ibid.

<sup>31</sup> The National Law Review, European Union Moves Towards Mandatory Supply Chain Due Diligence: Start Gearing up For New Directive August 15, 2021, Volume XI, Number 227.

<sup>32</sup> The National Law Review (n. 18).

<sup>33</sup> Corporate due diligence and corporate, (n.18) art 1; Morgan, Lewis & Bockius LLP, August 2 2021, Incoming

Changes for Corporate ESG Accountability in European Union, <https://www.lexology.com/library/detail.aspx?g=756f773e-75b3-48b8-98d1-51db9046f3f6>.

<sup>34</sup> Corporate due diligence (n.18).

<sup>35</sup> European Parliament, Corporate due diligence and corporate accountability, available at, [https://www.europarl.europa.eu/doceo/document/TA-9-2021-0073\\_EN.html](https://www.europarl.europa.eu/doceo/document/TA-9-2021-0073_EN.html)

<sup>36</sup> A copy of unofficial translation of Bill for Responsible and Sustainable Conduct (n.20).

<sup>37</sup> Ibid.

duty of care as "any enterprise that knows or can reasonably suspect that its activities may have negative impacts on human rights, labour rights or the environment in countries outside the Netherlands".<sup>38</sup>

### **Germany**

In 2021, the German Federal Cabinet presented a government draft on the Due Diligence Act/ Supply Chain Act and adopted 11 June 2021 and will enter into force 1 January 2023.<sup>39</sup> This Act is aligned with UN Guiding Principles on Business and Human Rights. The new Supply Chain Act will enter into force in 2023 and will initially apply to companies with 3,000 or more employees from 2024 to companies with 1,000 or more employees with a registered office or branch in Germany. The law obliges these companies to fulfil their due diligence obligations in their supply chains with regard to respecting internationally recognised human rights and certain environmental standards.<sup>40</sup> In the future, affected parties can authorise NGOs and trade unions to raise such claims – using the already existing causes of action – on their behalf directly before German courts. This can reduce the obstacles foreign affected parties face when bringing claims before German courts – for example, reducing the high costs of such proceedings or guaranteeing anonymity in case of threatened prosecution.<sup>41</sup> Law on due diligence is arguably a more developed piece of legislation on the duty of a corporation to comply with human rights norms.<sup>42</sup>

## **CONCLUSIONS**

As discussed above, multinational corporations should be regulated, and home states should maintain the moral and legal duty to ensure their corporations' compliance with human rights related norms. The law on due diligence, designed to regulate large corporations, operates extraterritorially. Thus, these laws are significant as they deal with the "domestic measures with extraterritorial implications". It can be said that the new laws seek to impose human rights values with sound regulatory enforcement, including monitoring, sanctions, grievance mechanism, action plan, risk assessment and remediation process etc. This new trend would encourage corporations to change their behaviour and take precautionary measures to avoid human rights violations. However, some argue that proposed laws are feeble and that it should be addressed to ensure full compliance with business values relating to human rights. Furthermore, the EU Directive applies to member countries; however, Union may enact legislation on corporate due diligence and corporate accountability with extraterritorial effects to reduce negative impacts and their prospect for achieving sustainable development.<sup>43</sup> The lacuna in the cross-border investment system to prevent the massive human rights and environmental problems of powerful corporations in developing countries has been addressed, although the practical aspect of implementation has not yet been explored.

<sup>38</sup> Ibid section 1.2

<sup>39</sup> Morrison Foerster (March 29, 2021) German Federal Government Agrees on Act on Human Rights Due Diligence Obligations of Companies, available at <https://www.mofo.com/resources/insights/210329-german-federal-government.html> accessed 6/5/2021.

<sup>40</sup> What the new Supply Chain Act (n.19); Human Rights Watch, Germany: New Supply Chain Law a Step in the

Right Direction, June 11, 2021, <https://www.hrw.org/news/2021/06/11/germany-new-supply-chain-law-step-right-direction> accessed on 8/15/2021

<sup>41</sup> What the new Supply Chain Act (n 39).

<sup>42</sup> Christophe (n.29).

<sup>43</sup> Corporate due diligence, (n.18) at Para F.

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## The Doctrine of Confidential Information and Privacy in United Kingdom and Sri Lanka

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### ABSTRACT

This paper aims to discuss whether the doctrine of confidential information and privacy in Sri Lanka (SL) & United Kingdom (UK) adequately safeguards individuals. European Convention on Human Rights Article 8 gives effect to the “right to private and family life” with the objective of protecting individuals from unsolicited interference and disturbance to their private life. However, UK who has ratified the ECHR appears to be unenthusiastic and lethargic in incorporating “right to privacy” into their own domestic law, thus the courts are left to interpret it in a favourable manner. Similarly, SL has failed to recognize the “right to privacy” within the fundamental rights chapter of the SL Constitution, even though it has ratified the International Covenant on Civil and Political Rights (ICCPR) which provides for the right to privacy in Article 17. However, there are cases that demonstrate that the courts have made effort to acknowledge the concept of privacy, granted that the focus has only been in a rather narrow section of the right to privacy.

## INTRODUCTION

English Law and Sri Lankan law have shown a lack of enthusiasm in acknowledging law of privacy for entirely distinct reasons. In this highly digitalized world where an individual can exploit another's private information at the click of a mouse, the concept of privacy comes to pass as an essential fundamental right. One could question whether the current laws of UK and SL adequately protect individuals?

## MATERIALS AND METHODS

The objective of the research is to determine whether the current laws addressing the doctrine of privacy in UK and SL are adequate. The current driven hypothesis on adequacy of the doctrine of privacy in UK and SL is that it is satisfactory on the surface and thereby adequate to protect the privacy of individuals. However, through this research provides a detailed analysis into the current mechanisms on the doctrine of privacy in both UK and SL.

This study was conducted in the format of a qualitative empirical research. The research uses primary legal sources such as legislations and provisions of Constitution within the jurisdiction of SL and UK. As for secondary legal sources for this study consist of journals and research available on data collection tools such as online sites, such as Westlaw, Lexis and Google Scholar. The research had to be conducted entirely online due to limitations that the current situation, the pandemic, has caused.

This research is conducted with reference to an assignment done in partial completion of a LLB (Hons) Law degree, for Intellectual property law, on whether the doctrine of confidence adequately protects individuals.

## UK LAW IN RELATION TO PRIVACY

ECHR Article 8 specifically addresses the "right to respect for one's private and family life" which UK has ratified, however, neglected to incorporate into their own domestic law. Lord Chancellor in House of Lords clearly expressed that there were no plans to create new legislations addressing the "right to privacy".

Gavin Phillipson expressed concerns about the lack of clarity on the Strasbourg jurisprudence, on whether the European Convention on Human Rights required English Law to implement some "high level principle of privacy".<sup>1</sup> However, by observing case law it can be clarified that English law is expected to uphold Article 8 of ECHR by the means of providing adequate remedies to private actors<sup>23</sup>. For instance, the case *Von Hannover v Germany*<sup>4</sup> where the children of Princess Caroline Louise Marguerite of Hanover were caught on film with no prior consent, it was detailed that the purpose of Article 8 is to shield an individual from both intrusion by the state, as well as "arbitrary interference by the public authorities". Pertaining to such rational, the European Court on Human Rights determined that it was the responsibility of the state as a signatory to the ECHR to make adequate measures to respect and protect an individual's private life. Several other cases mirrored this interpretation of

<sup>1</sup> Transforming Breach of Confidence? Towards a Common Law Right of Privacy under the Human Rights Act (2003) 66 MLR 726. At p 729.

<sup>2</sup> *Earl Spencer v United Kingdom* 25 EHRR CD 105.

<sup>3</sup> *Peck v United Kingdom* (2003) 36 EHRR 41.

<sup>4</sup> *Von Hannover v Germany* [2004] EMLR 379.

Article 8 further solidifying this approach<sup>5678</sup>.

Furthermore, Section 6 and Section 7 of the Human Rights Act 1998 provide that any deed that is contrary to ECHR would be against the law, further establishing the need for adequate measures addressing the right to privacy. However, English law showed no attempt to address privacy via legislative reforms. In the case of *Wainwright v Home Office*<sup>9</sup>, Lord Hoffmann expressed that he did not see the need for advanced laws on invasion of privacy by stating “I do not understand Sedley LJ to have been advocating the creation of a high-level principle of invasion of privacy. His observations are in, this writer’s opinion, no more than a plea for the extension and possibly renaming of the old action for breach of confidence.” Lord Hoffmann continued on to clarify that further development on right to privacy in English law will have to “wait for another day”, accentuating on the fact that English law has no plans to expand on the concept of right to privacy<sup>10</sup>.

### **Incorporation of privacy into the doctrine of confidence**

Section 43 (1) of the Human Rights Act 1998 explicitly confers the obligation to make a declaration of incompatibility upon the Judiciary, in an instance where the English law is not in line with the provisions of the ECHR. Therefore, the judicial body is left with the responsibility to interpret the law in a favorable manner to Article 8 of the convention. Consequently, the Courts have taken it upon themselves to attach the concept of

privacy to the already existing notion of confidence in tort law as explained in *A v B & C*<sup>11</sup>.

The case *Coco v Clark* laid the foundation for the traditional doctrine of confidence which aims to protect trade secrets and private interests of business ventures and individuals, by providing adequate remedies to thwart the exploitation of such commercial secrets, to gain an unfair advantage and protect the innocent party. However, the additional responsibility of reasonable expectation to uphold privacy of personal information was subsequently attached to the doctrine of confidence, with the enactment of Human Rights Act 1998.

### **Disparities between the doctrine of confidentiality and privacy**

Traditionally, the law of breach of confidence centered on a “relationship of confidence”, whereas law of privacy was not constructed upon any form of a relationship. Privacy could be breached by individuals who had absolutely no prior relationship to each other.

The concept of privacy holds a much greater scope than the doctrine of confidence, thus the Courts started to find it difficult to enclose this broad concept within confidence. Jackson LJ<sup>12</sup> expressed that there was a clear distinction between cases related to privacy and cases related to confidence, as privacy provided extensive protection to individual considering that it extended its protection to information already accessible in the public domain as well. This was not the case with the doctrine of confidence, as it stops being effective once the information becomes public knowledge. Megarry J<sup>13</sup> also expressed similar concerns

<sup>5</sup> *X and Y v The Netherlands* [1986] 8 EHRR 235.

<sup>6</sup> *Airey v. Ireland* [1979] ECHR 3].

<sup>7</sup> *Stjerna v Finland* [1994] ECHR 43

<sup>8</sup> *Verliere v Switzerland*, no. 41953/98, ECHR 2001-VII.

<sup>9</sup> *Wainwright v Home Office* [2003] UKHL 53.

<sup>10</sup> *Home Office v Mary Jane Wainwright & Anor* [2001] EWCA Civ 2081.

<sup>11</sup> *A v B & C* [2002] EWCA Civ 337.

<sup>12</sup> *PJS v News Group Newspapers Ltd* [2016] EWCA Civ 393.

<sup>13</sup> *Coco v AN Clark Engineers Ltd* [1968] FSR 415.

claiming that it is challenging to safeguard data once it is in the public domain. .

### **Viewing privacy as an independent concept due to the inadequacy of the doctrine of confidentiality**

*Prince Albert v Strange* greatly contributed to the growth of English law relating to privacy. It facilitated the judiciary to shift the concentration from commercial relationships to focusing on the intrusion of an individual's private life as well. In this case, Lord Cottenham LC convicted the defendant under the reasoning that claimant's right to privacy had been invaded<sup>14</sup>. The case of *Campbell v MGN*<sup>15</sup> expanded the scope further by changing the requirement of "necessary quality of confidence" which was set by *Coco v Clark*, to "whether the information is private", as the Court of Appeal explained that "unjustifiable publication of private information would be better described as breach of privacy rather than breach of confidence". This approach focused more on respecting an individual's dignity and safeguarding their informational autonomy, instead of merely focusing on commercial interests.

Observing the case law closely, one could notice the courts drifting further away from viewing privacy as a part of the doctrine of confidence and treating the former to be an independent concept. Bingham LJ voiced that English law was ill equipped in dealing with issues of privacy<sup>16</sup>. Similarly, Glidewell LJ also expressed his discontentment about the current standing of English law by declaring "It is well-known that in English law there is no right to privacy, and

accordingly there is no right of action for breach of a person's privacy<sup>17</sup>."

The inadequacy of the doctrine of confidence in dealing with privacy was reflected in *OBG v Allan*<sup>18</sup> and *K v. NGN*<sup>19</sup>. Here, it was explained how private information would keep getting re-shared and distributed over and over again causing it to be disclosed to larger communities which might impact the dignity of an individual and cause mental distress and anguish to such individuals. However, the doctrine of confidentiality lacks the satisfactory remedies to deal with such situations.

Moreover, closer examination is indicative of several cases where individuals would claim remedies for invasion of privacy under law of trespass instead, as the doctrine of confidentiality was ill-equipped to address such issues<sup>20</sup>.

### **Why is the Doctrine of Confidentiality inadequate in relation to privacy?**

Even though the courts have incorporated the concept of privacy into the doctrine of confidentiality, if observed closely, one would notice that the cases revolving around privacy have several factors involved and confidence is just one element of privacy. Two of the most prevalent factors discussed in cases relating to privacy are "intrusion" or "interference"<sup>21</sup>. Several Judges have commented on these two element in numerous judgments, such as in *McKennitt v Ash*<sup>22</sup> where it was declared that there can be "...further **intrusion** upon a claimant's privacy by further revelations..." Likewise, Tugendhat J explained that "...there may be such **interference** by the repetition in the press

<sup>14</sup> *Prince Albert v Strange* [1849] 1 Mac & G 25.

<sup>15</sup> *Campbell v Mirror Groups Newspaper Ltd* [2004] 2 WLR 1232

<sup>16</sup> *Kaye v Robertson* [1991] FSR 62.

<sup>17</sup> *ibid*

<sup>18</sup> *OBG v Allan* [2008] 1 AC 1.

<sup>19</sup> *K v. News Group Newspapers Ltd* [2011] EWCA Civ 439

<sup>20</sup> *Hickman v. Maisey* [1900] 1 QB 752.

<sup>21</sup> *X & Y v Persons Unknown* [2007] EMLR 290.

<sup>22</sup> *McKennitt v Ash* [2006] EMLR 10.

of information...” in *JIH v NGN*<sup>23</sup>. Moreover, Eady J expressed that “...modern law of privacy is not concerned solely with information or secrets, it is also concerned importantly with **intrusion**...”<sup>24</sup> One could observe a coherent pattern in the use of “**intrusion**” and “**interference**” in courts by many influential Judges to justify the rationale behind convicting the defendant, such as Tugendhat J in *TSE v NGN*<sup>25</sup>, MacDonald J in *H v A*<sup>26</sup> and Briggs J in *Rocknroll v NGN*<sup>27</sup>. In addition, the courts seem to favor these terms as there has not been any attempts to overrule judgements based on such justifications.

The courts lean towards this approach in relation to cases involving privacy, especially in situations involving nonconsensual photography at the cost of an individual’s dignity and respect. *Peck v UK*<sup>28</sup> mirrored this outlook as the courts declared that the claimant’s privacy had been **interfered** with, even though the claimant’s actions were recorded in a public space. The rationale behind this decision was that such a film of the claimant would harm his dignity and cause him emotional distress which would be detrimental to the claimant.

*Hickman v. Maisey*<sup>29</sup> was a case that illustrated the necessity of the element of **intrusion** within the concept of privacy as the claimant had to rely on the notion of trespass in order to claim remedies for an incident which led to the **invasion** of his privacy.

## Conflict between Article 8 and Article 10 of the European Convention on Human Rights.

An often-debated issue is whether the right to privacy would undermine the freedom of expression. This debate was sparked when Lord Mancroft proposed a private member bill titled “A Right to Privacy<sup>30</sup>” which advocated for the creation of a legislation addressing the right to privacy on the 14th of February 1969 in the House of Lords. This was concurred to by Lord Goddard and Lord Denning. However, Lord Chancellor Viscount Kilmuir contested expressing his concern over how it might interfere with the freedom of speech and limit the abilities of the press or journalists.

When deducing whether one takes precedent over the other, one could refer to Human Rights Act Section 12 (4) which provides that the freedom of expression should generally take precedence over the right to privacy. However, this has not been the case in practice. One could conclude that this was a result of Human Rights Act Section 3 which requires the courts to interpret laws in line with the ECHR which states that both Article 8 and 10 are at equal standing<sup>31</sup>.

In *Douglas v Northern and Shell PLC* it was reasoned that “one cannot have particular regard to Article 10 without having equally particular regard at the very least to Article 8<sup>32</sup>”

Nevertheless, when studying the relevant case law, one could notice that the weight

<sup>23</sup> *JIH v News Group Newspapers Ltd* [2011] EMLR 9.

<sup>24</sup> *CTB v News Group Newspapers Ltd* [2011] EWHC 1326.

<sup>25</sup> *TSE & Anor v News Group Newspapers Ltd* [2011] EWHC 1308.

<sup>26</sup> *H v A* (No 2) [2015] EWHC 2630.

<sup>27</sup> *Rocknroll v News Group Newspapers Ltd* [2013] EWHC 24.

<sup>28</sup> *Peck v UK* [2003] 36 EHRR 41.

<sup>29</sup> *Hickman v. Maisey* [1900] 1 QB 752.

<sup>30</sup> RIGHT OF PRIVACY BILL [H.L.] (Hansard, 13 March 1961)

<<https://api.parliament.uk/historic-hansard/lords/1961/mar/13/right-of-privacy-bill-hl>> accessed 1 January 2020.

<sup>31</sup> Whittingdale J, Privacy and injunctions: report, together with formal minutes, minutes of evidence and appendices (2012)

<sup>32</sup> *Douglas & Anor v Northern And Shell Plc & Anor* [2000] EWCA Civ 353.

of these articles is dependent on the circumstances of the claimant. For instance, the court granted an injunction against the entire world to safeguard the identity of the claimant who was a notorious murderer in *Thompson v NGN*<sup>33</sup> as there was a possible threat of a revenge attack which would endanger the claimant's life. Therefore, one could conclude the gravity of each right can be deciphered on a case by case basis.

## **SRI LANKAN LAW IN RELATION TO PRIVACY**

SL greatly lacks when it comes to law regarding privacy. Even though SL has ratified the ICCPR which explicitly addresses the right to privacy by expressing that no individual should ever be subject to "...arbitrary or unlawful interference with his privacy..."<sup>34</sup>, SL has made no attempt to incorporate the right to privacy into the domestic law. SL has enacted ICCPR Act of 2007 which incorporated the rights addressed under the ICCPR into domestic law. Nevertheless, the Act of 2007 overlooked by privacy despite its express recognition under Article 17 of the ICCPR. On another note, the 1978 Constitution of SL also fails to recognize the right to privacy as a fundamental right. Thus, neither the Constitution nor the ICCPR Act protect the right to privacy in SL.

However, there have been several attempts to incorporate this right into the Constitution. For example the proposed

draft Constitution in 1997 regarded the right to privacy to be a fundamental right. Here Article 14 (1) provided that "every person has the right to have his or her private and family life, home, correspondence and communications respected, and shall not be subjected to unlawful attacks on his or her honour and reputation." However, it never saw the light of the day. The proposed draft Constitution of 2000<sup>35</sup> also made references to privacy but was not as explicit as the proposed draft Constitution of 1997.

The right to privacy was again brought up as a fundamental right in the Constitutional Reform Project of 2015<sup>36</sup>. Nevertheless, this also fell through due to the lack of political will.

Moreover, Report of the Public Representations Committee on Constitutional Reforms recommended that SL should incorporate the right to privacy as a fundamental right<sup>37</sup>.

## **Reasons for the lack of enthusiasm about right to privacy in SL**

Observing the situation in SL, one could come to the conclusion that citizens do not have much regard for the right to privacy, nor do they want to educate themselves on such a matter. One of the major factors contributing to such a lack of enthusiasm is poverty. A good percentage of Sri Lankans lives on daily wages and 4.1% of the population survives below the national poverty line<sup>38</sup>. Such citizens are busy agonizing over by what means they could

<sup>33</sup> *Venables and Thompson v New Group Newspapers Ltd and others* [2001] Fam 430.

<sup>34</sup> UN OHCHR, "International Covenant on Civil and Political Rights – OHCHR", < <https://www.ohchr.org/en/professionalinterest/pages/ccpr.aspx> > accessed 28 June 2020.

<sup>35</sup> The Draft Constitution of Sri Lanka, August 03, 2000.

<sup>36</sup> B Fonseka, L Ganeshathasan, S Daniel, "Two years in government: A review of the pledges Made in 2015 through the Lens of constitutional

Reform, governance and Transitional justice" <https://www.cpalanka.org/wp-content/uploads/2017/02/Two-Years-in-Government.pdf> , accessed 29 June 2021.

<sup>37</sup> Public Representations Committee on Constitutional Reform, 'Report on Public Representations on Constitutional Reform', 2016, 97.

<sup>38</sup> Poverty: Sri Lanka | Asian Development Bank, < <https://www.adb.org/countries/sri-lanka/poverty> >, accessed 01 July 2021.

earn their next meal, that privacy is the least of their concerns. With such a foundation, the focus on privacy is lost and only the well-off and the rich have the luxury of paying attention to such issues. This lack of awareness was proven via the survey conducted in the Faculty of Law of Colombo University in 2016, where only 2% of the students considered the right to privacy to be a fundamental right<sup>39</sup>.

### **The response of the courts**

SL courts have recognized the right to privacy as Justice Yapa<sup>40</sup> once clarified that privacy has been a significant part of Roman-Dutch common law. However, it has been limited to a rather narrow scope. Nevertheless courts have addressed the right to privacy in cases varying from trespass<sup>41</sup>, defamation, divorce and even false arrest. For instance, in *A.M.K Azeez v W.T Senevirathne*<sup>42</sup> the Supreme Court reduced the sentence given to the Appellant by the Magistrate's Court by explaining that their privacy had been interfered with as the circumstances of the case took place after midnight disturbing the Appellant's sleep and private life.

Courts also recognized the right to privacy in *Chinnappa et al. v Kanakar et al*<sup>43</sup> where Grenier J explained "both the Tesawalamai and the Roman-Dutch Law makes no reference to the custom or servitude which permits a landowner screening his fence with olas, and for this purpose crossing over into his neighbor's land at irregular intervals whenever the fence gets out of repair."<sup>44</sup>

Moreover, in *Sinha Ratnatunge v State*<sup>45</sup> the Supreme Court stated "...to appreciate the value of privacy in the life of an individual, it is well to remember the importance which our Constitution attaches to the man's autonomous nature, through the guarantees of basic human rights...Therefore to invade his privacy is to assail his integrity as a human being and thereby deny him his right to remain in society as a human being with human dignity". Here the court also maintained the balance between freedom of speech and privacy declaring that there should be controls on the freedom of speech so that it would not affect an individual's dignity, going on to proclaim that "the press should not seek under the cover of exercising its freedom of speech to make unwarranted incursions into the private domain of individuals and thereby destroy his right to privacy."

We can draw similarities regarding situation concerning right to privacy between the SL Constitution and the Constitution of India. By the same token, the Constitution of India also does not expressly recognize right to privacy. However, the Indian Supreme Court has openly identified it as a constituent of the right to live in human dignity in cases like *Justice K. Puttaswamy v. Union of India*<sup>46</sup>.

### **Inadequacy of SL law in relation to right to privacy**

Even though these cases prove that the courts have recognized the importance of the right of privacy there have been many

<sup>39</sup> Survey for submission to the Public representations Committee for the drafting of a New Constitution for Sri Lanka, <<https://law.cmb.ac.lk/wp-content/uploads/2016/05/Survey-for-Submission-to-the-Public-Representations.pdf>> accessed date 29 June 2021.

<sup>40</sup> *Sinha Ratnatunge v State* [2001] 2 Sri LR 172.

<sup>41</sup> *Abraham v Hume* 52 NLR 449.

<sup>42</sup> *A.M.K Azeez v W.T Senevirathne* (SI Police) 69 NLR 209

<sup>43</sup> *Chinnappa et al. v Kanakar et al* 13 NLR 157.

<sup>44</sup> *Ibid.*

<sup>45</sup> *Sinha Ratnatunge v State* [2001] 2 Sri LR 172.

<sup>46</sup> *Justice K. Puttaswamy v. Union of India* AIR 2017 SC 4161.

instances where the law was inadequate. In the ICCPR Advisory Opinion of 2008 the Supreme Court stated that there are adequate remedies under SL common law and other subject specific legislation. However, due to prolonged and costly nature of court proceedings in SL, individuals often seek extra-legal remedies which are not regulated or sanctioned by law. In such situations the absence of privacy in the constitution could be detrimental to such individuals<sup>47</sup>.

The current SL law on privacy is narrowed down to Roman Dutch law action of *actio iniuriarum* which allows an individual to claim remedies for loss of reputation in under defamation, the Post Office Ordinance<sup>48</sup> which prevents officers from invading an individual's privacy by opening mail without authorization and Computer Crimes Act<sup>49</sup> which prevents unauthorized access to a computer. However, these laws are entirely inadequate. For instance Section 18 of Computer Crimes Act allows law enforcement authorities to tap into and intercept wire or electronic communication devices to conduct electronic surveillance if the claimant is suspicious. Moreover, a warrant is not deemed a necessity if the case is considered to be of importance and urgency. Furthermore, the Post Office Ordinance is impractical in the current context as the world is far more digitalized and technologically advanced. These laws fall short of addressing breach of privacy via high-tech methods. Besides

contemporary communication mostly involves social media and other digital platforms thus the Post Office Ordinance is inept. Moreover, SL does not have a Data Protection Act. Although SL has recognized General Data Protection Regulation, enacting SL's own data protection act would be beneficial when conducting international trade activities.

Not only that, several SL legislation are at odds with the right to privacy. For instance the Sri Lanka Telecommunications Act allows telecommunication officers to tap into communication services under the orders of a minister<sup>50</sup>. MP Wickramaratna<sup>51</sup> stated that there were several telecommunication companies that violate international law by divulging personal information of their clients to the Defence Ministry and continued to explain that "these companies come under duress from the Defence authorities, they cannot divulge people's personal information to State authorities<sup>52</sup>." Furthermore, several provisions of the Vagrants Ordinance severely undermine the right to privacy.

### **Right to information vs Right to privacy**

One of the most debated issues has been whether the right to privacy would undermine the right to information introduced as a fundamental right under the 19<sup>th</sup> Amendment of the SL Constitution<sup>53</sup>. However, the SL Right to Information Act itself protects an individual's privacy as it limits access and denies disclosure of information where personal information is not of public

<sup>47</sup> GSP plus and the ICCPR: A critical appraisal of the official position of Sri Lanka in respect of compliance requirements<  
<https://www.cpalanka.org/wp-content/uploads/2015/01/ICCPR-Chapter-Final.pdf>> accessed 02 July 2021.

<sup>48</sup> Post Office Ordinance, No. 11 of 1908: Sections 71, 75.

<sup>49</sup> Computer Crimes Act, No 24 of 2007: Sections 3, 8, 10.

<sup>50</sup> Sri Lanka Telecommunications Act, No. 25 of 1991, Sections 53 and 54.

<sup>51</sup> Kirinde, C., "Govt. plays Peeping Tom with its proposed eNIC", <  
<https://www.sundaytimes.lk/140824/columns/govt-plays-peeping-tom-with-its-proposed-enic-114692.html>> accessed July 07 2021.

<sup>52</sup> *Ibid*

<sup>53</sup> Right to Information Act, No. 12 of 2016.

interest under Section 5(1) (a). Thus one could conclude that there is no conflict between these two rights. While the right to information relates to information held by public institutions, the right to privacy tries to protect information of private individuals and families.

## CONCLUSIONS

It is undeniable that with the growing digital world where wide data spreading platforms such as the internet exist, the current approach to privacy is inadequate. With this evolving technological social order, the law must also progress to keep up with the advancements.

Currently, in UK the judiciary must rely upon the doctrine of breach of confidence which is heavily inadequate causing judges to come up with extreme interpretations of the law which is quite illogical and impractical. The Supreme Court addressed this concern in *PJS v NGN* “courts must of course be ready to consider changing their approach when it is clear that that approach has become unrealistic in practical terms or out of touch with the standards of contemporary society.”<sup>54</sup>

This inadequacy was also acknowledged by the Younger Committee’s Report on Privacy<sup>55</sup> where it was understood that there is a need for modification in law. With regard to SL, the journalist Nalaka Gunawardene famously declared SL has a rather nosy culture “where many want to know far too much about others’ private lives. Not just in villages, but in cities and towns as well.”<sup>56</sup> However, this culture is no excuse to ignore the right to privacy, as

Edward Snowden clarified “Arguing that you do not care about the right to privacy because you have nothing to hide is no different than saying you do not care about free speech because you have nothing to say.”

Especially with SL’s long record of disregarding human rights under the pretext of interest of national security, the inadequate laws surrounding privacy could be detrimental to the citizens. The Report of the Public Representation Committee on Constitutional Reforms recognized the need to repeal the laws undermining the right to privacy such as the Vagrants Ordinance and the Penal Code<sup>57</sup>. Thus improvement in the law related to privacy should be carried out starting with raising awareness among the citizens and for recognizing privacy as a fundamental right.

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## A Critique on the Existing Academic View on the Prohibition of Insider Dealing in the Sri Lankan Finance Law Regime: A Comparative Analysis

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### ABSTRACT

Insider Dealing (hereafter "ID") is an offence which relates to trading on securities of a company using information that is unpublished and price sensitive. This may cause serious prejudice to a company. This work presents that while Section 32 of the Securities and Exchange Commission of Sri Lanka Act No. 36 of 1987 (hereafter "SEC Act") contains a competent prohibition of ID, that competency is diluted by the nature of the express definition given to 'connected individual' in Section 34 in the same Act. A persistent myth relating to Section 34 is a lack of express inclusion of shareholders to the definition of a connected individual, as a loophole. However, this paper attempts to debunk the aforesaid myth, by emphasizing the inherent implied inclusion of shareholders within Section 34. This work focuses on the issue of the definition of a shareholder in the SEC Act as limited to natural persons, would result in a significant threat to the stability and security of the corporate sector, since it is possible that a shareholder who is also a legal person would not be made liable for the offence of ID. Unlike the Sri Lankan legal context, the English law extends its prohibition of ID to a competent extent, by two actions. The first is the express inclusion of shareholders in the definition of an insider. The second is the inclusion of both legal and natural persons into the definition of an insider. This paper intends to shed light on the said pressing concern, with a sincere hope that the legal system of Sri Lanka will be better equipped to implement a competent prohibition of ID.

## INTRODUCTION

### Context

Inside information is information about a certain company which is known by the directors and management of the company but is not yet known to the public<sup>1</sup>. Trading based on such inside information is known as ID<sup>2</sup>. This is an offence because the information on which investment decisions are based should be confidential.

The definition of an 'insider' can include any individual who trades shares based on information that is material and non-public<sup>3</sup>. ID can be identified as a criminal offence in most countries, albeit with varying degrees of effectiveness. An archetypal example of ID is a stockbroker, or merchant banker, who knows about an impending takeover offer and buys shares in the target company with the intention of making a profit. He shall be guilty of ID. The rationale for the development of ID to the extent of a criminal offence is to protect companies from the great prejudice which will be caused by the act of ID.

### Reasons for prohibiting ID

The conduct of ID has negative impacts on both the corporate sector and the stock market, which include, *inter alia*, undermining the public confidence in the integrity of the stock markets, and causing disruption in its' orderly conduct. On the other hand, the most fundamental issue created by ID is the unfair advantage to insiders regarding information that other potential investors do not have access to, which causes harm to both the company

itself and the investors. ID also discourages the confidence that the insiders ought to hold for the purpose of smooth operation of the company.

### Current Legal Context

The prohibition of ID in SL in the present context is governed primarily by the Securities and Exchange Commission of Sri Lanka Act No. 36 of 1987 and its subsequent Amendments.<sup>4</sup> Since the definition of a shareholder in the SEC Act is limited to natural persons, this would result in a significant issue to the stability and security of the corporate sector, since it is possible that a shareholder who is also a legal person would not be made liable for the offence of ID.

The objectives of this work are twofold. The first is to debunk the myth, namely, that in the present Sri Lankan context, the offence of ID does not apply to shareholders due to the lack of express inclusion of shareholders in the definition of connected individual when compared to the English Law. The above idea is presented as a myth because as a result of the proper interpretation of the SEC Act done in this work, shareholders are included in the definition of connected individuals. The second objective is to shed light on the real issue, with the solemn hope of presenting the properly required level of prohibition of ID which ought to be considered in relation to the offence of ID, by an analysis of existing legislations.

<sup>1</sup> 'Insider Information' (*Corporate Finance Institute*)  
<[<sup>2</sup> Akhilesh Ganti, 'Insider Trading' \(\*Investopedia\*, 25 February 2021\)](https://corporatefinanceinstitute.com/resources/knowledge/trading-investing/insider-information/#:~:text=Insider%20information%2C%20also%20called%20inside,regarding%20a%20publicly%20traded%20company&text=In%20other%20words%2C%20insider%20information,not%20accessible%20to%20the%20public.> accessed 20 June 2021</a></p></div><div data-bbox=)

<[<sup>3</sup> Securities and Exchange Commission of Sri Lanka Act No. 36 of 1987, s 34.](https://www.investopedia.com/terms/i/insidertrading.asp#:~:text=Insider%20trading%20involves%20trading%20in,the%20insider%20makes%20the%20trade.> accessed 20 June 2021</a></p></div><div data-bbox=)

<sup>4</sup> A recent SEC Act Bill to repeal the existing SEC Act No.36 of 1987 has been presented to the SL Parliament by the Minister of Finance, which is not effective as yet.

## MATERIALS AND METHODS

This paper is the result of a qualitative study, adopting the black letter research method.

### Limitations

This work shall limit itself to the provisions of Part IV of the SEC Act, especially Section 34. This work, which deals solely with the offence of ID, will conduct its analysis, and present recommendations and conclude with the sole intention of compelling the legislature to optimize the provisions of Part IV of the SEC Act.

Another point of significance is that a recent SEC Act Bill to repeal the existing SEC Act No.36 of 1987 has been presented to the SL Parliament by the Minister of Finance on 09<sup>th</sup> July 2021. However, since it has not been declared as to have come into operation, as of the date of finalizing this paper, namely at this point, this Bill is not considered within this work, as it is not in an enforceable state. Therefore, this work has focused on the existing law governing ID.

### Applicability of the Companies Act

It is to be noted that the Companies Act No. 07 of 2007 also contains provisions on ID. However, this work will only address the provisions of the SEC Act due to firstly, the provisions of the Companies Act having no progressive effect on the credibility of findings, and secondly, the word constraints of this work.

### Regarding Materiality

ID is based on information. The extent of the 'materiality of the information', which is a vital element that compounds the offence of ID, has been aptly addressed in the SEC Act. However, due to the word limitations, this work will not address the extent of the

materiality requirement, as it has negligible bearing upon the scope of this work.

## RESULTS AND DISCUSSION

### ID in the Sri Lankan Context

The offence of ID is the misuse of unpublished, price-sensitive information by connected individuals. A connected individual has been defined within Section 34 (1) of the SEC Act as an individual satisfying one or more of the following;

[a] He is a *director* of that company or a related company; or

[b] He occupies a position as *an officer (other than director) or employee* of that company or a related company; or

a position involving a *professional or business relationship* between himself (or his employer or a company of which he is a director) and the first company; or a related company which *in either case may reasonably be expected to give him access to information which*, in relation to listed securities of either company, is unpublished price-sensitive information and which it would be reasonable to expect (a person in his position not to disclose except) for the proper performance of his function,

[c] He has access to information (other than in the aforesaid official capacities) in relation to listed securities, which he knows, is unpublished price-sensitive information and which it would be reasonable to expect him not to disclose except in the course of performing his duties<sup>5</sup>.

The other pertinent element is that the information be unpublished and price-sensitive. *Unpublished information* is defined as information on specific matters concerning the company. *Price-sensitive information* is defined as information that is not generally known to persons dealing in

<sup>5</sup> Securities and Exchange Commission of Sri Lanka Act No. 36 of 1987, s. 34(1).

the listed securities, and which would affect the price of securities<sup>6</sup>.

At present, the SEC Act takes point on the prohibition of ID, with Section 32 detailing the offence of ID by its subsections<sup>7</sup> which detail the possible forms of ID which may occur, as well as relevant exceptions.

The first situation is where an individual who deals in securities, is connected to (or has been connected within six months immediately prior to his date of appointment) a company and possesses information which satisfies three requirements; first that he holds this information via connection to the company, second that he would reasonably be expected to not disclose except in performance of duty, and third that he can be reasonably expected to know that this information is unpublished and price-sensitive<sup>8</sup>.

The second situation is where an individual who deals in securities based on information regarding another company by virtue of being connected to a particular company, where such information is obtained because of a transaction (actual or contemplated) with the first company<sup>9</sup>.

The third situation is where an individual who deals in securities based on information that is unpublished price-sensitive, received from an individual who is prohibited by Section 32 (1) and/or Section 32 (2) of the SEC Act<sup>10</sup>.

The fourth situation is simply where an individual who makes a takeover offer to a company, and trades in listed shares of such company in a different capacity based on information that is unpublished and price-sensitive<sup>11</sup>. The fifth situation is

where an individual deals in securities based on information relating to a takeover offer by an individual aforesaid in Section 32 (4), and the first individual has reasonable cause to believe the information to be unpublished and price-sensitive<sup>12</sup>.

The sixth situation is where an individual under Section 32 (1-5) counsels or procures another person, knowing or having reasonable cause to believe that the latter would deal in securities based on such information<sup>13</sup>.

The seventh situation is where a person prohibited under Section 32 (1-5) counsels or procures another person, if the former knows or has reasonable cause to believe that the latter would counsel or procure a third individual based on such information<sup>14</sup>.

In the first five situations aforesaid, the individual himself is prohibited from dealing in securities based on such information, while in the sixth and seventh situations the individual is prohibited from counselling or procuring another based on this information.

The defences applicable to the offence of ID are outlined by Section 32 (8, 9) of SEC Act. In summary, the following instances have grounds for exculpation;

- i. Having no intention for making profit nor avoiding loss<sup>15</sup>
- ii. Regarding transactions entered in the capacity of liquidator, receiver or trustee in situations involving bankruptcy<sup>16</sup>
- iii. Information obtained in the ordinary course of business, and the act is done in good faith (e.g. stockbroker)<sup>17</sup>

<sup>6</sup> *ibid* s. 34(2).

<sup>7</sup> 10 subsections in Section 32 of Securities and Exchange Commission of Sri Lanka Act No. 36 of 1987.

<sup>8</sup> *ibid* s. 32(1).

<sup>9</sup> *ibid* s. 32(2).

<sup>10</sup> *ibid* s. 32(3).

<sup>11</sup> *ibid* s. 32(4).

<sup>12</sup> *ibid* s. 32(5).

<sup>13</sup> *ibid* s. 32(6).

<sup>14</sup> *ibid* s. 32(7).

<sup>15</sup> *ibid* s. 32(8)(a).

<sup>16</sup> *ibid* s. 32(8)(b).

<sup>17</sup> *ibid* s. 32(8)(c).

- iv. Actions carried out to facilitate the completion of a transaction<sup>18</sup>

In addition, Section 32 (10) extends the offence of ID to legal representatives of the said individuals<sup>19</sup>. From the point of view of coverage, Section 32 can be declared a competent and efficacious provision. Furthermore, as aforementioned, this work does not take issue to the competency of Section 32. Rather, the fact in issue is whether the interpretation provision (Section 34) is sufficiently competent and efficacious. Section 32 relies heavily on Section 34 to form an effective prohibition of ID, and the incompetence of Section 34 significantly dilutes the effectiveness of Section 32 as well (the aforesaid prohibition). Proving this incompetence is the core of this work, and will be addressed.

### **Conceptual framework for the Arguments**

Although the SEC Act addresses the offence of ID in a satisfactory manner, it is possible that there are certain parties (discussed below) who will not be made liable for the offence of ID under the provisions of SEC Act due to a restricted (narrow) definition of the 'connected individual'. On the contrary, the English law gives a much broader definition relating to the offence of ID. The reason for the relatively restricted definition involved in the Sri Lankan SEC Act, in comparison to the English law, is due to a comparative difference in the contextual elements in the Sri Lankan corporate practice, namely that the corporate context prevalent in SL favours the 'controlling shareholder' system, as opposed to the ideal dispersed shareholder system.

### **Whether shareholders are insiders**

It is noteworthy that the SEC Act neither expressly includes nor excludes shareholders from the definition of

insiders. Therefore, according to the literal interpretation, the apparent general acceptance is that shareholders are not considered to be insiders.

As aforementioned, the fact that shareholders cannot easily be included into the definition of insiders, due to the prevalent controlling shareholder system, is somewhat disadvantageous to the stability of the corporate system. The controlling shareholder system can be described as a situation wherein the majority of shares of a company are owned by a minority number of shareholders. If shareholders are considered insiders, it is possible for a minority number of shareholders who own the majority of voting shares to possess a disproportionately significant power in the decision-making process of a company in comparison to the majority number of shareholders. Therefore, in such a context, the inclusion of shareholders into the definition of insiders would create a situation which will pave the way for dangerous repercussions for corporate governance. Therefore, although in the context of SL, the exclusion of shareholders from definition of insiders in the aforesaid manner was done in the best interests of companies, the solution to the aforesaid issue has now created another issue. In other words, the same exclusion caused a dilemma in relation to ID.

According to the literal rule of interpretation it is obvious that if shareholders have not been included in the definition of insiders, there is no possibility that shareholders would be liable for the offence of ID.

Furthermore, since the definition of a shareholder in the SEC Act is not purely restricted to *natural persons*, it is possible that a *legal person* that is a *shareholder*

<sup>18</sup> *ibid* s. 32(9).

<sup>19</sup> *ibid* s. 32(10).

would not be made liable for the offence of ID. One could go so far as to argue that a shareholder that is a legal person would not even incur a cause of action relating to the offence of ID, due to the aforesaid literal approach followed by the SEC Act. Therefore, an *argument* which can be articulated, which provides the basis for the authors' legal analysis, is that Section 34 does not provide a competent prohibition, particularly against shareholders who engage in ID, since there is no *prima facie* inclusion of shareholders in the definition of the 'connected individual'.

In fact, the English Law inclusion of shareholders into the interpretation of 'connected individuals', as well as the absence of such inclusion in the Sri Lankan SEC Act is deemed a loophole, especially in law-related studies at the undergraduate level. It is in fact noteworthy that the authors' above articulated *argument* is a genuine question that would arise in the minds of those who are not yet experts in this area of law, and it is vital that this argument has to be settled in order to obtain deeper understanding of the real issue at hand which is addressed below.

### Concerns Ought to Be

The primary tool given to identify who would be liable for the offence of ID is the interpretation of 'connected individual' within Section 34 of the SEC Act. The aforesaid provision expressly details who shall be liable for the offence of ID. Therefore, the timely and pressing concern presented in the aforesaid arguments, which is the lack of inclusion of shareholders, can be settled by identifying whether the intention of the law was to include shareholders in the same provision (the definition of connected individuals).

This work emphasizes that *Section 34 (1)(c) is sufficiently competent to cover*

*shareholders*. This is further proven when one recognizes that the individuals other than those expressly mentioned in Section 34 (1) (a, b) who have access to unpublished price-sensitive information relating to securities, must obviously include shareholders<sup>20</sup>. Therefore, it is concluded that although the interpretation of a 'connected individual' does not expressly include shareholders, it is clear that shareholders are also intended to be included, and should be considered as included in reality. Therefore, the authors hereby declare that the previously pressing issue has now been *answered*. It is clear that the true necessity is not *whether shareholders are included* in the definition of 'connected individuals'. The real concern ought to be whether the aforesaid definition is sufficiently competent to cover both natural and legal persons, regardless of whether shareholders are included therein.

Now another issue remains; namely whether all shareholders are included in the interpretation of 'connected individual'. It is to be noted herein that there are two main types of shareholders. The first type is natural persons who purchase shares in a company. Meanwhile, the second type of shareholder is a *company* which purchases shares in another company, thereby *becoming a shareholder* but a legal person. The interpretations relating to Part IV of the SEC Act do not contain express inclusion of all types of persons into the term 'connected individual'. Therefore, this raises another timely and pressing concern; specifically, whether legal persons can also be included in the interpretation of a 'connected individual'.

If a legal person could be included in the aforesaid interpretation, it would result in firstly, a company being eligible to be a shareholder under Part IV of the SEC Act,

<sup>20</sup> Securities and Exchange Commission of Sri Lanka Act No. 36 of 1987, s. 32.

and secondly a company which is a shareholder being liable for ID. However, this is a dilemma which is yet to be settled in the field of law of finance, since there is no fixed ironing out of creases as to whether or not a legal person is to be included in the interpretation of a 'connected individual'. If this inclusion is not expressly recognized, it would result in a miscarriage of justice where a company who was subjected to the offence of ID would be left irremediable, until the aforesaid crease is ironed out.

### Lessons to be Learned from English Law

From the perspective of the authors, a comprehensive prohibition of ID exists in the English legal system, since it is generally accepted that the English legal system is comprehensive and well-developed in terms of corporate law, as well as being a stimulant for Sri Lankan corporate law. Therefore, this work compares the English and Sri Lankan legal systems.

### Evolution of ID

The cornerstone legislation in the chain of historical development of the protection against ID is the Criminal Justice Act of 1993 of UK (hereinafter "CJA").

Although the CJA was comprehensive in 1993, it bore the possibility of being incomprehensive from the point of view of this work in the present context, since the CJA limits the scope of persons who may be liable for ID to the word 'individuals'. The CJA does not present a *clear interpretation* for the term itself in the four corners of the legislation as to *whether* 'individual' applies

to both natural and legal persons. On the other hand, it is to be noted that the CJA expressly includes shareholders in the definition of an insider<sup>21</sup>, for the prohibition against ID<sup>22</sup>. However, the issue which remained in the CJA was *whether* if a company became a shareholder, it can be interpreted as a prohibition from ID for that company.

However, unlike the law prevalent in SL regarding ID, the Financial Services and Markets Act of 2000 of UK (hereafter "FSMA") and its subsequent amendments extended the prohibition with regard to ID already present in the CJA. It is to be noted that while the FSMA also lacks a clear definition for 'person' (No interpretation provision of the FSMA defines 'person'), the use of the word 'person' broadens the scope of the offence considerably, because the general legal definition for 'person' includes both natural and legal persons<sup>23</sup>. Furthermore, this apparent expansion of the scope can be clearly identified when one considers that the previous version of the prohibition of ID in UK was limited to 'individuals' as aforementioned. Therefore, this work argues that the English legal system has indeed broadened the scope of its prohibition of ID by the FSMA.

On the other hand, it has been accepted that by the use of the term 'any person', the FSMA "cover both legal persons and natural persons... thus providing a very progressive interpretation to the 'insider'<sup>24</sup>". Firstly, it is the academic understanding that "In UK shareholders are recognized as insiders <sup>25</sup>" in the same provision (Section 118B) thus preventing

<sup>21</sup> Criminal Justice Act 1993 of UK, s. 57 (2).

<sup>22</sup> Priyam Kumar, 'A Critical Analysis of Insider Dealing Under U.K. And U.S.A. Law' (2019) 2 International Journal of Law Management & Humanities.

<sup>23</sup> Ken Adams, "Person" (*Adams on Contract Drafting*, 29 June 2014) <<https://www.adamsdrafting.com/person/>> accessed 28 June 2021.

<sup>24</sup> Edirisinghe, A., 2016. Insider Trading Laws in Sri Lanka: Identifying the 'Insider' to Combat White Collar Crimes. In: International Conference on the Humanities and the

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<sup>25</sup> *ibid*.

“shareholders from engaging in insider dealings<sup>26</sup>”. Secondly, it is obvious by the interpretations given that the FSMA was intended to cover both legal and natural persons, which is a well-established finding in the present context.

Another point to consider when discerning the aforesaid expansion is the comparative laws enacted within the European Union. It is to be established at the outset that with *Brexit*, EU legislations in force as at 31<sup>st</sup> December 2020 remain applicable<sup>27</sup> as domestic law in UK<sup>28</sup>. The Market Abuse Regulations No. 596 of 2014<sup>29</sup> (hereafter “MAR”) addresses the prohibition of ID in the EU sphere. It is noteworthy that the MAR clearly and *expressly* defines ‘person’ to include *both natural and legal persons*<sup>30</sup>. The aforesaid definition given by the MAR perfectly coincides with a core requisite of this work, namely the significance of considering the inclusion of both natural and legal persons within the definition of connected individual.

When considering the above legislations in force within UK, it becomes obvious that the scope of the protection against ID, from the point of view of the types of persons that can be held liable for the offence of ID, has been expanded considerably from the aforesaid provisions of CJA, FSMA and MAR. Therefore, the authors submit that the laws against the offence of ID in the English legal system are both competent and efficacious.

## CONCLUSIONS

When one studies the SEC Act, the most obvious issue arising is that of the apparent omission of shareholders from the definition of a connected individual, which is often mistaken to be the loophole of

Section 34. Proponents of this argument often use the express prohibition of shareholders in the English law counterpart to the SEC Act, to emphasize that there is a lack of such express prohibition in the Sri Lankan SEC Act. The authors claim firstly that this myth has been debunked in this work.

In this work the authors emphasize that *the real issue* to be resolved is in fact slightly different from the above. Rather, the primary goal of this work is to shed light on the timely and critical issue, which is to determine whether or not legal persons are included in the definition of a connected individual under the SEC Act.

Therefore, there is a possibility that if a company is subjected to ID by a shareholder who is a company (legal person), there would be an irremediable situation. This negatively impacts the consistency and capacity of the law to uphold justice. Therefore, the intention of this work is to shed light on the real issue, with the solemn hope that the law will be better equipped to uphold the ideal of justice. Thus, the required upgrade that is *recommended* by this work is straightforward, and the authors claim secondly that replacing the term ‘individual’ existing in the interpretations within Part IV of the SEC Act with the term ‘person’, would effectively expand the prohibition of ID to cover both natural and legal persons. This may be done by way of amendment to the SEC Act, other legislative enactments, judicial precedent, or any other means by which the aforesaid effect can be achieved. Furthermore, it is to be noted that upon the new SEC Act Bill becoming effective, this work may be used as a foundation to determine whether the

<sup>26</sup> *ibid*.

<sup>27</sup> legislations enacted after this date are not applicable.

<sup>28</sup> ‘EU legislation and UK law’ ([legislation.gov.uk](https://www.legislation.gov.uk/eu-legislation-and-uk-law)) <<https://www.legislation.gov.uk/eu-legislation-and-uk-law>> accessed 22 June 2021.

<sup>29</sup> Regulation (EU) 596/2014 on market abuse (Market Abuse Regulation) [2014].

<sup>30</sup> Regulation (EU) 596/2014 on market abuse (Market Abuse Regulation) [2014], art 3(1).

succeeding SEC Act at that point has provided sufficient redress to the issue presented in this work, will further broaden the significance this work even after the aforesaid Bill becomes enforceable.

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## Compulsory Licence a Myth or Reality; Analysis through Experiences of India and Sri Lanka during the COVID-19 Pandemic

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### ABSTRACT

The Trade Related Aspects of Intellectual Property Rights (TRIPS) provides compulsory license as one of the exceptions for patented pharmaceuticals. The issue is whether compulsory license is an effective solution for low- and middle-income countries (LMICs) in responding to a global health pandemic like COVID-19 since all countries are not homogeneous. Most of the LMICs are countries that have low or no manufacturing capacities. Further, due to fear of granting a compulsory license, most of the pharmaceutical products have not been patented in LMICs. Hence, when there are no operating patents in the own jurisdiction of LMICs, they are unable to proceed with generic drug productions by using a compulsory license. This doctrinal research reveals that the existing social economic legal and political disparities of LMICs have exaggerated the inability of realising compulsory license as an effective solution during the COVID-19 pandemic. Therefore, the global community is currently considering several alternatives like COVID-19 Technology Access Pool (C-TAP), and TRIPS waiver proposals to remove barriers associated with LMICs in realising compulsory license in midst of a global health pandemic. Global initiatives like C-TAP and TRIPS waiver proposals can be appreciated as timely efforts for reducing disparities in realisation of compulsory license by LMICs in responding global health pandemic of COVID-19.

## INTRODUCTION

The COVID-19 pandemic has created the debate on whether existing global and national policies and mechanisms in ensuring access to medicine in the globe are adequate for a time of a global health pandemic. COVID-19 has reiterated the long-lasting conflict between intellectual property rights and the right to health. The Preamble to the Constitution of the World Health Organization provides that; "health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. The enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being without distinction of race, religion, and political belief, economic or social condition"<sup>1</sup>. Hence, despite economic and social disparities attaining highest health standards by all the states is vital. The right to health has been recognized as a human right by the United Nations Declaration of Human Rights<sup>2</sup> and International Covenant on Economic, Social and Cultural Rights<sup>3</sup>.

Releasing patented COVID-19 pharmaceutical products to the global market for with high prices and competitive market strategies may negatively impact the right to health of people in LMICs. The rationale for discussing the perspectives of LMICs is their high vulnerability in the process of securing adequate COVID-19 medicine. This paper analyses the viability of the compulsory licence provisions of the TRIPS and national legislations of India and Sri Lanka to ensure access to medicine for

LMICs during a global health pandemic. Finally, this paper makes recommendations on how to enhance the actual realization of compulsory license by LMICs in midst of a global health calamity.

## METHODOLOGY

This doctrinal research is conducted through an extensive review of literature relating to international trade law, intellectual property law, human rights and health law. The extensive review of primary and secondary sources used to critically analyse the theoretical basis and practical implementation of the TRIPS provisions on compulsory license amidst the COVID-19 pandemic. Special reference has been given to national legislations of Sri Lanka and India.

## RESULTS AND DISCUSSION

### Access to medicine in midst of COVID-19 pandemic

The COVID-19 outbreak is recognised as 'the most crucial global health calamity of the century and the greatest challenge that the humankind faced since the Second World War'.<sup>4</sup> Nevertheless, 2.05 billion of the world population<sup>5</sup> had been vaccinated against COVID-19 as of June 03, 2021. However, the number of doses of COVID-19 vaccine have been distributed unevenly between developed countries and LMICs. Eighty five percent (85%) of vaccine doses have already been administered among high-income and upper-middle-income countries whilst 0.35% of the vaccine doses have been

<sup>1</sup> Constitution of the World Health Organisation adopted by the International Health Conference held at New York on 9th to 22<sup>nd</sup> 1946 and subsequently amended by supplements, October 2006.

<sup>2</sup> Article 25 of the 1948 Universal Declaration of Human Rights (UDHR).

<sup>3</sup> Article 12 of International Covenant on Economic, Social and Cultural Rights (ICESCR) 1966.

<sup>4</sup> Indranil Chakraborty and Prasenjit Maity, 'COVID-19 Outbreak: Migration, Effects on Society, Global

Environment and Prevention' (2020) 728 Science of The Total Environment <<https://pubmed.ncbi.nlm.nih.gov/32335410/>> accessed 5 June 2021.

<sup>5</sup> The New York Times, 'Tracking Coronavirus Vaccinations around The World' (2021) <<https://www.nytimes.com/interactive/2021/world/covid-vaccinations-tracker.html>> accessed 26 June 2021.

administrated in LMICs<sup>6</sup>. The rapid increase of COVID-19 deaths has created a compelling need for assuring equal access to vaccines. Due to the uneven distribution of COVID-19 vaccines, the global south tends to allege the global north regarding the efforts for vaccine nationalization<sup>7</sup>.

The crucial factors affecting the uneven distribution of COVID-19 vaccine and denying access to medicine in LMICs, could be related to inherent vulnerabilities such as lack of finance to purchase vaccines and lack of expertise and technology to produce generic medicines in LMICs. Further, the vulnerability has been exaggerated by the barriers imposed by intellectual property rights holders of already invented COVID-19 vaccines<sup>8</sup>. It is observed that LMICs are denied of opportunity to grant compulsory licenses for COVID-19 medicine due to the unavailability of patents in their own jurisdictions. The territorial nature of the applicability of intellectual property law has further become a barrier in the context. As evident, the only instance of manufacturing COVID-19 medicine under an “emergency license,” is evident in AstraZeneca vaccine being manufactured by India and Brazil as major producers.<sup>9</sup>

Last 12 months of the pandemic provides ample evidence on how patent owned high-tech pharmaceutical companies created barriers to LMICs’ access to COVID-19 vaccine<sup>10</sup>. Further, evidence shows that how developed nations who financed high-tech pharmaceutical companies have entered into agreements with them on manufacturing and distributing a higher volume of vaccine doses on a priority basis.<sup>11</sup> For example, AstraZeneca had announced that they offer priority in providing the vaccine for both the USA and the UK in mid-2020.<sup>12</sup> These actions revealed how patent rights could create barriers<sup>13</sup> for LMICs’ access to COVID-19 vaccines.

### **Patents: a barrier to ensure equal access to medicine**

The issue is whether in fact patents are a barrier to ensure access to medicine in a global pandemic. The debate between patent rights and their impact on access to medicine propound that patent rights are based on economic ideology and the incentive theory which could become a major impediment in ensuring equitable access to patented pharmaceuticals. Thus, in a global health emergency patent monopoly

<sup>6</sup> *ibid*.

<sup>7</sup> Mohammed Saheer Abbas, 'Practical Implications Of 'Vaccine Nationalism': A Short-Sighted and Risky Approach in Response to COVID-19' [2020] South Centre <<http://hdl.handle.net/10419/232250>> accessed 16 June 2021.

<sup>8</sup> Levon M. Khachigian, 'Pharmaceutical Patents: Reconciling the Human Right to Health with the Incentive to Invent' (2020) 25 *Drug Discovery Today* <<https://doi.org/10.1016/j.drudis.2020.04.009>> accessed 17 June 2021.

<sup>9</sup> 'Access To COVID-19 Vaccines: Global Approaches in a Global Crisis' (OECD, 2021) <<https://www.oecd.org/coronavirus/policy-responses/access-to-covid-19-vaccines-global-approaches-in-a-global-crisis-c6a18370/>> accessed 23 July 2021.

<sup>10</sup> A.A.C.J Adikari and W.S.S. Wijesinghe, 'Making Intellectual Property A Common Good To Combat Global Pandemics And The COVID-19 Technology

Access Pool (C-TAP): Responding To The Challenges Exerted By Big Pharma And Some High-Income Countries' (2021) 07 (II) *Vidyodaya Journal of Management* (Forthcoming).

<sup>11</sup> Godwell Nhamo and others, 'COVID-19 Vaccines and Treatments Nationalism: Challenges for Low-Income Countries and The Attainment of The SDGs' (2020) 16 *Global Public Health* <<https://pubmed.ncbi.nlm.nih.gov/33317389/>> accessed 18 June 2021.

<sup>12</sup> Laurence S. J. Roope and others, 'How Should a Safe and Effective COVID-19 Vaccine Be Allocated? Health Economists Need to Be Ready to Take the Baton' (*The University of Melbourne*, 2021) <<https://minerva-access.unimelb.edu.au/handle/11343/247605>> accessed 24 June 2021.

<sup>13</sup> Helen Gubby, 'Is the Patent System a Barrier To Inclusive Prosperity? The Biomedical Perspective' (2019).

backed by the incentive theory could create barriers in access to affordable vaccine.

Article 31 of TRIPS Agreement allows to issue compulsory license in circumstances such as "national emergency", "other circumstances of extreme urgency", "public non-commercial use", or "against anti-competitive practices".<sup>14</sup> Doha Declaration eventually became operative via Article 31*bis* of the TRIPS Agreement. As per TRIPS Article 31*bis*, a country in need of a particular pharmaceutical product, and without manufacturing capabilities to produce it, is provided with the opportunity to import the drug under a compulsory license from a producing country without violating provisions found elsewhere in the TRIPS Agreement.

From a theoretical perspective, the Doha declaration serves the desires of LMICs. It is a historical win for LMICs long-lasting claim that patents and other IPRs prevent them from access to essential medicine.<sup>15</sup> Besides, the TRIPS Agreement itself recognises the need for balancing conflicting interests between IPRs and public health. For example, TRIPS Article 08 of Part I substantiated that TRIPS Agreement intends to protect and enforce intellectual property rights to contribute to the promotion of technological innovation and to the transfer and dissemination of technology, to the mutual advantage of producers and users of technological knowledge and in a manner conducive to social and economic welfare, and as provided in Article 07 of Part 1 to a balance of rights and obligations.

In Sri Lankan context, initially, the Intellectual Property Rights Bill was challenged in the Court of Law<sup>16</sup>. The Special

Determination of the Supreme Court clearly endorsed the importance of incorporating contents of Article 31 of TRIPS and the Doha Declaration as exceptions to the rights conferred to the patent holder. Later on, Intellectual Property Act No 36 of 2003 came out of the parliament with incorporating Section 86, being TRIPS compliant and having exceptions of compulsory licensing and parallel importation. This envisaged the necessity of having the two exceptions in Intellectual Property Law.

### **Compulsory licensing a myth or a reality in a global pandemic?**

According to Zaheer Abbas, compulsory licensing is a "necessary evil" in the context of IPRs and access to medicine.<sup>17</sup> Even though compulsory licensing restricts the rights of the patent holder such restriction is required to avoid misuse of monopoly rights and to protect the human right to health.

The practical scenarios experienced by India and Sri Lanka during the COVID-19 pandemic substantiated the proposition that compulsory licensing is not a reality in a time of a global health pandemic.

By May 2021, in the hike of COVID deaths in India, the government was in a dilemma to issue compulsory licenses for manufacturing Covaxin by three shortlisted public companies. In a recent matter on distribution of essential supplies, Justice Chandrachud<sup>18</sup> has reiterated that "Even as TRIPS obliges countries to ensure a minimum level of patent protection, it creates a permissive regime for the carving out of exceptions and limitations that further public health objectives"<sup>19</sup>. It is apparent that the Indian Government is in a

<sup>14</sup> Article 31 of the TRIPS Agreement.

<sup>15</sup> Sandra Bartelt, 'Compulsory Licences Pursuant To Trips Article 31 in the Light of the Doha Declaration on the TRIPS Agreement and Public Health' (2005) 6 The Journal of World Intellectual Property.

<sup>16</sup> *Supreme Court Special Determination on Intellectual Property Bill* [2003] Supreme Court (Supreme Court).

<sup>17</sup> Muhammad Zaheer Abbas, 'Pros and Cons of Compulsory Licensing: An Analysis of Arguments'

[2013] International Journal of Social Science and Humanity.

<sup>18</sup> *In re: distribution of essential supplies and services during pandemic; Suo Motu Writ Petition (Civil) No3 of 2021* [2021] Supreme Court of India (Supreme Court of India).

<sup>19</sup> United Nations Organisation, 'Report of The United Nations Secretary-General's High-Level Panel on Access to Medicines Promoting Innovation and

position to issue compulsory licences, as per section 84 of the Indian Patent Act, when a reasonable requirement of the public with regard to the patented invention not being satisfied or the patented invention is not available to the public at a reasonably affordable price or the patented invention is not worked in the territory of India.<sup>20</sup> Further as per Section 100 of the Act, the Central Government can authorize certain companies to use any patents for the "purpose of the government". Under Section 102, alternatively, the government can acquire patents from the patentee and it can revoke patents for the interest of the public as provided in Section 66. With these weapons in hand, the Indian government has reluctant to issue a compulsory license for Covaxin, due to expected horrendous retaliation from US<sup>21</sup>. This indicates how economic concerns dilute the realisation of compulsory license.

On the other hand, the Indian Government in its affidavit to Supreme Court in the above matter it has mentioned that "any discussion or a mention of exercise of statutory powers either for essential drugs or vaccines having patent issues would have serious, severe and unintended adverse consequences in the countries efforts being made on the global platform using all its resources, good-will and good-offices through diplomatic and other channels."<sup>22</sup> In fact, the assertion of Indian government must appreciate, due to the fact that India is fighting along with South Africa on behalf of all LMICs at the TRIPS Council of WTO by forwarding TRIPS waiver proposal despite concerning

implementing compulsory license in its territory for the betterment of their own subjects.

In the Sri Lankan context, Sri Lanka had asserted at the Council for Trade-Related Aspects of Intellectual Property Rights held on last October that developing countries including Sri Lanka face many legal, technical and institutional challenges in using TRIPS flexibilities due to the lack of ambiguity in the existing legal provisions. This substantiates the non-homogenous nature of states in implementing TRIPS compliant national legislations. Hence, issues are more vulnerable for countries like Sri Lanka which never have to utilise compulsory license. It had further iterated that "national patent laws may not even have the necessary provisions to issue compulsory licences in the public interest or government use licenses."<sup>23</sup> Currently Sri Lanka Institute of Technology (SLINTEC), has ventured in to innovate and commercialize SLINTEC Swabs and SLINTEC Sterile with high export potential in the USA and the EU these products are having reverse engineered COVID-19 testing swabs and has been producing them in-collaboration with the Medical Research Institute of Sri Lanka, the Lady Ridgeway Hospital, and Hi-Fashion Holdings Pvt limited.<sup>24</sup> Nevertheless, the Sri Lankan government has expressed its fear on overriding the patent holders' rights in the importing countries if Sri Lanka proceeds with production of generic from and export these SLINTEC Swabs and SLINTEC Sterile which are already patent protected in other

Access To Health Technologies' (United Nations organisation 2016) <<https://www.tralac.org/images/docs/11064/report-of-the-united-nations-secretary-generals-high-level-panel-on-access-to-medicines-september-2016.pdf>> accessed 9 October 2021.

<sup>20</sup> Section 84 of Indian Patent Act 1970.

<sup>21</sup> M Ramesh, 'The Dilemma of Licensing in A Pandemic' (@businessline, 2021) <[https://www.thehindubusinessline.com/business-laws/the-dilemma-of-licensing-in-a-](https://www.thehindubusinessline.com/business-laws/the-dilemma-of-licensing-in-a-pandemic/article34573699.ece)

pandemic/article34573699.ece> accessed 10 October 2021.

<sup>22</sup> *Supra note 18* in the matter the affidavit dated 09.05.2021 submitted on behalf of the Union of India.

<sup>23</sup> Council for Trade-Related Aspects of Intellectual Property Rights, 'Minutes of meeting held in the centre William Rappard on 15-16 October and 10 December 2020' (WTO 2021) <<https://docs.wto.org/>> accessed 8 October 2021.

<sup>24</sup> *ibid*.

countries. Further, Intellectual Property Act No 36 of 2003 has not yet adopted Article 31 *bis* of TRIPS even though it is the largest importer of drugs in the Asian region<sup>25</sup>.

The above analysis substantiated the proposition that economic, social, political and legal disparities of LMICs have diluted the effective realisation of compulsory license in midst of the global health pandemic of COVID-19. To address the issues associated with the effective realisation of compulsory license globe has sought alternative paths in midst of this health calamity.

### **Global efforts to overcome hurdles accessing of COVID 19 medicine**

One of the alternative initiatives launched by WHO is COVID-19 Technology Access Pool (C-TAP). The proposal by Costa Rica, basically embedded the ideologies of a global corporation and voluntary participation to promote global non-exclusive voluntary licensing for COVID-19 treatment.<sup>26</sup> The C-TAP intends to provide public disclosure of gene sequences and data, to create transparency and publication of all clinical trial results related to COVID-19 pandemic in furthering a medicine or treatment, ensure government collaboration in funding agreements with pharmaceutical companies to ensure equitable distribution of products, licensing of any potential treatment, diagnostic, vaccine, or other health technologies and to promote open

innovation models and technology transfer that increase local manufacturing and supply capacity through joining the Open COVID pledge and the Technology Access Partnership.<sup>27</sup> It seems that even though C-TAP is a pragmatic solution in overcoming issues associated with the realization of compulsory license in midst of COVID-19, there is less support by extended by developed nations for its success.

Further, in late 2020, India and South Africa made a proposal at the WTO, to waive certain provisions of TRIPS Agreement for the prevention and contamination of COVID-19.<sup>28</sup> In the said proposal, both countries have encapsulated the potential threats/challenges by IPRs hindering or potentially hindering timely provisioning of affordable medical products to the patients. In the 10<sup>th</sup> Paragraph of said communication, both countries have reiterated the argument that the procedure embedded in TRIPS Article 31*bis* is insufficient in this context as it provides a "cumbersome and lengthy process for the import and export of pharmaceutical products" during a global pandemic. In such context, these countries requested the TRIPS Council to waive the application and enforcement of Sections 1, 4, 5, and 7 of Part II of the TRIPS Agreement in relation to prevention, containment or treatment of COVID-19. Amidst the vast objections a green light towards the proposal was revealed when USA<sup>29</sup>, China and New Zealand expressed their conditional consent to support text-based discussions of the

<sup>25</sup> *ibid*.

<sup>26</sup> Brook Baker, 'Rationale for Supporting Costa Rica's Proposal for Emergency COVID-19 Technology IP Pool for All Countries' (*Health GAP (Global Access Project)*, 2020) <<https://healthgap.org/rationale-for-supporting-costa-ricas-proposal-for-emergency-covid-19-technology-ip-pool-for-all-countries/>> accessed 17 June 2021.

<sup>27</sup> 'COVID-19 Technology Access Pool' (*Who.int*, 2020) <<https://www.who.int/initiatives/covid-19-technology-access-pool>> accessed 22 June 2021.

<sup>28</sup> World Trade Organization, 'Waiver from certain provisions of the TRIPS agreement for the

prevention, containment and treatment of covid-19 communication from India and South Africa' (World Trade organisation 2020) <<https://www.wto.org/>> accessed 13 October 2021.

<sup>29</sup> Intellectual property office of Vietnam, 'statement from Ambassador Katherine Tai on the Covid-19 TRIPS waiver - world IP activities - Intellectual property office of Vietnam' (*Ipvietnam.gov.vn*, 2021) <[https://www.ipvietnam.gov.vn/en\\_US/web/english/world-ip-activities/-/asset\\_publisher/ZMuTgr44COLR/content/statement-from-ambassador-katherine-tai-on-the-covid-19-trips-waiver](https://www.ipvietnam.gov.vn/en_US/web/english/world-ip-activities/-/asset_publisher/ZMuTgr44COLR/content/statement-from-ambassador-katherine-tai-on-the-covid-19-trips-waiver)> accessed 10 October 2021.

proposal<sup>30</sup>. Recently, due to support of 64 States at WTO for TRIPS Waiver, a revised text of the proposal is being under discussion with specifying 03-year term for implementing the proposed waiver.<sup>31</sup> This proposal can be appreciated as an effective solution for addressing issues associated with realisation of compulsory license by LMICs in midst of global health pandemic of COVID-19.

## CONCLUSIONS

The analysis of this research reveals that even though TRIPS based compulsory license provisions offer a pragmatic mechanism, its realisation in LMICs could differ due to the non-homogenous nature of states. Economic, social, political, and legal disparities of LMICs have made compulsory license an unrealistic health flexibility to effectively use in supplying their COVID-19 vaccine requirement. This research appreciated the support extended by C-TAP and proposed TRIPS waiver in addressing the issues faced by LMICs in realising benefits of compulsory license in midst of a global health pandemic. Finally, the research suggests that integration of global initiatives like C-TAP with TRIPS based compulsory license process could be effectively utilised to ensure access to medicine of LMICs for a considerable extent in midst of COVID-19.

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<sup>30</sup> Kirtika Suneja, 'China, Ukraine And New Zealand Back India And South Africa's IPR Waiver Joint Proposal on COVID Medical Products' (*The Economic Times*, 2021)

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<sup>31</sup>World Trade Organisation, 'Waiver from certain provisions of the TRIPS agreement for the prevention, containment and treatment of Covid-19 revised decision text' (world trade organisation 2021) <<https://docs.wto.org/>> accessed 13 October 2021.

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## Revitalizing 'Digital Democracy': Regulating Social Media Discourses in Sri Lanka

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### ABSTRACT

Digitalization in the 21<sup>st</sup> century largely contributed to the evolution of the world. The idea of 'Digital Democracy' believes in improving democracy through more citizen discussion on public policies and active participation in decision-making processes in the digital sphere. Social media facilitates a large cluster of the public in promoting democratic values in cyberspace. Yet, such unfettered and unlimited opportunity occasionally clutches up, giving birth to the surfeit of hate speech and fake news as deleterious consequences. Sri Lanka also witnessed several incidents, including the social media cohesion, which arose immediately after the 'Easter Sunday Attacks' in 2019. The urge to regulate social media has been recognized all around the world. This research adopts a comprehensive socio-legal study addressing the compulsion of regulating social media to protect democratic values on the internet. The research primarily concentrates on the Sri Lankan legal jurisprudence while adopting a comparative study. The paper attempts to dive in and analyze the legal framework and the effectiveness in regulating social media in Sri Lanka. As a comparative view, the study suggests various measures adopted by different states in regulating social media. As the significant outcome of the paper, it proposes a combination of legal and extra-legal measures that would be the prime choice in regulating social media in Sri Lanka without stifling the free speech and expression that are the backbones of a 'democratic society'.

## INTRODUCTION

Digital democracy is an emerging idea that believes, because of information and technology innovation, online spaces have replaced physical spaces as venues for political argument and social interaction. The digitalization of democratic processes in the near future seems inevitable<sup>1</sup>. Defining democracy is complex and almost as difficult. Yet, there are numerous definitions proposed for digital democracy by various literature and scholars. Where some refer to the use of digital tools to provide information and promote transparency, for others, it describes how information and communications technologies (ICTs) can broaden and deepen participation, while others talk of promoting empowerment by enabling citizens to make decisions directly through online tools<sup>2</sup>. However, it can be simply defined as 'the practice of democracy using digital tools and technologies'.

The role of social media platforms is predominantly significant in digital democracy. It facilitates more citizen discussion on public policies and active participation in decision-making processes through the digital sphere. In 2021, the social media boom is observed everywhere on its various platforms including Facebook, Twitter, YouTube, and WhatsApp. As South Asia recorded 31 percent (31%) of social media users out of the population in 2021 January, Sri Lanka marked around 37 percent (37%) of the active social media accounts out of

its population, which is nearly 7.9 million<sup>3</sup>. In the Sri Lankan context, Facebook is recorded with the highest number of users, approximately seven (7) million. In addition, Twitter, WhatsApp, and YouTube also interact with a larger audience.

While the social media counts from Sri Lanka march towards rapid growth, legal framework's urge to regulate or control the discourses around social media debated over the years. Remarkably, after a series of suicide bombings in churches and luxury hotels on Easter Sunday 2019 (Well Known as 'Easter Sunday attacks') in Sri Lanka, the discourses boomed on the social media platforms alarmed our legal system with this question<sup>4</sup>.

In this context, this research attempts to identify the lessons of the social media discourses in the Sri Lankan context around the Easter Sunday attacks in 2019. Thereby, while examining and interpreting the bitter experiences and positive trends, the research addresses the impacts of laws or regulations in the sustainability and the protection of the digital democracy. Further, the international standards and comparative jurisdiction analysis is referred throughout the research. Finally, the research attempts to amplify the possible legal and extra-legal measures to protect the digital democracy.

## RESEARCH DESIGN

### Research Problem

Social media facilitates a large cluster of the public in promoting democratic

<sup>1</sup>Rosie Beacon (2021); 'What Is the State of Debate on Digital Democracy?'  
<<https://institute.global/policy/what-state-debate-digital-democracy>>.

<sup>2</sup> Julie Simon, Theo Bass, Victoria Boelman and Geoff Mulgan (2017); 'Digital Democracy: The tools transforming political engagement'; Pp.11.  
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<sup>3</sup> Datareportal (2021); 'Digital 2021: Sri Lanka'  
<<https://datareportal.com/reports/digital-2021-sri-lanka>> .

<sup>4</sup> Daily News (2019); 'Laws to regulate Social Medias Soon';  
<<http://www.dailynews.lk/2019/06/01/local/187191/laws-regulate-social-media-soon>>.

values in the cyberspace. Yet, such unfettered and unlimited opportunity occasionally clutches up, giving birth to the surfeit of hate speeches and fake news as deleterious consequences. In Sri Lanka, proposals are suggested to regulate the social media platforms to overcome these emerging challenges especially after the Easter attack. On the other hand, number of debates penetrated that the proposed legal measures would hamper the digital democracy and freedom of expression in the cyberspace. This study attempts to suggest the extra-legal measures along with the regulations will help to promote the digital democracy in Sri Lanka.

### **Hypothesis of the Study**

A combination of legal and extra-legal measures would be an effective tool in regulating social media without stifling the free speech and expression in the online space.

### **Research Questions**

- i. What's the co-relation between the social media platforms and digital democracy?
- ii. To what extent the present legal frameworks in Sri Lanka address social media related issues?
- iii. What's the global trend on regulating social media platforms?
- iv. How social media can be regulated without hampering the fundamental rights in the cyberspace?

### **Research Methodology**

The research is a socio-legal study. The research is primarily a qualitative mode

of an approach based on the primary and secondary data. The data for this research were collected from Conventions, Statutes, Regulations, Acts, Resolutions, and Policy Frameworks as the primary sources. As the secondary sources, the data were collected from the books, e-books, reports prepared by the NGOs and INGOs, statistical reports, journals, scholarly articles and empirical data available at both library and electronic databases.

### **Research Limitations**

The Study adopts a potential limitation on the social media discourses and the measures in the Sri Lankan landscape from the period of Easter Sunday attacks in 2019 up to the Date.

This timeline selected due to the penetration of the debates on regulating social medias bloomed immediately after the Easter Sunday attacks'19.

## **RESULTS AND DISCUSSIONS**

### **Social Media and Democracy**

Social Media platforms and movements undoubtedly contribute to promote the digital democracy around the world. In addition to the mainstream media, the role of social media and its contents in amplifying movements in promoting human rights, sustainability, and good governance has been immense in the recent past<sup>5</sup>. Particularly in the 21<sup>st</sup> century, including the 'black lives matter' protest<sup>6</sup>, the recent fall of 'Kabul' (Afghanistan) and the role of the international community,<sup>7</sup> and many more. In Sri Lanka also, a number of occasions reflected different discourses through social media such as 'Easter

<sup>5</sup> Gabriel Granillo (2020); 'The Role of Social Media in Social Movements' ;  
<<https://www.pdxmonthly.com/news-and-city-life/2020/06/the-role-of-social-media-in-social-movements>>.

<sup>6</sup> *Ibid*.

<sup>7</sup> Times of India (2021); 'Watch: Visuals of Kabul's fall to Taliban go viral on social media' ;  
<<https://timesofindia.indiatimes.com/videos/news/watch-visuals-of-kabuls-fall-to-taliban-go-viral-on-social-media/videoshow/85367308.cms>>.

attack<sup>8</sup>, constitutional coup by the government<sup>9</sup>, and up to very recent government concerns on the Covid-19 measures in the island. Likewise, these social media platforms play a vital role in boosting the voices that promote democracy through the digital space by enabling free access to its users.

Still, conversely, the grey side of these social media cannot be denied. Due to the ultimate freedom of these platforms and access, many challenges arise out of it. Studies suggest, 'informational chaos that poses a vital threat to democracies'<sup>10</sup>. In addition to specific threats revolving around the arena of social media – digital sphere, the (unlimited) freedom of expression through publications tend to cause, untrue statements and hate speeches as the critical challenges to the democracy. Untrue statements can take either form of disinformation which is 'fabricated or deliberately manipulated content, intentionally created conspiracy theories or rumors'<sup>11</sup> or misinformation which is 'unintentional mistakes such as inaccurate photo captions, dates, statistics, translations, or when satire is taken seriously'<sup>12</sup>.

For example, during the recent covid-19 pandemic, numerous cases were

reported as the circulation of fake news on social media platforms and instant messaging (IM) platforms was a problem even before the pandemic hit the world. The reports suggest the messages like '*WHO requires funds so please donate in the form of Bit coins*' is not only fake news, but it is also a scam<sup>13</sup>. The Sri Lankan Computer Emergency Readiness Team (SLCERT) revealed in its annual report of 2019 that the highest numbers of complaints were received on matters related to Social Media in 2019.

**Table 1.** Types of incidents reported in 2019 (Source – SLCERT Annual Activity Report 2019<sup>14</sup>)

Incident Type	No of Incidents
File Recovery	1
DDOS	2
Ransomware	11
Abuse/Hate/Privacy violation	307
Malicious Software issues	3
Phone Hacking	1
Scams	5
Phishing	5
Website Compromise	175
Financial/Email frauds	28
Intellectual property violation	1
Server Compromised	2
Social media	2662
Other	363
<b>Total</b>	<b>3566</b>

Also, misinformation should be addressed in this context as the

<sup>8</sup> Open Democracy (2019); '(C)overt Islamophobia: the aftermath of the Sri Lanka Easter attacks'; <<https://www.opendemocracy.net/en/countering-radical-right/covert-islamophobia-aftermath-sri-lanka-easter-attacks/>>.

<sup>9</sup> Democracy Reporting International (2019); 'Social Media Analysis : What Facebook Tells Us About Social Cohesion in Sri Lanka'; Briefing Paper 97- February 2019 < <https://democracy-reporting.org/wp-content/uploads/2019/02/Social-Media-Analysis-draft-8-1-1.pdf>>

<sup>10</sup> Luke Hurst (2020); 'Informational chaos: Proposals made to regulate social media'; <<https://www.euronews.com/2020/11/12/informational-chaos-proposals-made-to-regulate-social-media>>

<sup>11</sup> Claire Wardle and Hossein Derakhshan (2017); 'INFORMATION DISORDER: Toward an interdisciplinary framework for research and policy making'; Council of Europe report DGI(2017)09 <<https://rm.coe.int/information-disorder-toward-an-interdisciplinary-framework-for-research/168076277c>>.

<sup>12</sup> Ibid.

<sup>13</sup> The Cyber Blog India (2020); 'Coronavirus: Fake News, Phishing Campaigns, Malware Attacks, and much more' (28 April, 2020) <<https://cyberblogindia.in/coronavirus-fakenews-phishing-malware-ransomware-cyber-crime/>>

<sup>14</sup> SLCERT (2019): Publications and Downloads- Annual Activity Report 2019 Retrieved: <[https://www.cert.gov.lk/Downloads/General/Sri\\_Lanka\\_CERT\\_Annual\\_Activity\\_Report\\_2019.pdf](https://www.cert.gov.lk/Downloads/General/Sri_Lanka_CERT_Annual_Activity_Report_2019.pdf)>

information based on reality, used to inflict harm on a person, organization or country rather than the public interest<sup>15</sup>. As an emerging virus in the social media platforms, hate speech includes 'publications to attack a person or a group based on attributes such as race, religion, ethnic origin, sexual orientation, disability, or gender'<sup>16</sup>. Sri Lanka witnessed the spread of hate speech on Facebook in 2018 and 2019 following the Easter bombings and anti-Muslim riots in Kandy and Negombo<sup>17</sup>.

As social media facilitates users to share the contents with unlimited access, occasionally, it leads to dreadful consequences. Few of the examples discussed above are evident and urge the need to regulate social media through various measures to control these adverse consequences.

### **Social Media Cohesion around 'Easter Sunday Attack' in Sri Lanka**

After the end of the local war in 2009 and while Sri Lanka slowly marching towards peace building and reconciliation regime nearly a decade, a series of suicide bombings in churches and luxury hotels on Easter Sunday 2019 were carried out by an independent and little-known local Islamist militant group, the National Thowheed Jamaath

(NTJ), with the Islamic State claiming responsibility for the attacks two days later<sup>18</sup>.

In Sri Lanka, social media represents multi-ethnic societies from time to time, advocates for and against pluralism and diversity for years. Riots held in 2018 Ampara and Digana are good examples of case studies that boomed with the fake news and hate speech contents shared against the Muslim community via Facebook. Surprisingly, In May 2020, two years after the riots, Facebook apologized for its inaction in 2018<sup>19</sup>. A year following these riots, the online space was once again heavily consumed by false information and incitement to hatred and violence in the aftermath of the 2019 Easter Sunday bombings<sup>20</sup>.

In response, the government of Sri Lanka blocked access to social media networks and messaging services, including Facebook, Instagram, WhatsApp, Viber, Snapchat and YouTube, within hours of the attack. This access ban lasted for nine (9) days from 21<sup>st</sup> April 2019<sup>21</sup>. Where there are numerous opposing views<sup>22</sup> expressed for the measures of shutting-down, researchers such as Dr. Claire Wardle<sup>23</sup> say the shut-down doesn't work as expected, since the technology provides so many other measurements to the access such as through virtual

<sup>15</sup> *Ibid.*

<sup>16</sup> Facebook's definition of Hate Speech:

<[https://www.facebook.com/communitystandards/hate\\_speech](https://www.facebook.com/communitystandards/hate_speech)>

<sup>17</sup> Rebecca Devitt (2020); 'Hate Speech and Social Media in Sri Lanka'; Conference Paper IPSA World Congress of Political Science 2020.

<sup>18</sup> BBC News 2019; "Sri Lanka attacks: What we know about the Easter bombings", Available at: <<https://www.bbc.com/news/world-asia-48010697>>

<sup>19</sup> Aljazeera (2020); 'Sri Lanka: Facebook apologises for role in 2018 anti-Muslim riots' <<https://www.aljazeera.com/news/2020/5/13/sri-lanka-facebook-apologises-for-role-in-2018-anti-muslim-riots>>

<sup>20</sup> The Straits Times (2019); "Fake News Rampant in Sri Lanka After Attacks", Available

at: <<https://www.straitstimes.com/asia/south-asia/fake-news-rampant-in-srilanka-after-attacks>>

<sup>21</sup> BBC News (2019); 'Sri Lanka attacks: The ban on social media'-

<<https://www.bbc.com/news/technology-48022530>>

<sup>22</sup> Amarnath Amarasingam & Rukshana Rizwie (2020); "Turning the Tap Off: The Impacts of Social Media Shutdown After Sri Lanka's Easter Attacks"; Strategic Communications Project Report October 2020; Pp.2-4.

<sup>23</sup> Dr. Claire Wardle leads the strategic direction and research for First Draft and is the co-founder of one of First Draft's founding partners, Eyewitness Media Hub.

private networks (VPNs). Statistics are evident of, the rising numbers in Google searches for “VPN” in Sri Lanka at the time<sup>24</sup>. Also, the public started to adopt social media platforms that were less popular, such as Twitter, and remained fully active. Thus, the experiences suggested that Sri Lanka needs to develop a policy framework and an effective measure to regulate the social media platforms. In light of this context, government started addressing these issues in the process of enacting laws to regulate social media, notably after the ‘Easter Sunday Attack’.

### Relevant Legal Frameworks

Despite different opinions as to measures that could be taken to regulate social media in Sri Lanka, there are few pieces of legislations that could suggest legal redress against hate speech and disinformation. Those include the International Covenant on Civil and Political Rights (ICCPR) Act No. 56 of 2007, Penal Code of Sri Lanka Ordinance No. 2 of 1883, Police Ordinance No. 16 of 1865, Public Security Ordinance No. 25 of 1947, Prevention of Terrorism (Temporary Provisions) Act (PTA) No. 48 of 1979, Sri Lanka Telecommunications Act No. 25 of 1991, and Computer Crimes Act No. 24 of 2007. While these laws are in force, specifically the ICCPR Act of Sri Lanka passed with one of the objectives of protecting persons from speech that incites violence and discrimination, still, there is not any noticeable prosecution in the cases including Easter Sunday attacks.

<sup>24</sup>Yudhanjaya Wijeratne (2019); “The Social Media Block Isn’t Helping Sri Lanka,” Slate, April 25, 2019, <<https://slate.com/technology/2019/04/sri-lanka-social-media-blockdisinformation.html>> <sup>25</sup> Verite Research (2019); ‘Broken shield and weapon of choice’; <<https://www.veriteresearch.org/2019/06/24/iccpr-act-sri-lanka/>>

As Gehan Gunatilleke rightly pointed out,

*‘In the 12 years since its enactment (ICCPR Act), not a single person who has incited violence against a minority group in Sri Lanka has been convicted under the Act; this is despite four major incidents of mob violence against the Muslim community in the past five years’*<sup>25</sup>.

Contrastingly, many critiques by the civil society activists and academics refer to the over-inclusive application of the ICCPR Act to shut down free speech in the democratic society. The incidents of the arrest of author Shakthika Sathkumara in April 2019 for the publication of a book that mentioned sexual misconduct among the clergy and the arrest of Abdul Raheem Masaheena in May 2019 for wearing motifs that were thought to resemble a valued symbol of Buddhism are few of the examples<sup>26</sup>. Likewise, in the present context, the relevant pieces of legislations are applied to stifle the voices of democracy with the interpretation and application.

Against this backdrop, the government states that they’re going through a process of regulating social media in Sri Lanka to promote human rights and democracy. That includes,

- i. Secretary to the Defence Ministry, retired Major General Kamal Guneratne asking Sri Lanka Computer Emergency Readiness Team to control social media in January 2020.<sup>27</sup>

<sup>26</sup> The Morning Lk (2021) ; ‘Regulating social media in Sri Lanka: Verité launches report on mechanisms to fight hate speech and disinformation’ <<https://www.themorning.lk/regulating-social-media-in-sri-lanka-verite-launches-report-on-mechanisms-to-fight-hate-speech-and-disinformation/>>

<sup>27</sup> Economynext. (2020); ‘Sri Lanka drafting laws to control social media: defence ministry’; <<https://economynext.com/sri-lanka-drafting->

- ii. Talks by Justice Minister Ali Sabry, PC stating that new laws to control the dissemination of disinformation via the social media platforms in Sri Lanka in April 2021.<sup>28</sup>
- iii. Sri Lanka's Information Minister (Former), Keheliya Rambukwella, sharing that the country is drafting a new law to check the spread of fake news on social media platforms in April 2021.<sup>29</sup>
- iv. Concerns raised by the Minister of Labor, Nimal Sri Pala De Silva either to ban or to regulate social media in Sri Lanka in August 2021.<sup>30</sup>

### **Threats of Social Media Regulations.**

Understandably, the vast array of social media cannot be left alone without any checks and balances. Consequently, the proposed social media regulations as the only option to countermeasure the social media threats would stifle digital democracy. As discussed above, the application and interpretation experience of the ICCPR Act is an excellent example of the danger of leaving the control of social media entirely in the hands of laws or regulations.

As free speech, opinions and expressions are the foundations of digital democracy, leaving the authority (central enforcement authority) entirely in the organ of the government (through the Laws) will lead to the consequence of freedom of expression being stifled. Also,

it might be a route to share and manipulate biased contents and publications that favor or are backed up by the State.

Therefore, the proposed laws to regulate social media should satisfy the three-part tests of legality, necessity and proportionality to secure the right to free speech as a democracy's precious gift, but without stifling others' voices.

Defining hate speech and untrue statements sometimes involves a subjective test. Though few contents seem untrue for the moment, maybe it may become a truth in the future. However, there are some objectively false statements are revolving around social media<sup>31</sup>. For example, you might have seen content shared with a picture of any religious identity (either Lord Shiva or Jesus) stating that something good will happen to you shortly if you shared the content. These are all manifestly untrue things, and you can prove that. Therefore, on those occasions, it won't be a tricky question at all. But when it becomes the debates on specific concerns, which we cannot be sure about the reality, it varies. Therefore, leaving all these particulars to a state authority seems redundant regarding the larger perspective of democracy in the digital space, since all these consequences urge some independent fact checking. Therefore, it would be apt to think extra-legal measures to regulate the social media platforms in addition to the laws.

[laws-to-control-social-media-defence-ministry-42446/>](https://www.dailynews.lk/2021/04/19/local/246966/laws-control-fake-social-media-platforms)

<sup>28</sup> Dailynews (2021); 'Laws to control fake social media platforms'; <<https://www.dailynews.lk/2021/04/19/local/246966/laws-control-fake-social-media-platforms>>

<sup>29</sup>Spherex (2021); 'Sri Lanka Implements Singapore Style Law to Control Fake News'; <https://spherex.com/regulation/sri-lanka->

[implements-singapore-style-law-to-control-fake-news/](https://economynext.com/ban-or-regulate-social-media-in-sri-lanka-top-minister-tells-parliament-84604/)

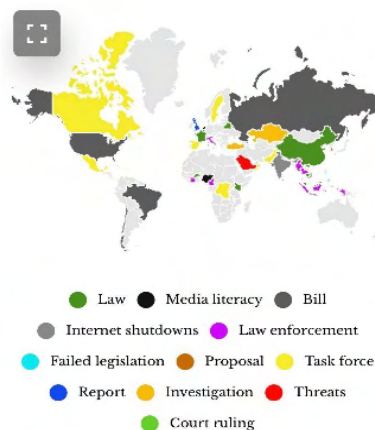
<sup>30</sup> Economynext (2021); 'Ban or regulate social media in Sri Lanka, top minister tells parliament'; <<https://economynext.com/ban-or-regulate-social-media-in-sri-lanka-top-minister-tells-parliament-84604/>>

<sup>31</sup> Chris Fox (2020); 'Social media: How might it be regulated?'; <<https://www.bbc.com/news/technology-54901083>>

## Global Trends on Regulating Social Media.

Though the mainstream media have well-systemized regulations and policies, as the digital media are in the emerging stage, their policies and measures are yet to be tested and defined. The nations are adopting their approaches of regulating social media such as task forces, media literacies, and internet shutdowns following their domestic procedures.

**Figure 1.** Counter Measures of Nations against Online Fake News (Source – Poynter Resources<sup>32</sup>)



As the numerous conflicting rights such as freedom of expression, media freedom, individual dignity and democracy revolving around the social media platforms, the nations adopt their own approaches as illustrated in the above Figure 1. The majority of the countries also adopt media literacy and task forces to facilitate and promote democracy in the digital sphere while countering fake news in the social media. The global picture clearly reflects that, most of the states around the world adopt extra-legal measures to regulate the social media platforms. Such arrangements enhance the effectiveness of the measures at the meantime, help to

draw a tiny line between the online rights and limitations.

It is suggested for Sri Lanka to revisit and contemplate on measures directed for regulating social media platforms and to choose the appropriate one from the wide array of choices. Such measure shall be an effective barrier that promotes democracy and not stifling the voices.

## CONCLUSIONS

Social media platforms play a vital role in promoting democracy in the digital sphere in a number of ways. Still, as a grey side, the unfettered freedom leads to the publications of untrue and hateful contents as detrimental consequences. While various measures are suggested as tools for regulating social media, the research finds that extra-legal measures are necessary to ensure the protection of democratic values in cyberspace. The study suggests that the legal measures should qualify as satisfying the three-part test; legality, necessity, and proportionality, to regulate social media without hampering the rights and freedoms.

Further, as extra-legal measures, social media literacy and public awareness are deemed necessary to give a better understanding on the Contents shared on social media. Assigning a few key responsibilities to the social media platforms and internet service providers (ISPs) in developing content moderating and overseeing policies, developing independent fact-checking mechanisms by artificial intelligence (AI) and algorithms and implementing tools such as 'circuit breakers' which regulate a viral content by temporarily stopping it from spreading while it undergoes fact-checking, will facilitate to overcome

<sup>32</sup> Poynter Resources (2019); 'A guide to anti-misinformation actions around the world';

<<https://www.poynter.org/ifcn/anti-misinformation-actions/>>

these struggles. Simply, a combination of the legal and technological measures would be effective to regulate social media while respecting democratic values without stifling in online.

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## The Scope of the Data Protection Regime in Sri Lanka; The Way Forward

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### ABSTRACT

In the age of business where information is recognized as one of the most essential factors, the methods by which data is obtained and maintained can jeopardize the privacy of persons and may result in multiple violations of one's rights. Thus, proactive measures imposed through legislation is a necessity as data protection is proven to be a concern that should not be treated as trivial. Sri Lanka has, within the past few decades, made individual attempts to ensure the safety of data in various fields including the banking sector, registration of persons and in relation to the usage of computer devices. However, it remains a question as to whether Sri Lanka has successfully afforded protection against modern-day perils. A comprehensive analysis of domestic legal provisions exemplified a clear collective attempt made by the local legislature to ensure protection for data at the domestic level. However, concerns in terms of the sufficiency of the existing legal provisions in the Sri Lankan legislative framework is notable when compared with different jurisdictions such as the United Kingdom which contains recent laws regarding the subject area of data protection. Even though Sri Lankan legislative framework consists of multiple laws in the discipline of data protection in varying capacities as an umbrella of protection, similar to the United States of America, improvements can be incorporated to guarantee optimum efficiency in protection for data. Hence, the conclusion that is made, considering the prevalent legal stance of Sri Lanka and the international standards, is to ensure the recognition of the Data Protection Bill of Sri Lanka to effectively address related challenges to a level satisfactory with accountability and diligence in line with the support of the existing legislative framework on data protection.

## INTRODUCTION

According to the Cambridge Dictionary, the term 'data' is defined as information in the form of numbers and facts, including information that is in electronic form, stored and used through an electronic device or such means for purposes such as analyzing and decision making.<sup>1</sup> With the development of technology and technological literacy, it is reasonable to conclude that ensuring security for data in an electronic environment can be unique and challenging for any jurisdiction due to various conflicting interests of businesses, consumers as well as employees.<sup>2</sup>

Therefore, examining and identifying the possible ways in which data protection can be guaranteed while mitigating the risks that are associated with illegal or unauthorized use of data, is essential and should be prioritized.<sup>3</sup> In doing so, it is of utmost importance to incorporate a proper data protection mechanism for the purpose of assuring that data/information which belongs to, or represents the behaviour of any such personal aspects of persons are not illegally stored and used without proper authorization.

In the effort to examine the validity of the concept of data protection it is crucial to evaluate existing justifications towards protecting data as the concept itself can be conflicting when compared with other human rights including the freedom of expression, especially in online

platforms.<sup>4</sup> Anyhow, the importance of data protection can be portrayed in diverse perspectives. For instance, Marsoof stresses on the perspective that data protection has a direct and an obvious association with the privacy of a person among other human rights<sup>5</sup>. The protection that is guaranteed for the privacy of persons can be traced back to the Universal Declaration of Human Rights where it is expressly stated that no person should be a subject of an attack or even subjected to arbitrary interference against his/her privacy, family and home, reputation and honour. The Declaration further recognizes that a person should be entitled to the protection of the law against any such interferences as well.<sup>6</sup> A similar standard of protection is also depicted in Article 17 of the International Covenant on Civil and Political Rights as well.

Privacy, as per Alan Furman Westin can also be identified, as to the extent to which a person wishes to expose himself or herself to society, including their behaviour and attitudes, freely without the effects of any external influence/s.<sup>7</sup> However, it is highly doubtful as to whether such freedom can be guaranteed under the current atmosphere created by technology and its literacy, mainly in electronic transactions. Therefore, a proper legal system that attempts to

<sup>1</sup> 'Data' (*Dictionary.cambridge.org*, 2021) <<https://dictionary.cambridge.org/dictionary/english/data>> accessed 2 June 2021.

<sup>2</sup> Darrell Carpenter and others, 'Privacy and Biometrics: An Empirical Examination of Employee Concerns' (2016) 20 *Information Systems Frontiers* <[https://www.researchgate.net/publication/293803734\\_Privacy\\_and\\_Biometrics\\_An\\_Empirical\\_Examination\\_of\\_Employee\\_Concerns](https://www.researchgate.net/publication/293803734_Privacy_and_Biometrics_An_Empirical_Examination_of_Employee_Concerns)> accessed 1 June 2021.

<sup>3</sup> Muli David Tovi and Mutua Nicholas Muthama, 'Addressing The Challenges Of Conducting Research In Developing Countries' (2013) 1 *European Journal of Computer Science and Information Technology* <<https://www.eajournals.org/journals/european-journal-of-computer-science-and-information-technology-ejcsit/vol-1-issue-2-september->

2013/addressing-the-challenges-of-data-protection-in-developing-countries/> accessed 24 October 2020.

<sup>4</sup> C Nyst, 'Two Sides Of The Same Coin – The Right To Privacy And Freedom Of Expression' (*Privacy International*, 2018) <<https://privacyinternational.org/blog/1111/two-sides-same-coin-right-privacy-and-freedom-expression>> accessed 24 October 2020.

<sup>5</sup> A Marsoof, 'The Right To Privacy In The Information Era: A South Asian Perspective' (2008) 5 *SCRIPT-ed* <[https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=1578222](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1578222)> accessed 24 October 2020.

<sup>6</sup> *ibid*.

<sup>7</sup> Alan F Westin, *Privacy And Freedom* (New York Ig Publishing 2015).

guarantee data protection should be influenced by the idea of assuring that persons; legal or natural, are not allowed to use the information of another in any way that exceeds the consent of the person from whom such information stems from. In terms of businesses, it is well known that data is being used to develop their processes, products as well as for the purpose of developing new business models.<sup>8</sup> Proper use and management of data can also be perceived as an element that can guarantee a competitive edge to businesses as well. Even though businesses have the tendency to portray data protection methods as factors that hinders the business process, methods of data protection should not be solely regarded as a factor that imposes an unnecessary burden on businesses and users of data. The reason for such presumption stems from the rationale that businesses, by guaranteeing the privacy of private individuals, can further benefit commercially by creating more value for the business and by evading possible lawsuits mainly for jeopardizing privacy. Thus, through effective means of protection for data, the reliability of the business would increase the potential of developing new avenues for success.<sup>9</sup> Therefore, in brief, a consumer or a person, especially in the online platform or a user of any technology will be able to benefit from data protection laws against the unnecessary use of private information by outsiders. Hence, persons will be able to benefit by being entitled by law to have a private family life. Moreover, on the other hand, a business might also benefit, even though the regulations tend

to impose restrictions on how data can be used for diverse purposes by businesses, by injecting confidence into the minds of consumers and employees in terms of the security of their data.<sup>10</sup> Furthermore, the capabilities that the businesses might lawfully obtain in developing innovative business models that can benefit them within the legal boundaries, set by the data protection legal framework should also be noted. Hence, a presumption can be raised on the importance of a proper data protection mechanism for any country, including Sri Lanka, and the research will henceforth focus on evaluating the Sri Lankan laws on data protection and their competence to encourage and foster the interests of the parties involved and thereby conclude as to how the prevalent legal system can be improved.

## MATERIALS AND METHODS

The research has utilized the doctrinal and the epistemological methods of qualitative research to identify the black letter law, scholarly opinions and the inspirations behind legal principles for the purpose of evaluating the strength and the position of Sri Lanka, in terms of data protection and privacy, in light of international instruments and statutory enactments of selected jurisdictions.

## RESULTS AND DISCUSSION

### Provisions in the Current Legal Framework in Sri Lanka.

In terms of the prevalent legal system of Sri Lanka, it should be noted that, even though a specific data protection law is yet

<sup>8</sup> Philipp Max Hartmann and others, 'Capturing Value From Big Data – A Taxonomy Of Data-Driven Business Models Used By Start-Up Firms' (2016) 36 International Journal of Operations & Production Management <<https://www.emerald.com/insight/content/doi/10.1108/IJOPM-02-2014-0098/full/html>> accessed 26 October 2020.

<sup>9</sup> P.R Allison, 'Data Protection: How Privacy Can Be A Benefit, Not A Burden' (*ComputerWeekly.com*, 2019)

<<https://www.computerweekly.com/feature/Data-protection-How-privacy-can-be-a-benefit-not-a-burden>> accessed 1 July 2021.

<sup>10</sup> Nick Ismail, 'Data Privacy Can Give Businesses A Competitive Advantage' (*Information Age*, 2018) <<https://www.information-age.com/data-privacy-businesses-competitive-advantage-123471059/>> accessed 1 July 2021.

to be introduced that is applicable for online transactions as well, that there are statutes that impliedly foster the proper use of data. For instance, the Intellectual Property Act, No. 36 of 2003, Banking Act, No. 30 of 1988, the Computer Crimes Act, No. 24 of 2007, the Telecommunications Act, No. 25 of 1991 and the Registration of Persons (Amendment) Act, No. 8 of 2016 can be regarded as legal instruments that foster proper management and use of data with certain clear limitations on how such data can be used for diverse purposes. Thus, considering the relevant legal provisions concerning privacy and data management from the aforementioned legislative enactments could shed light on the legal stance of Sri Lanka in that regard.

### **Intellectual Property Act, No. 36 of 2003**

Intellectual property law ensures protection for diverse creations of the mind which is the reason why different rights are facilitated by law to ensure effective protection for different types of works, inventions and aspects that are of value for persons and businesses such as trademarks, trade names, industrial designs and etc.<sup>11</sup> In terms of data protection, one of the most important rights that stem from the Intellectual Property Act of Sri Lanka is unfair competition; Section 160 (6), which specifically identifies the act of using confidential information of a competitor, without their consent, in a manner that is against the proper and ethical commercial practices as deviant conduct. Even though it can be argued that the existing provisions may not be sufficient in guaranteeing protection for trade secrets extensively, it is a notable legal provision that should be considered in terms of data protection as it also has the capability to

inject a deterrence effect in terms of the illegal acquisition and use of data.

### **Banking Act, No. 30 of 1988**

The Banking Act mandates licenced banking institutions, during the course of their business affairs to ensure confidentiality of the information of their clients. For instance, Section 34B (1) of the Act specifically states that every officer who operates a numbered account on behalf of a customer, or any such person and thereby, as a result of his/her occupation and related capabilities, secures access to by way of any record, material or register pertaining to their clients should protect the secrecy of such information and should continue to do so for the best interests of the customers.

According to the Section 34B (2), a licensed bank has no permission or capability in any capacity to disclose information of a person on behalf of whom a numbered account is maintained by the bank related to their identity to any other bank, individual, department, officials, agents, representatives of the Sri Lankan government or any other government as such, any other legal or natural person, judiciary or the military unless otherwise, the disclosure of information falls within the exceptional circumstances embodied in the Section.

Information as such can only be disclosed by a bank to either of the aforementioned parties if such disclosure is expressly permitted by the customer, if there are any legal proceedings that are instituted either by the bank or by the owner of the numbered account in terms of any banking transaction that stems from such numbered account, if such disclosure is required by any provision of law in terms of criminal proceedings and international obligations concerning narcotics, hijacking and finally through an order

<sup>11</sup> Christopher Burnett, "The Importance Of Intellectual Property (*Lexology.com*, 2020) <<https://www.lexology.com/library/detail.aspx?g=0b6>

76aa6-7a3b-4bcb-8570-ccb90699eeef> accessed 17 October 2020.

issued by the Supreme Court of Sri Lanka under the Prevention of Terrorism Act, No. 48 of 1979.

Moreover, it should further be noted that the secrecy in transactions will be owed by the officials including directors, employees and managers of the bank to the bank in which they are employed under Section 77 (1) of the Act. Such stance in extending protection for confidential information that is entrusted to banking institutions portrays the precedent that was laid down by cases such as *People's Bank v. Newland Merchant Ltd* and *Tournier v. National Provincial and Union Bank of England*.

#### **Telecommunications Act, No. 25 of 1991**

As per Section 73 of the Act, 'telecommunication' is defined as the transmission of diverse aspects such as images, sounds etc. through radio waves, electromagnetic systems or by any optical means. This can be regarded as an aspect where violations of data protection and privacy related rights can occur practically. Therefore, it is reasonable to presume that any country which considers data protection as an essential feature aimed at giving effect to the privacy and related rights of its citizens will extend protection towards telecommunication as well. Abiding by such notion, Section 60 of the Act identifies the act of retaining and using a message that is ought to be delivered to someone else as a punishable offence.

Moreover, it should further be noted that the Act criminalizes acts such as wilful interception of a telecommunication transmission as per Section 53 and the act of intercepting a transmission and disclosing the content by a telecommunication officer or any such person who acts under the colours of such office as deviant conduct that will be subjected to punishments. Even though

such provisions are not indicated in a separate statutory instrument that is dedicated to data protection, it is still quite reasonable and justifiable to conclude that such measures have the capability to inject a deterrence effect to demotivate perpetrators in securing illegal access and use of data.

#### **Registration of Persons (Amendment) Act, No. 8 of 2016**

The Registration of Persons Act was introduced to the legislative framework of Sri Lanka for the purpose of registering citizens, to issue national identity cards to such citizens who are eligible, and to address any matter that is incidental or connected thereto. With reference to the long title of the Act, it is quite clear that the authorities involved in implementing the Act will be performing the function of data handling, managing and usage. Since issuing national identity cards involves a procedure within which personal information of applicants should be disclosed, the need to incorporate a sense of accountability and responsibility in protecting accumulated data, which is the database that is referred to as the NRP as per Section 10 of the Registration of Persons (Amendment) Act, No. 8 Of 2016, for individuals connected to such process is essential.

The Amendment Act (2016), acting proactively, has introduced legal provisions preventing the illicit use of information that are made available for official purposes. Specifically, Section 23, which introduced Section 39E to the principal enactment, prevents securing access to the NRP without the proper approval of the Commissioner and further prohibits the act of changing the data and making copies of the information therein. Additionally, it is also stipulated by the amendment, particularly Section 39F, that any official who is appointed for the purposes of the Act should sign a

declaration and pledge himself/herself not to disclose any information that he/she gets access as per the powers of his/her office unless otherwise permitted by the Act or any other statutory law.

### **The Computer Crimes Act No. 24 of 2007**

Computers have become a method by which various kinds of offences. As a response, the Computer Crimes Act was introduced to Sri Lanka as a statutory instrument that specifically addresses criminal conduct on the use and accessing of data in the electronic environment. To effectively stand up to its underlying objectives, the Act addresses, indirectly, the concerns regarding data protection and security by criminalizing unlawful access to computer devices through Sections 3, 4 and 5. The sections, respectively, criminalize the acts of securing unlawful access to a device or the information therein, securing unlawful access to devices and information therein for the purpose of committing a further offence and the act of manipulating a device to function in a certain way without having any lawful authority to do so. In addition to the aforementioned Sections, Section 10 further criminalizes the act of disclosing information that is entrusted to such person for obtaining services from a certain device which is further supported by Section 14 by enabling aggrieved parties to receive compensation for any possible harm sustained due to such offences. Finally, it should also be considered that Section 19 provides power to police officers to preserve information that may be useful for legal proceedings but may be at the risk of being destroyed or tampered with. Effective

consideration of such legal provisions depicts the fact that data protection is not a completely alien principle for Sri Lanka.

### **Other Remedies for Violating Privacy**

Chapter 3 of the Constitution of Sri Lanka (1978) embodying the fundamental rights, also supported by judgements such as *Sinha Ratnatunga v. The State*<sup>12</sup> clearly lays down the standard that freedom of expression is not unlimited and cannot be used to invade the privacy of persons. Such attitude portrays the clear inclination of the Sri Lanka courts towards respecting privacy. The same stance is further supported by the visible attempts made to balance the conflicting rights of parties mainly on right to information. One example of such a notion is the ability of the information officer to reject a request for information under Section 28 of the Right to Information Act, No. 12 of 2016. Additionally, it should further be noted that *Actio Injuriarum* is a Roman-Dutch law remedy providing effective relief against an intentional invading a person's personal rights that are connected to the reputation and privacy. Therefore, it could be an option available to a person aggrieved by a violation of privacy and related aspects and to ensure protection for one's data.<sup>13</sup>

### **Recent Trends and International Experience**

Data protection is not an aspect that is only relevant for business organizations. With the use of technology and consumer behaviour, the scope of data protection is rapidly increasing which thereby yields drastic measures for the best interest of all parties concerned; consumers, businesses, state, or government. Therefore, with

<sup>12</sup> *Sinha Ratnatunga v. The State* (2001) 2 Sri Lankan Law Reports 172. <https://www.uhi.ac.uk/en/about-uhi/governance/policies-and-regulations/data-protection/the-seven-principles/> accessed 17 October 2020.

<sup>13</sup> Mangala Wijesinghe, 'J. Actio Injuriarum In Roman Dutch Law Of Delict: Elements Of Liability' <[https://www.researchgate.net/publication/334372986\\_Actio\\_Injuriarum\\_in\\_Roman\\_Dutch\\_Law\\_of\\_Delict\\_Elements\\_of\\_Liability\\_Mangala\\_Wijesinghe\\_Senior\\_Lecturer\\_Faculty\\_of\\_Law](https://www.researchgate.net/publication/334372986_Actio_Injuriarum_in_Roman_Dutch_Law_of_Delict_Elements_of_Liability_Mangala_Wijesinghe_Senior_Lecturer_Faculty_of_Law)> accessed 23 October 2020.

reference to various challenges imposed by technology and related criminal activities against assuring protection for data, it is notable that different states have employed various approaches such as, comprehensive regulatory approach, sectoral approach, and the self-regulatory approach. For instance, in terms of the United Kingdom, the introduction of Data Protection Act 2018, although subjected to various opinions, tends to be one of the most significant developments that took place in the sphere of data protection during recent years inspired by the General Data Protection Regulation. The General Data Protection Regulation specifically introduced a comprehensive set of data protection principles which includes data minimization, accuracy, lawfulness and transparency, purpose limitation, storage limitation, lawfulness, accountability and security.<sup>14</sup>

This approach tends to be different compared to the approach of the USA on data protection, which is similar to Sri Lanka, as the legal system in terms of data protection consists of a sector-specific statute. For instance, in USA, at the federal level, the Driver's Privacy Protection Act 1994, the Video Privacy Protection Act, the Children's Privacy Protection Act and Cable Policy Communications Act can be considered, and is quite similar to the plethora of legislation that protects data protection in Sri Lanka.<sup>15</sup> The Federal Trade Commission, similar to the data protection principles that are portrayed by the General Data Protection Regulation, has issued principles under which institutions should function while guaranteeing optimum protection for data. The principles include transparency, lawful procession, data retention regulations among other considerations.<sup>16</sup>

However, the Data Protection Act (2018) has effectively introduced data protection principles under which institutions and persons should conduct themselves with reference to the use and processing of data. For instance, Part 3, Chapter 2 of the Act which specifically caters to the needs of data usage for law enforcement and Section 35 enumerates the capability to process data for legal requirements and law enforcement can be considered. It should further be noted that a similar attitude is portrayed under Section 7 of the Data Protection Bill of Sri Lanka as well. Even for the purposes of law enforcement, it should be noted that the Section stresses on sensitive processing where it is required to use certain types of data, including health, ethnic origins, religious views, for law enforcement in exceptional circumstances as supported by Section 37. One of the most notable elements in the Data Protection Act (2018) is the fact that it lays down a uniform mechanism that is applicable for law enforcement. The Sri Lankan legal system tends to provide provisions under different statutes, for the extent that is required similar to the experience of USA, which at certain instances may not suffice in guaranteeing optimum protection for data. The need of a comprehensive law such as the General Data Protection Regulation or the Data Protection Act (2018) is much required in the current challenging environment that is created by technology. For instance, the General Data Protection Regulation clearly lays down a platform on which users of data should conduct themselves in such a way so as to guarantee the protection for the data being used, which is essential for any system. As per the principles, it is required for the data collection mechanism to be transparent, fair and

<sup>14</sup> The Seven Principles (*University of the Highlands and Islands*, 2020).

<sup>15</sup> Steve Chabinsky and F. Paul Pittman, 'International Comparative Legal Guide To Data Protection 2019 Published' (*Whitecase.com*, 2019)

<<https://www.whitecase.com/publications/alert/international-comparative-legal-guide-data-protection-2019-published>> accessed 18 October 2020.

<sup>16</sup> *ibid*.

lawful where the data subjects will be properly informed about the reasons for which data is collected and how such data will be processed. Such principles are quite important as such a process will provide an opportunity for the data subjects to provide their informed consent for the purposes for which data is collected.<sup>17</sup> Moreover, the principles further stress the fact that data should be collected for the purposes specified to the data subjects and if the collection of data goes beyond such purpose such fact should be informed to the data subjects and informed consent should be obtained. Apart from the aforementioned principles, retaining data only for the time that is necessary, as a principle, while incorporating a mechanism to assure the security of such retained data further enhances the extent of protection that is provided for data in diverse perspectives. Retention of data for necessary extents further acts as a solution for the problems caused by data graveyards which depict the importance and effectiveness of data protection principles.<sup>18</sup>

When due consideration is provided for the aforementioned principles it can be presumed that they do not solely address the importance of protecting privacy but impliedly attempts to assure security for data by preventing unnecessary disclosure, securing the collected data, imposing limitations on the capability to collect and maintain data bases. Additionally, these principles are highly influential and have inspired many states such as Brazil, Argentina and Malaysia in

drafting their respective data protection laws, which is quite notable in terms of the current trend in data protection.<sup>19</sup>

Apart from such obvious concerns in terms of data protection, specifically with reference to online transactions, it should be identified that there are unique challenges that impose a visible threat for data protection. For instance, technological means such as cookies which monitor the preferences of a browser on the internet can be cited for clarity. User behaviour and needs also encompasses personal data amounting to his/her right to a private life and therefore, monitoring user behaviour without the informed consent can be a violation of privacy and may further impose threats to data protection.<sup>20</sup> Any website that uses cookies should inform such use for the users of the website and should get the consent of the user to proceed with it. Any failure to do so can lead to fines being imposed by law depending on the legal position.

In addition to such aspects, another trend that can be detected in the international sphere for the purpose of strengthening data protection is the compulsory training for institutions and persons who handle data.<sup>21</sup> In support of such perception, The General Data Protection Regulation makes it a requirement to train data protection officers even though it is not a requirement for all types of organizations, under the requirements laid down by Articles 39, 47 and 70. Such requirement is also portrayed in Section 20 (1) of the proposed Data Protection Bill of Sri Lanka

<sup>17</sup> Luke Irwin, 'The GDPR: Understanding The 6 Data Protection Principles' (*IT Governance Blog En*, 2021) <<https://www.itgovernance.eu/blog/en/the-gdpr-understanding-the-6-data-protection-principles>> accessed 1 July 2020.

<sup>18</sup> Mike Branch, 'Do You Have A Big Data Graveyard?' (*Geotab*, 2017) <<https://www.geotab.com/blog/big-data-graveyard/>> accessed 12 October 2020.

<sup>19</sup> Aaron Burstein and Alys Zeltzer Hutnik, 'The U.S. Approach To Privacy: What Is It, And Where Is It Headed?' (*Ad Law Access*, 2020) <<https://www.adlawaccess.com/2020/01/articles/the->

[u-s-approach-to-privacy-what-is-it-and-where-is-it-headed/](#)> accessed 19 October 2020.

<sup>20</sup> Claudio Dodd, 'Cookies: An overview of associated privacy and security risks' (*INFOSEC*, 2020) <<https://resources.infosecinstitute.com/topic/cookies-an-overview-of-associated-privacy-and-security-risks/>> accessed 21 October 2020.

<sup>21</sup> Nick Henderson, 'GDPR Training Requirements - Vinciworks Blog' (*VinciWorks Blog*, 2019) <<https://vinciworks.com/blog/gdpr-training-requirements-guide-to-data-protection-training/>> accessed 19 October 2020.

as well, which is an important feature that can guarantee data protection to a significant extent. By imposing such requirements, the need to assure data protection through imposing responsibility and a sense of accountability by injecting expertise on the matter to organizations can be satisfied significantly.

## CONCLUSION

When proposing law reforms, apart from the factors discussed in terms of the existing legal framework of Sri Lanka on data protection in light of insights from foreign jurisdictions, the Data Protection Bill of Sri Lanka should not be overlooked. When considering the Data Protection Bill of Sri Lanka, it should be stated that the principles enshrined in the Data Protection Act (2018) and the General Data Protection Regulation with reference to the use of data is duly portrayed. For instance, when data is processed, under Section 5 the processing should be done lawfully, as per Section 6 the purpose of data processing should be defined except under limited exceptional circumstances, Section 7 requires the controllers to ensure the accuracy of personal data and mandates that inaccurate irrelevant data should be rectified, Section 8 requires data controllers to maintain and retain data only for the purpose expressed and the retention time period should be limited by such purpose. More importantly, Section 10 further mandates that the controllers of data should ensure the confidentiality and integrity of the data that is being processed and should take measures to prevent unauthorized access to such data and ensure that the data so collected will not be damaged or destroyed. Likewise, the Data Protection Bill of Sri Lanka tends to provide a strong foundation or platform on which data handling should be done by users of data and it is reasonable to conclude that such standards coincide

with international trends and patterns that are effectuated to guarantee data protection.

In addition to the obligations of the data controllers, it should be highlighted that the proposed Data Protection Bill of Sri Lanka has expressly recognized the rights of the data subjects. For instance, Section 13 clearly identifies the right of the data subjects to withdraw the consent and object against processing their data, which is significant in terms of the freedom of parties in deciding how their data can be used and it could also be regarded as a ceiling under which data controllers are compelled to use collected data. Moreover, among other rights, it should further be noted that the Data Protection Bill of Sri Lanka provides the data subjects with the ability to rectify submitted data and to complete the submission of data properly through Section 15.

By observing such provisions, it is clear that the Data Protection Bill of Sri Lanka has properly identified the ambit of its responsibility in securing data to a level satisfactory, especially with reference to rights of data subjects and obligations of data controllers. Apart from such rights and obligations, compliance and training were also identified as significant trends in the sphere of data protection and is clearly visible in the international and foreign instruments that were discussed formerly in this paper. Matching those perceptions, the Data Protection Bill of Sri Lanka has also imposed requirements in terms of electing data protection under Section 31 for the purpose of ensuring proper compliance with the provisions of the Act. Additionally, Section 31 (5) further identifies the functions of the data protection officers and includes capacity building of staff in terms of data protection among other functions, which sheds light on the importance of having trained individuals who are capable of properly handling data obtained from different sources. Such aspect is an area that has

been identified as a key trend that is related to data protection and privacy related measures in the world.

When considering all the said facts, additionally to the legal provisions that are already available in the sphere of privacy as discussed in Section 2 of this paper, purports to lay down a legal framework that is strong and efficient enough to uplift data protection and privacy to a level satisfactory. In support of the said argument, when considering the Data Protection Bill of Sri Lanka, the level of certainty provided by it is duly visible when, for instance, Schedule V which specifically indicates the types of information that should be provided to the data subject when data is obtained is observed. Furthermore, the Data Protection Authority clearly has function powers to give effect to international laws on data protection as per Section 29 (h) of the Data Protection Bill of Sri Lanka which expands the horizons of the data protection law to higher extents.

Therefore, considering the aforementioned facts, a reasonable conclusion can be made suggesting that Sri Lanka data protection legal framework can be made stronger and more efficient if the Data Protection Bill of Sri Lanka is given due effect amongst the existing legal framework on discipline related laws there exists in the legal system.

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## The Desirability and Feasibility of Adopting the CISG: Analysis of the UK and Sri Lanka

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### ABSTRACT

The United Nations Convention on International Sales of Goods (CISG) 1980 is implemented for unification of sales law among trading nations and for overcoming uncertainty of rights and duties of trading parties. The UK and Sri Lanka have not ratified the CISG owing to the importance already attached to English common law (ECL) in international sales of goods. The desirability of ratifying the CISG is attributed to cost and time saving, providing a conducive regime for buyers and sellers, uniformity of legal concepts, progress with modern technology and etc. The non-feasibility of ratifying the CISG can be assigned to competitive advantage of ECL over the CISG. Therefore, the CISG should be amended by seeking recommendations from interested parties. Similar experiences can be drawn from Uniform Customs and Practice for Documentary Credits (UCP) and International Commercial Terms (Incoterms).

## INTRODUCTION

‘...to plead for complete uniformity may be to cry for the moon’<sup>1</sup>

National laws formulated for domestic transactions are unsuitable for international trade transactions involving countries with varied legal systems.<sup>2</sup> The differences in laws governing international sales lead to uncertainties in determining applicable law to an international sale. The uncertainty of applicable law results in uncertainty of rights obligations and remedies of parties to a sales contract.<sup>3</sup> This calls for harmonization of international sales law to promote certainty in international trade. International institutions such as UNIDROIT, UNCITRAL etc. focused on harmonization of international sales law. The CISG was devised with legal rules and practical procedures for cross-border sales of goods transactions. UNCITRAL attempted to unify the law of international sale of goods by drafting the CISG.<sup>4</sup> The UK opted out from the CISG which demands analysis of desirability and feasibility of adopting the CISG. This essay firstly discusses desirability of adopting the CISG. Secondly, feasibility of adopting the CISG by the UK and Sri Lanka is discussed.

## METHODOLOGY

The researcher follows a qualitative research paradigm, comprising methods,

methodology and epistemology. This research was conducted with primary legal sources such as statutes, case law etc. The secondary legal sources perused were books, journal articles, newspapers, websites etc. The tertiary legal sources referred were research papers from online database collections such as Lexis Nexis, Law Trobe, Jstor etc. Information from available literature was used to assess gaps in literature. Thus, the black letter approach was used for the research.

## CISG and the UK

The desirability of a convention entails in usefulness to address a subject matter. The better accessibility of the CISG saves time and costs and makes outcomes of cases more predictable.<sup>5</sup> The CISG allows exclusion in favour of domestic laws which is a downside.<sup>6</sup> The desirability of adopting the CISG can be attributed to application of a uniform law, creation of a conducive regime for sellers and buyers, and progression par modern technology.

## Application of a uniform law

The objective of the CISG is to adopt uniform trade rules to promote international trade.<sup>7</sup> A uniform law answers legal aspects by applying equitable principles such as good faith, equity, fairness and etc,<sup>8</sup> which minimise cross border legal risks.<sup>9</sup> The CISG departs from domestic legal terms and

<sup>1</sup> Lord Wilberforce in *Photo Production Ltd v Securicor Transport Ltd* [1981] All ER 556, 562.

<sup>2</sup> Bzhar Abdullah Ahmed and Hassan Mustafa Hussein, ‘Avoidance of Contract as a Remedy under CISG and SGA: Comparative Analysis’ (2017) 61 Journal of Law, Policy and Globalization 126-142, 137.

<sup>3</sup> Indira Carr and Peter Stone, *International Trade Law* (6th edn, Routledge 2018) 60.

<sup>4</sup> Kazuaki Sono, ‘The Vienna Sales Convention: History and Perspective’ in Peter Sarcevic and Paul Volken (eds), *International Sale of Goods: Dubrovnik Lectures* 1985 (Oceana Publications 1986) 2.

<sup>5</sup> Ingeborg Schwenzer and Pascal Hachem, ‘The CISG- A Story of Worldwide Success’ 128.

<sup>6</sup> CISG, Article 6; Bruno Zeller, ‘The UN Convention on Contracts for the International Sale of Goods (CISG) – A Leap Forward towards Unified International Sales Law’ (April 2000) 12 Pace International Law Review 79, 81.

<sup>7</sup> Andre Janssen and Sorren Claas Kiene, ‘The CISG and Its General Principles’ in Andre Janssen and Meyer (eds), *CISG Methodology* (2009) 261-285, 261.

<sup>8</sup> *ibid* (n 9).

<sup>9</sup> *ibid*.

concepts and seeks an independent legal language.<sup>10</sup>

The level of uniformity required from the CISG needs clarification. If this means an identical interpretation of every provision, it is difficult to be achieved.<sup>11</sup> The uniformity which should be expected is 'consistent' interpretation with similar effects.<sup>12</sup> However, a uniform law will not exist inert on paper and requires continuous legal development.<sup>13</sup>

There is no positive correlation between unification of laws and increase in cross-border trade.<sup>14</sup> This is attributable to two reasons. Firstly, when parties are entering into a contract across borders, they are driven by factors such as distance between countries, differences in culture or language etc.<sup>15</sup> Secondly, contracting parties have no interest in unification of laws. Their concern is to choose the domestic legal system that is best known to them and provide legal certainty. The creation of a uniform law complicates matters when parties are not governed by a single law.<sup>16</sup>

The CISG is a system of mixed jurisdictions which adds uniformity.<sup>17</sup> The framework of the CISG rules originate from a combination of ECL,<sup>18</sup> American Common Law,<sup>19</sup> French

system<sup>20</sup> etc.<sup>21</sup> Discussed below are areas which uniformity is achieved.

### ***Transfer of property***

The passing of property involves determining the point at which a seller ceases to be owner of property and a buyer assumes ownership.<sup>22</sup> The time which property passes determines who bears losses.<sup>23</sup>

There are two models for transfer of property. In the first model, transfer of goods takes place when a contract is concluded, irrespective of whether delivery of goods and /or payment for goods has taken place.<sup>24</sup> This model appears in the Sale of Goods Act (SOGA) of the UK for transfer of property<sup>25</sup> which states that risk *prima facie* passes at the same time as property.<sup>26</sup> Contrary opinion expressed in *Head v Tattersall*<sup>27</sup> that risk passes after property is passed, where buyer is allowed to return goods which do not match the description. The second model is where property transfers after delivery of goods.<sup>28</sup> The CISG lacks a rule for transfer of property.<sup>29</sup> This was a deliberate attempt of the drafters of the CISG to avoid a stance relating to transfer of property which is decided differently in

<sup>10</sup> Ingeborg Schwenzer and Pascal Hachem, 'The CISG- A Story of Worldwide Success' 124.

<sup>11</sup> Jan M Smits, 'Problems of Uniform Sales Law- Why the CISG May Not Promote International Trade' (2013) Maastricht European Private Law Institute Working Paper 1/2013, 6.

<sup>12</sup> *ibid.*

<sup>13</sup> Michael Bridge, 'An Overview of the CISG and an Introduction to the Debate about the Future Convention' (2013) 58/4 Villanova Law Review 487-490, 487.

<sup>14</sup> *ibid* (n 15).

<sup>15</sup> *ibid.*

<sup>16</sup> *ibid* (n 15).

<sup>17</sup> Ulrich Magnus, 'The Vienna Sales Convention (CISG) between Civil and Common law- Best of all Worlds?' (2010) 3/1 Journal of Civil Law Studies 68-97, 69.

<sup>18</sup> For example, liability for breach of contract and termination of contract under restrictive conditions.

<sup>19</sup> For example, seller's right to cure without delay and unreasonable inconvenience for buyer.

<sup>20</sup> For example, price reduction as a contractual remedy, specific performance for breach of contract, foreseeability test for quantification of damages.

<sup>21</sup> Angelo Chianale, 'The CISG as a Model Law: A Comparative Law Approach' [2016] Singapore Journal of Legal Studies 29-45, 30.

<sup>22</sup> *ibid.*

<sup>23</sup> Anwar Aboukdir, 'The Timing of the Passing of Risk under the English Sale of Goods Act 1979, the CISG and the Libyan Law- The Interplay between the Principle of Party Autonomy and the Default Rule', 1 (PhD thesis, University of Stirling 2016).

<sup>24</sup> *ibid* 23.

<sup>25</sup> *ibid*; See further Benjamin Hayward, Bruno Zeller and Camilla Andersen, 'The CISG and the United Kingdom- Exploring Coherency and Private International Law' (2018) 67/3 International and Comparative Law Quarterly 1-35, 10.

<sup>26</sup> SOGA, section 20; *ibid* (n 25) 9.

<sup>27</sup> (1871-72) LR 7,7.

<sup>28</sup> *ibid* (n 23) 31.

<sup>29</sup> *ibid.*

various jurisdictions by judicial interpretation.<sup>30</sup>

### ***Civil and common law***

The CISG follows a unitary approach and recognizes both civil and common law.<sup>31</sup> It follows the common law approaches such as making a person liable irrespective of his fault<sup>32</sup> exempting liability only in exceptional circumstances,<sup>33</sup> and termination of contract under restrictive conditions.<sup>34</sup> The CISG also recognizes civil law remedy of price reduction for a buyer.<sup>35</sup> The Federation Arbitration Court of the North Caucasus Area, Krasnodar on 3<sup>rd</sup> October 2011 held buyer's right for price reduction when defective goods were delivered to the buyer, and refused the seller's claim that a record or receipt was sufficient proof of delivery of goods that match the description.<sup>36</sup>

### ***Progressing with technology***

The text of the CISG has not changed since 1988.<sup>37</sup> However, the CISG in its subject matter and interpretation is subject to development.<sup>38</sup> Software and electronic contracts are recognized under the definition of 'goods' deliverable in the CISG<sup>39</sup> which were not recognized at the inception of the CISG.<sup>40</sup> The CISG should prescribe by setting

a time frame in which action must be commenced.<sup>41</sup> The CISG suggests that a buyer must examine goods or cause them to be examined within a short period as practicable in circumstances.<sup>42</sup> A buyer who fails to examine nature of goods or type of defect and give notice of non-conformity within a reasonable time loses the right to remedies under Article 45.<sup>43</sup> Thus, a buyer must specify in the contract the time period which goods will be examined and notice of non-conformity will be issued, derogating from Articles 38 and 39.<sup>44</sup>

### ***Conducive for sellers and buyers***

The CISG adheres to breach of contract of common law descent, moving away from cause-oriented approach.<sup>45</sup> The CISG refers to awarding damages based on market prices for breach of contract.<sup>46</sup> The CISG states that a substitute transaction must stand in reasonableness to an original transaction in terms of damages and reasonable time after avoidance.<sup>47</sup> Article 76 grants price difference between contractual price and price prevailing in market at the time of avoidance<sup>48</sup> at the place where delivery should have taken place.<sup>49</sup> In online transactions, current price is based on a

<sup>30</sup> *ibid* (n 31) 32.

<sup>31</sup> *ibid* (n 21) 76.

<sup>32</sup> Articles 45 (1) (b) and 61 (1) (b), CISG.

<sup>33</sup> Article 79, CISG.

<sup>34</sup> Articles 49 and 64, CISG.

<sup>35</sup> Article 50, CISG.

<sup>36</sup> Russian Federation (2011) Federal Arbitration Court of the North Caucasus Area, Krasnodar <<http://www.unilex.info/cisg/case/1882>> accessed 8 June 2021.

<sup>37</sup> Benjamin Hayward, 'Prospect, Benefits and Dangers of Expansion of the CISG- The Case Study of Prescription' [2016] Deakin Law School Research Paper No. 16-36, 21-42, 21.

<sup>38</sup> *ibid* 22.

<sup>39</sup> Kristina Fausing Kylkjaer, 'The Applicability of the CISG on Transaction of Software' (PhD, 2019).

<sup>40</sup> *Ibid* (n 40) 22.

<sup>41</sup> *ibid* 25.

<sup>42</sup> CISG, Article 38; Andrew J Kennedy, 'Recent Developments: Nonconforming Goods Under the CISG- What's a Buyer to Do?' (1998) 16/2 Penn State International Law Review 319-341, 326.

<sup>43</sup> Mohammed Zaheeruddin, 'Examination of Goods by Buyers Under International Sales Contracts' (2021) 27/1 Academy of Entrepreneurship Journal.

<sup>44</sup> *ibid*.

<sup>45</sup> *ibid*.

<sup>46</sup> Jonathan Yovel, 'An Analysis of Market-Based Damages for Breach of Contract in the CISG and PECL' in John Felemegas (ed), *An International Approach to the Interpretation of the United Nations Convention on Contracts for the Sale of Goods* (Cambridge University Press 2007) 1-7, 1.

<sup>47</sup> CISG, Article 75.

<sup>48</sup> Djakhongir Saidov, 'Article 35 of the CISG: Reflecting on the Present and Thinking about the Future' (2013) 58/4 Villanova Law Review 529-552, 538.

<sup>49</sup> *ibid*.

'virtual' transaction.<sup>50</sup> This enables to avoid damages based on current market prices.<sup>51</sup>

The CISG establishes a comprehensive regime for termination of contract considering commercial realities.<sup>52</sup> The CISG considers avoidance of contract as a last resort since large investments are made in cross border trade transactions.<sup>53</sup> It is only allowed in instances of fundamental breach.<sup>54</sup> The SOGA allows avoidance of contract when a condition is breached irrespective of consequences of breach.<sup>55</sup> The CISG seeks justice in commercial transactions whereas the SOGA seeks certainty.<sup>56</sup> The CISG provides right of avoidance to both seller and buyer with identical provisions.<sup>57</sup> The SOGA recognizes buyer's right of avoidance and avoids similar provisions for seller.<sup>58</sup>

## Feasibility of CISG- UK experience

### Competitive advantages of ECL

ECL was the leading international sales law before the CISG was enacted.<sup>59</sup> ECL has three advantages over the CISG. First, ECL is a comprehensive legal system whereas the CISG is non-comprehensive.<sup>60</sup> Second, there are more ambiguities in the CISG than in the

SOGA.<sup>61</sup> Third, legal ambiguities and conflicting legal principles are solved through case law in the UK, however there is no judicial institution to resolve matters under the CISG.<sup>62</sup>

### *A fragmentary law*

When a person makes a choice to use ECL as the applicable law for a transaction, he chooses not only English sales law, but also the whole system of ECL.<sup>63</sup> The CISG's narrow scope requires a contracting party to select another law to govern legal issues that are not covered by the CISG.<sup>64</sup> The CISG is a fragmentary body of legal rules which excludes many areas of law relating to sales of goods. The CISG only governs formation of contract of sale, seller's rights and obligations, and buyer's rights and obligations arising from a contract of sale. The CISG is not concerned with validity of a sales contract and the effect it has on property of goods.<sup>65</sup>

Contracting parties are not only interested in a suitable contract law or private law regime,<sup>66</sup> they also require procedural law and tax law. The CISG regime is not exclusively applicable to contractual party relationships.<sup>67</sup> The CISG only includes contracts for sale of goods and excludes consumer sales.<sup>68</sup>

<sup>50</sup> *ibid* (n 50) 2.

<sup>51</sup> *ibid*.

<sup>52</sup> *ibid* (n 2) 137; *See further* Jonathan Yovel, 'The Seller's Right to Avoid the Contract in International Sales' in John Felemegas (ed), *An International Approach to the Interpretation of the United Nations Convention on Contracts for the Sale of Goods* (Cambridge University Press 2007) 1-31, 15.

<sup>53</sup> *ibid*; *See further* Ulrich G Schroeter, 'Defining the Borders of Uniform International Contract Law: The CISG and Remedies for Innocent, Negligent, or Fraudulent Misrepresentation' (2014) 58/4 Villanova Law Review 553-588, 553-554.

<sup>54</sup> Kourosh Majdzadeh Khandani, 'Does the CISG, compared to English law, put too much emphasis on promoting performance of the contract despite a breach by the seller' (2012) 1/98 Manchester Student Law Review 98-135, 118.

<sup>55</sup> Ronald A Brand, 'The CISG: Applicable Law and Applicable Forums' (2019) University of Pittsburgh School of Law Working Paper 14/ 2019, 11-12.

<sup>56</sup> *ibid* (n 2) 126.

<sup>57</sup> *ibid* (n 55).

<sup>58</sup> *ibid*.

<sup>59</sup> Qi Zhou, 'CISG Versus English Sales Law: An Unfair Competition' in LA DiMatteo (ed), *International Sale Law A Global Challenge* (Cambridge University Press 2014) 669-682, 680.

<sup>60</sup> *ibid*.

<sup>61</sup> *ibid* (n 63); *See further* Ndubuisi Nwafor, 'Comparative Evaluation of the Doctrine of Fundamental Breach under the CISG, UNDRIT Principles and English Law' 6 (2013).

<sup>62</sup> *ibid* (n 63).

<sup>63</sup> *ibid* 673.

<sup>64</sup> *ibid*.

<sup>65</sup> CISG, Article 4; Larry A DiMatteo, 'CISG as Basis of a Comprehensive International Sales Law' (2013) 58/4 Villanova Law Review 691- 722, 700.

<sup>66</sup> *ibid* (n 15) 9.

<sup>67</sup> *ibid*.

<sup>68</sup> *ibid* (n 2) 138.

Therefore, contractual parties prefer one jurisdiction which is imperfect than rights and obligations governed by fragments of different origins with high quality.<sup>69</sup> In *Switzerland v China*<sup>70</sup> decided by China International Economic and Trade Arbitration Commission (CIETAC) on 15<sup>th</sup> September 2009 upheld that Chinese law and the CISG are two legal regimes and the CISG is not part of Chinese law due to its dualist character. If contracting parties are in two states, the CIETAC arbitral tribunal uses the CISG to fill gaps in Chinese contract law, even if parties have not agreed to use the CISG as the applicable law.<sup>71</sup> The CISG also has fragmented principles brought in from different origins.<sup>72</sup>

In contrast, the SOGA is a comprehensive body of law which covers all key legal aspects of international sale contracts and in *casus omissus*, common law is referred.<sup>73</sup> The CISG is a fragmentary body of law due to reservations awarded to countries.<sup>74</sup> States can opt out of Part II (formation) or Part III (obligations of sellers and buyers),<sup>75</sup> and non-application of the CISG for transactions between countries that have same or closely related legal rules.<sup>76</sup>

### ***Ambiguities in the CISG***

The CISG contains principles and abstract legal terms that are undefined.

The CISG has legal uncertainties with terms such as fundamental breach.<sup>77</sup> The seriousness awarded to the term 'fundamental breach' warrants a clear definition. The definition given for 'fundamental breach' in the CISG<sup>78</sup> is unclear and vague. The CISG refers to a 'reasonable person, reasonableness or unreasonableness' which have not been defined in the Convention and allows contracting parties to attribute a subjective perspective.<sup>79</sup> These abstract terms and general principles have resulted in uncertainty in application of CISG.<sup>80</sup>

In contrast, the ambiguous legal jargon in the SOGA have been clarified through judiciary in line with developments in commercial transactions.<sup>81</sup> Furthermore, vague terms such as 'satisfactory quality' of goods are defined.<sup>82</sup>

### ***Diverse Legal Interpretations***

The principles for interpreting the CISG are international character, need for uniformity, and observation of good faith principle.<sup>83</sup> This is provided in a hierarchical order.<sup>84</sup> The provisions of the CISG have been interpreted in diverse ways by developed and developing nations. This can be illustrated by interpretations given to Article 9 of the CISG relating to usage of trade practices established between

<sup>69</sup> *ibid* (n 15) 9.

<sup>70</sup> CIETAC Award, 15 September 2009 (Ferrosilicon case, Swiss buyer v. Chinese seller).

<sup>71</sup> Shiyuan Han, 'The Application of the CISG in International Commercial Arbitration in China' 10.

<sup>72</sup> *ibid* (n 73).

<sup>73</sup> *ibid* (n 63) 674.

<sup>74</sup> Clayton P Gillette and Robert E Scott, 'The Political Economy of International Sales Law' (2005) New York University Law and Economics Research Paper Series Working Paper 2/2005.

<sup>75</sup> CISG, Article 92.

<sup>76</sup> CISG, Article 94.

<sup>77</sup> *ibid* (n 2) 138.

<sup>78</sup> CISG, Article 25 defines a fundamental breach as a 'detriment to the other party as *substantially* to

deprive him of what he is entitled to expect under the contract.'

<sup>79</sup> *ibid* (n 77) 683.

<sup>80</sup> *ibid* (n 77) 676.

<sup>81</sup> George L Peiris, 'The Common Law Process and the Selection of Efficient Rules' (1977) 6/1 The Journal of Legal Studies 65-82, 67.

<sup>82</sup> SOGA, section (2) (A) as meeting a standard a reasonable person would regard as satisfactory, taking account of goods' description, price and other relevant circumstances

<sup>83</sup> CISG, Article 7; James E Bailey, 'Facing the Truth: Seeing the Convention on Contracts for the International Sale of Goods as an Obstacle to a Uniform Law of International Sales' (1999) 32/1 Cornell International Law Journal 273- 317, 286-287.

<sup>84</sup> *ibid*.

contracting parties. Developed countries take a flexible approach to Article 9, whereas developing countries take a stricter approach and rely on the written contract due to little development of trade usages. There is no supreme authority for the CISG to resolve conflicting interpretations of its provisions, which led to uncertainty. In contrast, the English sales law consisting of the SOGA and ECL is developed through case law giving more certainty to legal interpretations.

### Adaptation of CISG to Sri Lanka

The adaptation of the principles in the CISG to Sri Lanka, should be discussed in the context where Sri Lanka lacks case law on sale of goods. Sri Lanka applies the Sale of Good Ordinance (SOGO),<sup>85</sup> for sale of goods transactions. The development of sale of goods law is essential in light of the Colombo Port City Economic Commission Bill which aims to attract foreign direct investment.<sup>86</sup> However, one may argue, by applying the Civil Law Ordinance,<sup>87</sup> ECL which is currently applied in the UK for commercial matters, can be applied in areas of *casus omissus* in the SOGO.

The SOGO is modelled on the English Sale of Goods Ordinance of 1893.<sup>88</sup> Despite the vast growth in technology and commerce, the SOGO remains static leading to crucial problems.<sup>89</sup>

The SOGO recognises all movables except money and things attached to or forming part of land and are severed before sale as “goods”.<sup>90</sup> In the modern

world, goods transacted on online platforms such as music videos, software, computer games etc. These items do not fall within the definition of “goods” under the SOGO. The Intellectual Property Act (IPA),<sup>91</sup> recognises computer software, music videos and other digital purchases,<sup>92</sup> which allows an innocent party to bring action against the infringing party under the IPA.<sup>93</sup> In *St Albans City and District Council v International computers*<sup>94</sup> the court held that software connected with hardware are ‘goods’ within the SOGA, and software ‘itself’ could be considered a service under the intellectual property category.<sup>95</sup> This approach in *St Albans* can be adopted in Sri Lanka for computer-related items/aspects. Thus, a combination of the existing legislation in Sri Lanka and developed case law of the UK (as persuasive authority) can be utilised by the judiciary of Sri Lanka to overcome shortcomings in existing regime of sale of goods. Thus, adoption of the CISG is not warranted as a feasible and desirable method for Sri Lanka to address issues pertaining to sale of goods.

### RECOMMENDATIONS AND CONCLUSIONS

The CISG should be more accepted by contracting parties, so that case law can be produced by courts and more legal certainty can be provided.<sup>96</sup> When compiling the CISG, international traders were excluded, hence interests of traders

<sup>85</sup> No. 11 of 1896.

<sup>86</sup> Price Waterhouse Coopers, ‘Economic Impact Assessment of the Port City Colombo: Corporate Finance and Valuation Consulting’ (Price Waterhouse Coopers 2020) <<https://www.pwc.com/lk/en/assets/document/2020/Port-City-Report.pdf>> accessed 15 October 2021. <sup>87</sup> Civil Law Ordinance, No. 5 of 1852 (as amended), section 3.

<sup>88</sup> Lakshman Marasinghe, ‘Law and Development in Sri Lanka: A Historical Perspective 1796-1978’ (DPhil thesis, University of London 1981) 518

<sup>89</sup> RNK Chandrawansa, ‘The Need for Reforming the Sake of Goods Ordinance of Sri Lanka: A Comparative Analysis’ (2020) 15/1 Open University of Sri Lanka Journal 67-82, 68.

<sup>90</sup> SOGO, section 59(1).

<sup>91</sup> No. 36 of 2003.

<sup>92</sup> IPA, section 5.

<sup>93</sup> *ibid* (n 89) 70.

<sup>94</sup> [1996] 4 All ER 481.

<sup>95</sup> *ibid* (n 89) 70- 71.

<sup>96</sup> *ibid* (n 15) 10.

are not addressed in the CISG. In contrast, the UCP and Incoterms<sup>97</sup> were drafted with the support of bank industry who are primary users of UCP 600 and Incoterms.<sup>98</sup> They were drafted by the International Chamber of Commerce.<sup>99</sup> Bank interests are addressed in UCP 600 and includes principle of autonomy to ensure due care when reviewing documents by banks, and to reduce risks.<sup>100</sup> However, the CISG is a treaty and is hard law which cannot be amended without approval of all member states. Its hard law status should be abolished to reach amendments.<sup>101</sup> The option clause in the CISG should be eliminated, due to creation of competition between the CISG and national jurisdictions.<sup>102</sup>

In conclusion, the CISG is an international treaty formulated to promote uniformity in international sales law which did not receive desired success. The above analysis connotes advantages and disadvantages of ratifying the CISG by the UK and feasibility of adopting the CISG in Sri Lanka. The ratification of the CISG by the UK would be unnecessary due to the clear regime of ECL and SOGA with continuous development through judicial interpretation. Similarly, ratification of the CISG by Sri Lanka is unwarranted due to application of ECL developed through judicial activism of the UK courts to Sri Lanka, by the Civil Law Ordinance.

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<sup>97</sup> Gralf-Peter Calliess and Insa Stephanie Jarass, 'Private Uniform Law and Global Legal Pluralism: The Case of ICC'S Incoterms and UCP' (2018) King's College London Research Paper Series Working Paper 12/2018, 4.

<sup>98</sup> *ibid* (n 63) 680

<sup>99</sup> *ibid* (n 97); *ibid* (n 63) 680.

<sup>100</sup> *ibid* (n 63) 680.

<sup>101</sup> *ibid* (n 69) 721.

<sup>102</sup> *ibid* (n 15) 10.

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## **Demanding higher standards for animal welfare legislation into exiting law in Sri Lanka: with special reference to Domestic Animals in Sri Lanka**

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### **ABSTRACT**

We live in a society where human rights are highly considered to be valuable. However, the requirement of higher standards of animal welfare remains as a loophole in the current legal framework. Many stories in relation to animals' welfare remain appalling. Animal welfare Law requires to be more alive today as it is as a burning Socio-legal problem. Sri Lanka has seen its last amendment to law which addresses cruelty to animals in 1995 and the Prevention of Cruelty to Animal's Ordinance 1907 under which welfare of animals is taken into consideration. The recent past is evidence of many unpleasant news relating to degrading treatment of domesticated animals. The society love animals yet simultaneously perpetrate extreme violence against them. Animals though domesticated should be adequately given freedom within boundaries. The issue is whether this is allowed in Sri Lanka. Cruelty against animals has become a key issue today for Sri Lanka. The published incidents of animal cruelty are just the tip of a large iceberg. A few could have happened due to a lack of awareness but majority of them are deliberately done. These incidents have left a question to think whether the current Law is adequate to secure the innocent lives of pet animals in Sri Lanka. Adopting the qualitative method, the researcher intends to build and elaborate on this research critically, based on Prevention of Cruelty to Animals Ordinance No 13 of 1907.

## INTRODUCTION

It is our culture to feed animals but there is no responsibility ownership. We used to be known as “Aryawansa”, the “noble race”, because of the way we treated animals. Sri Lanka had an animal friendly environment which began 2300 years ago at the time when Arhat Mahinda encountered King Devanampiyatissa at Mihintale. Discussions about animal welfare is not a modern phenomenon, and concern for animal care and wellbeing has existed since the start of the domestication of animals, which occurred at least 10,000 years ago during the Neolithic times. Likewise, the human animal bond prevails and advances, in various ways. For the time being it is evident that discussions relating to the animal welfare are only centralized and legally protected around non-domestic animals. Animal welfare refers to an animal’s quality of life, and how well an animal is coping with its environment. Animal welfare and animal rights varies from one another, and animal welfare is a fact driven approach to the human relationship with them.

*“Sri Lanka has laws in place to prevent cruelty towards animals. Few people pay attention to this however, and cruelty continues”.<sup>1</sup>*

The recent and continuous incidents on animal cruelty have proven this much better. Ill-treatment, negligence, deliberateness which leads to degrading cruelty towards domestic animals have created the worst issues. At the international level, countries have taken positive steps towards protecting the welfare rights of the animals focusing on domestic animals. However, Sri Lanka is still lagging behind even without having an

updated piece of legislation to be a voice towards these voiceless living beings.

In discussing the above, this research will be based on the animal cruelty prevalent in Sri Lanka due to lack of proper legislation, giving special attention to the context of domestic animals. This research intends to review on prevailing legal framework for animals and will critically analyse the provisions contained in the Prevention of Cruelty to Animals Ordinance No. 13 of 1907 in order to identify deficiencies with it. Lack of recognition of duty of care, outdated penalties, lack of a proper definition for “animals”, distinguishing between different sets of animals, lack of provisions for a third- party involvement and lack of proper authority to monitor animal welfare matters are key areas identified in the prevailing Law. After analysing and critically evaluating those lacunas present in the existing law, the author aims to make recommendations to improve the legal system of Sri Lanka in relation to animals’ welfare specifically for domestic animals, by taking lessons from UK, Germany and India. This research will address the question of “How does the regulation of law towards the protection of welfare of domestic animals should be identified and why does Sri Lanka need to implement the new law in relation to it?”.

## MATERIALS AND METHODS

In order to carry out this research the researcher has followed up qualitative method by gathering primary and secondary data. While analysing and critically evaluating those sources the researcher will fulfil research objectives. The primary sources used are the

<sup>1</sup>Anver, G., 2011, Animal Rights and Sri Lanka, the Sunday Leader. Available at <http://www.thesundayleader.lk/2011/05/29/animal-rights-and-sri-lanka/>, accessed on 30 March 2021.

Lk/2011/05/29/animal- rights-and-sri-lanka/, accessed on 30 March 2021.

Prevention of Cruelty to Animals Ordinance No.13 of 1907 in Sri Lanka, other legislations in international regime and statutes of the UK and India which describe animal welfare protection laws. Secondary sources are journal articles and scholarly articles based on welfare of domestic animals.

## **RESULTS AND DISCUSSION**

### **Prevention of Cruelty to Animals Ordinance No.13 of 1907**

This is the primary and commonly used law in Sri Lanka, relating to Animals Rights. This Ordinance has been amended for many times as, 1912, 1917, 1919, 1921, 1927, 1930, 1945 and lastly as No 22 of 1955. The prevailing Ordinance has taken animal welfare law into consideration over a century ago. Global community is moving towards efforts to integrate effective ways and means on behalf of animal welfare and to safeguard those by enacting laws. The published incidents of animal cruelty are just the tip of the large iceberg. A few of them might have happened due to a lack of awareness but majority of them were deliberately done.

A greater step was taken forwarded on 2006 presenting 'The Animal Welfare Bill', proposed by The Law Commission of Sri Lanka. The bill was an outcome of public discussions, expert consultations, and very wide representations made by various stakeholders since year 2004. Many unaddressed areas were covered through this Bill. A ten-member committee titled the National Animal Welfare, which comprised of leading activists of animal welfare sphere, is also introduced under the Bill. Abuse or negligence of animals, abandonment of animals, imprisonment of animals in kennels without adequate freedom, spontaneously killing animals, disregarding the safety of animals when

being transported are some of the leading issues that were identified for the sake of welfare of domestic animals. But still, Sri Lanka has not implemented the new legislation and the concerns prevail as it is. Ultimately, Sri Lanka is still depending on an outdated piece of legislation, with the most questions unanswered. Therefore, this research will address the capability of decreasing animal abuse through a better legal framework.

Prevention of Cruelty to Animals' Ordinance No.22 of 1955, being the existing legislation for animals' welfare in Sri Lanka does indicate on the following. (Herein after referred to as PCAO)

Section 2: cruelly beat, ill-treat, over-drive, over-ride, abuse or torture or cause or procure to be cruelly beaten, ill-treated, over driven, over-ridden, or abused or tortured any animal;

b) Any act or omission cause unnecessary pain or suffering to animal; or

c) convey or carry or cause to be conveyed or carried, in any ship, boat, canoe or in any vehicle, basket, box or cage, or otherwise, any animal in such manner or position as to subject such animal to unnecessary pain or suffering.

Section 8 of the Ordinance prescribes; a prosecution for an offence against this ordinance shall not be instituted after the expiration of three months from the date of the commission of the offence.

Thus, many animal and environmental activists including experts were committed to present this bill but it still has not been implemented so far.

### **Deficiencies identified in prevalent law**

Firstly, the term 'animal' is described as captured or domestic animal including birds, reptiles, or fish in captivity. The broad sense for a definition is required in

order to distinguish each type of welfare rights of animals. As identified, there is no provision included for a third party or an environmental or animal activist to intervene or initiate in legal proceedings as “next friend” of an animal. Thirdly, the penalties included in the Ordinance are extremely outdated. Wrongdoers can easily slip away from the given penalties without any interruption. Thus, a duty of care also has not been identified as a compulsory component in this arena of law. Unless the concept of duty of care is enforced, people would not be bound by any morality to take serious consideration of the animals they own and the concerns of their animals. The duty of care of the person who is in charge of animal to ensure the well-being of domestic animals bears a big importance. In most of the scenarios, pet dogs become stray dogs with the time being. Further, inadequate police powers have been given to enforce law under PCAO. According to section 08 of the Ordinance the limitation for prosecutions also is too short in period. A longer period should be enabled in as to gather evidence prior to laying a charge<sup>2</sup>. The overall PCAO can be identified in limited in scopes which does not cover up the timely needs. In Indian Constitution Article 51A (g) stipulates “it is the fundamental duty of every citizen of India to have compassion for all living creatures” They have given express consent of recognition towards animal welfare by its supreme law. In Germany, the Federal States Berlin, Saxony and Thuringia have included an animal protection concept in their Constitutions.

<sup>2</sup> Weeararatna S, 2000, Requirement for new animal welfare legislation in Sri Lanka, The Bar Association Law Journal

<sup>3</sup> Dept.of Enivironment,Food And Rural Affairs, Animal and Plant Health Agency,Animal Welfare Act 2006

Fedral Law Gazzette I,P.1094,Animal Welfare Act,Germany

<sup>3</sup> ibid.

Under UK they recognize the pet abuse laws came into force in England and Wales in 2007.

Considerable steps have been taken by including many important concepts like including the concept of duty of care and upgrading the penalties accordingly and proposing for an establishment of an animal welfare authority from the proposed Animal Welfare Bill. When looking through humanity, the visible fact is that it is more effective to protect animal welfare from the supreme law of the country itself. It is also much required to have a moral educative function in the sense of encouraging the individuals to become responsible, be aware and act on their duty to treat animals humanely.<sup>3</sup> It should be in all conditions not when their pets are chubby and healthy.

## CONCLUSIONS

It is the high time to enact a new legal framework to safeguard animals' welfare of domestic animals in Sri Lanka in order to prevent and minimize the victimization of domestic animals. The burning concerns such as quality of food, proper and adequate maintenance, accepted ways of sterilization, vaccination; liabilities must be very clearly answered in order to have even minimum protection of welfare rights of domestic animals. The welfare of animals has not been well served by the existing PCAO. Consequently, only through a proper safeguard from a strong legislation even judicial activism on justice for animals can be improved. Thus, the

emphasis should be given to more on welfare of domestic animals rather than mere focus on preventing them from cruelty.

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## Pro-Choice v. Pro-Life: A Perennial Conundrum- An Alternative Discourse for Abortion in Sri Lanka

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### ABSTRACT

Abortion is a highly contested issue all over the world. In Sri Lanka, the abortion discourse is emotionally charged and dictated by religious and customary norms and practices that regulate female morality and sexuality. Several attempts at introducing menial changes to the law have failed. Regulation of women in the private sphere, subject to a different set of norms, convolutes the theory of abortion as a right to autonomy and bodily integrity. In the United States, the pro-choice versus pro-life debate has been central to the discourse on a woman's right to terminate her pregnancy. Since the ruling in *Roe v. Wade*, activists from both spectrums have fought aggressively to utilize the forces of politics and law to catalyst change. Contrastingly, most Western European states decriminalized abortion whilst maintaining a normative disapproval of abortion. The legal processes adopted in Western European countries situated the debate within broader social and public policy concerns. In this paper, it is argued that the abortion discourse in Sri Lanka should be isolated from the pro-choice/pro-life dichotomy that pits women against their unborn children, limiting possibilities and compromises. The paper advocates an alternative approach by engaging in a comparative analysis. It draws attention to the limitations of the privacy doctrine beyond *Roe* and repositions the debate within a broader socio-legal framework which encapsulates the real concerns of women.

## INTRODUCTION

Abortion is a contentious and highly contested issue all over the world. In Sri Lanka, the abortion discourse is emotionally charged and dictated by religious and customary norms and practices. These practices ‘endow patriarchal institutions and social formations’<sup>1</sup> to provide an ideological platform to control female morality and sexuality. Several attempts at introducing menial changes to the law have failed due to religious opposition. Positioning abortion as ‘*Her Body, Her Right*’<sup>2</sup> to challenge multiple forms of discrimination has met unprecedented challenges.

In the United States, the pro-choice versus the pro-life debate has been central to the discourse on a woman’s right to terminate her pregnancy. The ruling in *Roe v. Wade* was undoubtedly an indelible turning point for reproductive rights. Since then, activists from both spectrums have fought aggressively and sometimes violently, to utilize the forces of politics and law to catalyst change. Proponents of pro-choice advocate the right to choose, to symbolize the capacity of women, either individually or collectively, to “control fertility and the consequences of heterosexual sex”.<sup>3</sup> They argue that “embedded deeply in the American political culture is ... the belief of individual choice and privacy in intimate matters”.<sup>4</sup> Hence, those who support abortion, do so in the language of privacy and personal liberty. The pro-life movement on the other hand, exposes the potential threat to the unborn foetus. The

issue of personhood is key in the current debate; with pro-life forces contending that the foetus is a person from the moment of conception, and therefore entitled to live.

Contrastingly, most Western European States decriminalized abortion during the period 1960-1980, in specified circumstances, whilst maintaining a ‘*normative disapproval*’ of abortion.<sup>5</sup> The legal processes adopted in Western European countries, a far cry from the classical liberal direction, acted as a ‘*mechanism for social and cultural order*’ by framing the debate within broader social and public policy concerns. Recently, given the deeply intense and polarized positions of the US liberal rights discourse and the limitations of the privacy doctrine, some scholars have attempted to locate abortion rights within the broader scope of reproductive justice, linking decisions on reproduction to broader issues of social and economic inequality.<sup>6</sup>

This paper, argues that the abortion discourse in Sri Lanka should be isolated from the pro-choice/pro-life dichotomy that pits women against their unborn children, obfuscating possibilities of a potential compromise. The paper advocates an alternative approach, by engaging in a comparative analysis. It draws attention to the limitations of the privacy doctrine, beyond *Roe*, and advocates repositioning the debate within a broader socio-legal framework that encapsulates the real concerns of women.

<sup>1</sup> Sunila Abeysekera, ‘Abortion in Sri Lanka in the context of women’s human rights’ (1997) 5(9) Reproductive Health Matters 87.

<sup>2</sup> In 1999, the Women’s Forum carried a media campaign that highlighted their position on abortion through the slogan ‘*Her Body, Her Right*’.

<sup>3</sup> Rosalind Pollack Petchesky, *Abortion and Woman’s Choice: The State, Sexuality, and Reproductive Freedom* (Northeastern University Press 1990).

<sup>4</sup> *ibid.*

<sup>5</sup> Ofrit Liviatan, ‘Competing Fundamental Values: Comparing Law’s Role in American and Western European Conflicts over Abortion’ in W Cole Durham *et al* (eds), *Law, Religion Constitution: Freedom of Religion, Equal Treatment, and the Law* (Routledge 2020).

<sup>6</sup> Patricia Palacios Zuloaga, ‘Pushing Past the Tipping Point: Can the Inter-American System Accommodate Abortion Rights?’ (2020) Human Rights Law Review 1.

## The Sri Lankan Debate

In Sri Lanka, abortion is permissible only in grave circumstances, to save the life of the mother.<sup>7</sup> Restrictive criminal laws on abortion in Sri Lanka have driven women underground, to resort to dangerous means to terminate an unwanted pregnancy. According to empirical research, daily abortion rates escalated dramatically and were as high as 650 abortions a day in 2016<sup>8</sup>, with actual figures estimated to be higher. A network of underground physicians and quacks operate freely and thrive in back-alley abortion clinics. Despite being a success story in maternal health, 7% to 16% of all women's hospital admissions are attributed to complications relating to abortion<sup>9</sup> and has been reported as the second leading cause of maternal deaths in 2006, 2008 and 2014.<sup>10</sup> The impact of the criminal law is harshest on lower-class working women.<sup>11</sup>

Attempts have been made to reform abortion laws in Sri Lanka since the seventies. Legislative amendments were suggested in 1995 for decriminalization in specific circumstances such as rape, incest and congenital abnormalities, incompatible with life. The amendments were withdrawn due to heightened opposition, particularly from religious minorities. A subsequent attempt in 2017, where a Draft Bill proposing several amendments, formulated by the Law Commission, inclusive of preventative

measures too, did not materialize due to controversy surrounding the debate. Unsurprisingly, patriarchal attitudes and conventional social and cultural norms applied to women and morality, dominated the parliamentary debate in 1995, although some claimed to ground their opposition on religious and moral convictions. Liberalization was readily associated with the misconception that it would open up the 'floodgates' and encourage promiscuity and indecency, especially amongst the young. Breakdown of traditional power structures within a marriage and severe repercussions to 'our culture' reverberated throughout the discussion.<sup>12</sup> Thus, attempts to insulate the abortion debate on deeply contested grounds, based on morality has only failed; deepening the divide and burying the issue.

## The US Debate: A Clash of Absolutes

The legal breakthrough of *Roe v. Wade*<sup>13</sup> was an inevitable outcome of a long judicial struggle to develop a constitutionally protected right of privacy in matters considered too intimate and personal to warrant government intrusion<sup>14</sup>, and the social transformation that transpired in the 1960s. Justice Blackmun, writing for the majority, held that although the right to privacy is not explicitly mentioned in the Constitution, privacy, embedded in the "*fourteenth amendment's concept of personal liberty is broad enough to encompass a woman's*

<sup>7</sup> Penal Code Ordinance No. 2 of 1883, s 303-307.

<sup>8</sup> K A A N Thilakarathna, 'Liberalizing Abortion Laws in Sri Lanka; Prospects and Challenges' (2018) 9(2) Sri Lanka Journal of Forensic Medicine, Science & Law 4.

<sup>9</sup> Ramya Kumar, 'Abortion in Sri Lanka: The Double Standard' (2013) 103 (3) American Journal of Public Health 400.

<sup>10</sup> Achalie Kumara, 'Genderizing Life, Choice, and Rights: Asking the Woman Question in the Abortion Debate' (2019) 26 Va J Soc Pol'y & L 137.

<sup>11</sup> Tilak Hettiarachchy and Stephen L Schensul, 'The Risks of Pregnancy and the Consequences among

Young Unmarried Women Working in a Free Trade Zone in Sri Lanka' (2001) 16(2) Asia Pacific Population Journal 125.

<sup>12</sup> Shermila Antony, 'Women and Abortion in Sri Lanka: A Perennial Dilemma' (LL.M. Dissertation, Harvard Law School, 2004).

<sup>13</sup> 410 U.S. 113 (1973).

<sup>14</sup> The fundamental right to privacy was developed by courts beginning with the early cases of *Skinner v Oklahoma* 316 U.S. 535 (1942); *Griswold v Connecticut* 381 U.S. 479 (1965); *Loving v Virginia* 388 U.S. 1 (1967) and *Eisenstadt v Baird* 405 U.S. 438 (1972).

*right to decide whether or not to terminate her pregnancy*".<sup>15</sup> The Supreme Court also recognized the state's right to regulate abortion to safeguard interests including potential life. Predicated on the court-developed trimester framework, the interests of the state became more compelling towards the end of the pregnancy.

The decision was celebrated by pro-choice activists only to be coupled with criticism by pro-life activists; this prompted the long-drawn struggle to define the reproductive rights of women. The *'tug a war dynamic'* of the debate has restricted abortion rights and access to abortion on demand, by way of litigation<sup>16</sup>, banning or restricting funding through federal and state legislation<sup>17</sup>, introducing administrative hurdles<sup>18</sup>, public protest campaigns and constant crusades to change the potency of the debate by reconfiguring the political and judicial arena.

Discursively, the pro-choice/pro-life dichotomy has intensified and polarized the debate and reduced it to a matter of semantics, pitting women against their unborn children. This leaves minimal space for *"giving voice to the human reality on each side of the 'verses', keeping both women and fetus in focus at the same time."*<sup>19</sup> Some feminist scholars have argued that for abortion to be a meaningful fundamental right, one must envision women's liberty beyond the

traditional liberal concepts of the private self.<sup>20</sup> Legality does not provide women with any means of support. Minimizing government intrusion may lead to indifference or outright opposition. Such a vision requires a critical deconstruction of class, race and gender that imbue the current abortion discourse. Otherwise, *"it will remain not only a class biased and racist concept but an antifeminist one [that denies] social responsibility to improve the conditions of women as a whole"*.<sup>21</sup>

## The European Debate

Contrastingly the debate on abortion, in most Western European states during 1960-1980, remained detached from the liberal rights discussion, which pervades the American discourse. Whilst abortion was legalized and continues to be primarily regulated by the Supreme Court in the US, European states followed a legislative and constitutional process to decriminalize or liberalize stringent abortion laws, within a very short period. Although the reasons may allude to the differences in the system of governance and constitutional structures, it has nevertheless produced dissimilar effects.

Evidently, European regulation of abortion may be clumped together as a set of 'indications' or 'circumstances' under which an abortion may be performed, considering the health and safety of the woman, whilst protecting the interests of the foetus. The United Kingdom adopted a

<sup>15</sup> David Goldenberg, 'The Right to Abortion: Expansion of the Right to Privacy Through the Fourteenth Amendment' (1973) 19 (1) The Catholic Lawyer 36.

<sup>16</sup> *Webster v Reproductive Health Services* 492 U.S. 501 (1989); *Planned Parenthood of Southern Pennsylvania v Casey* 505 U.S. 833 (1992); *Gonzales v Carhart* 550 U.S. 124 (2007); and *Gonzales v Planned Parenthood Federation of America, Inc. (Carhart II)* 550 U.S. 124 (2007).

<sup>17</sup> The Hyde Amendment 1977; Partial Birth Abortion Ban Act 2003.

<sup>18</sup> Such barriers range from requirements to obtain either parental consent. Forced viewing of the pregnancy and fetal heartbeat on ultrasound, requiring pre-abortion counselling, waiting periods, etc.

<sup>19</sup> Laurence H Tribe, *Abortion: The Clash of Absolutes* (W. W. Norton & Company 1992).

<sup>20</sup> Suzanne Staggenborg, *The Pro-Choice Movement: Organization and Activism in the Abortion Conflict*, (Oxford University Press 1991); Sylvia Law, 'Rethinking Sex and the Constitution' (1984) 132 U. Pa. L. Rev. 955.

<sup>21</sup> Petchesky (n 3).

physician's approach to abortion under Abortion Act 1967,<sup>22</sup> which allows medical practitioners to decide in good faith whether grounds for abortion exists. The Act recognized an *'important role for doctors as gatekeepers to abortion services'* and attempted to prevent back-alley abortions through legislation.<sup>23</sup> A reluctant Germany re-evaluated its position after unification and permitted abortion in limited circumstances, with additional preventative mechanisms which included financial and social benefits for pregnant women.

In France, the test of 'in a state of distress' was offered as a humane and democratic compromise to health, and socio-economic realities and developments. Interestingly, the law contains several provisions that affirm respect for human life and only allows abortion in situations of necessity, of which distress is one. Under the Netherlands law<sup>24</sup>, women with their doctors are permitted to decide whether there is an 'intolerable situation' under which abortion is permitted up until the 24<sup>th</sup> week. Netherlands law too imposes several permutations, including a five-day waiting period and information for pregnant women to deal with distress other than by abortion.

In Italy, the government passed a liberal law, despite fierce opposition from the Vatican. Under this new law, any woman over the age of 18 years may have an abortion for health, social, economic, or familial reasons within the first 12 weeks of the pregnancy, provided she obtains a doctor's certificate. However, even within the 90 days, the law institutes mandatory

counselling and a minimum seven-day waiting period.<sup>25</sup> The legislation allows doctors to register as "conscientious objectors" to abortion on religious, moral, or social grounds.

## CONCLUSIONS

There is a need to revisit the abortion dilemma in Sri Lanka, considering the experience of women. Although the right to abortion, embedded in the right to privacy and autonomy, has profound meaning for feminists and their struggle, it is coloured by the pro-choice and pro-life discourse in the USA, which scholars believe not only severely limited the access to abortion, but also failed to provide women with an alternative position. Additionally, the pro-choice/pro-life narrative has several other flaws. First, the narrative of the 'pro-choice movement' is less robust than its counter-narrative of the 'pro-life movement'.<sup>26</sup> By centring the debate on the value of life, particularly unborn life, pro-life activists successfully decimated women's choice, post *Roe*, as a matter of convenience. Second, the denial of choice may be viewed as a denial of autonomy and nothing more - "[invisibilizing] the very real suffering that pregnancy, childbirth and motherhood bring about for those who are unwilling, unsupported or unprepared to go through with it."<sup>27</sup>

Referring to sex-selective abortions in India, Menon highlights the '*philosophical incoherence*' and inherent contradictions in situating abortion within the discourse of privacy rights.<sup>28</sup> She adds that rights have meaning within discourses, and they

<sup>22</sup> The Abortion Act was amended in 1990 by the Human Fertilization and Embryology (HFE) Act 1990.

<sup>23</sup> Sally Sheldon, 'The Decriminalization of Abortion: An Argument for Modernisation' (2016) 36(2) Oxford Journal of Legal Studies 334.

<sup>24</sup> Law on the Termination of Pregnancy of 1 May 1981.

<sup>25</sup> Law No 194 of 22 May 1978 on the Social Protection of Motherhood and Voluntary Termination of Pregnancy.

<sup>26</sup> Zuloaga (n 6).

<sup>27</sup> *ibid.*

<sup>28</sup> Nivedita Menon, 'Abortion and the Law: Questions for Feminism' (1993) 6(1) Canadian Journal of Women and the Law 103.

would “alter significantly if displaced from [one] discourse to another.”<sup>29</sup>

Unsurprisingly, the early success of *Roe* was not necessarily followed in other Western states. By ‘interweaving rights-based arguments with economic policies, social concerns over family welfare and political objectives for the society as a whole’<sup>30</sup>, European states have stayed clear of the moral and religious path inherent in the pro-choice/pro-life debate. Although the European model has been criticized as wholly inadequate to protect women’s rights, resulting in ‘empty compromises’ or ‘hypocrisy’ by infusing ‘pro-life rhetoric with pro-choice policy’, they have effectively made abortion more accessible than in the United States.<sup>31</sup>

Apart from the limitations highlighted above, the pro-choice/pro-life narrative is misplaced in the constitutional and cultural context of Sri Lanka, as it does not place a similar value on individual freedom and autonomy. Privacy is not a recognized fundamental right under the Sri Lankan constitution.<sup>32</sup> Neither has there been significant judicial activism, comparable to the US Supreme Court, on the part of the highest court in the country, to read-in privacy as a constituent of the right to liberty. The absence of judicial review of legislation makes it impossible to review current penal laws on abortion.

Documented case studies in Sri Lanka, although limited in scope, are evidence that women resort to abortion primarily due to contraception failure and socio-economic conditions and burdens, despite restrictive penal laws and/or significant health risks, including death.<sup>33</sup> Research also indicates evidence of religious and moral convictions as a self-imposed bar to abortion.<sup>34</sup> Given the improbability of emerging victorious on either side of the moral debate, resolving the physical and psychological implications of an ‘unwanted, unsupported or unprepared’ pregnancy (on a moral basis) is seemingly futile.<sup>35</sup>

The Western European experience of applying the law to “[generate] compromises [that] offer greater promise for perpetual socio-cultural conflicts”<sup>36</sup> to initiate reforms, needs to take into account the real needs of women before laws are passed to protect them. This is a challenge for all women.<sup>37</sup>

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<sup>29</sup> *ibid.*

<sup>30</sup> *Liviatan* (n 5).

<sup>31</sup> *ibid.*

<sup>32</sup> A Bill to Repeal and Replace the Constitution of Sri Lanka, 3<sup>rd</sup> August 2000 <[1007 \(peaceagreements.org\)](http://1007.peaceagreements.org)> accessed 8 October 2021; The Constitutional reform process that culminated in the “Draft Constitution 2000” attempted to include a ‘fundamental right to private and family life’ by inserting Article 14; The current constitutional reform process too advocate for the inclusion and recognition of the fundamental right to privacy.

<sup>33</sup> N Thalagala, ‘Unsafe abortions in Sri Lanka –facts and risk profile’ (2010) 15(1) *Journal of the Community Physicians of Sri Lanka*.

<sup>34</sup> C Arambepola, L C Rajapaksa, ‘Decision making on unsafe abortions in Sri Lanka: a case-control study’ (2014) 11(91) *Reproductive Health Journal*.

<sup>35</sup> Reproduction and sexuality are two related by separated categories. While procreation is one important function of sexuality, it is not the only one. A remarkable achievement of the family planning movement has been to separate sex from reproduction.

<sup>36</sup> *Liviatan* (n 5); Sarah Y Lai and Regan E Ralph, ‘Recent Development: Female Sexual Autonomy and Human Rights’ (1995) 8 *Harv. Hum. Rts. J.* 201.

<sup>37</sup> Ngare Naffine, ‘Sexing the Subject (of Law)’ in Ngaire Naffine and Rosemary Owens (eds), *Public and Private, Feminists Legal Debates* (North Ryde 1995).

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## War Theories Depending on International Humanitarian Law: Study Based on Just War Theory

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### ABSTRACT

This research focuses primarily on just war theory and International Humanitarian law. Therefore, this analysis will track the historical progress of the theories into their modern manifestations, and focuses on the Just War Theory primarily in that context. The main purpose of the research is to provide an in-depth analysis of the impact of war theories and just war theory of international humanitarian law. It also studies and analyses the relevance of just war theory as a major war theory in international humanitarian law today, as well as the role of international humanitarian law and the impact of war debt. Just war theory shifted generally from a morally-grounded calculus that subjects rulers' decisions to make war to limiting questions of justice in war primarily to whether the means used are relative. Research shows that just war theory has had a positive and negative impact on international humanitarian law from historical times to the present. It is clear that human rights, humanitarian law, the prevention of conflict and the realization of one's aspirations through war vary according to the nature of the war. An alternative definition, and a compilation of worldwide wars, is put up for the modern great-power system, which is considered in terms of a Eurocentric focus and the primacy of military security matters.

## INTRODUCTION

### War Theory

The term “war theory” refers to the establishment of principles of warfare as a societal instrument for specific cultures, established upon the particular opinions of that culture's notion of justice and statehood. In the same way, the theories of justice and the state will mirror the specific cultural ideals. Theory of War is a 1992 novella by Anglo-American writer Joan Brady.<sup>1</sup> It took him ten years to write, but his US agent rejected it. It was then published by the British editor Andre Deutsch and received a great deal of attention. It became in 1993 the Whitbread Novel of the Year and Book of the Year in the UK, won the Best Foreign Book Award in France and received a national arts grant in the United States of America. The Western war theory, of the Just War Theory as it is usually known, is an amalgam assortment of Greek, Roman, Catholic, Enlightenment, and innovative notions of war, which have built along each other and being moulded into a cohesive theory for about 2300 years. Unlike Chinese and Islamic theories, Western model has no authors or particular period when different concepts have been fused into one unified theory. Even modern theory, set up after World War II, uses a wide variety of adapted elements of its vast history.

The problem is further aggravated by similar and discontinuous developments with western theories of justice and the state, whose progress is marked by stops, frequent setbacks and sporadic implementation.

This discontinuity is characterized by virtual destruction of the very notions of statehood, justice, and a coherent war

theory with the decline of the Roman Empire – notions which had gradually taken shape over preceding centuries, and would stay forgotten for nearly a millennium. It is impossible to present the theory of just war, or its theories of state and justice, as a one-man project or a single epoch. This reduces the capacity of such a context to provide a clear overview of the basis and development of the theory of war. In simple terms, the “classical” West War theory does not exist. Consequently, Western model must be considered in its full historical evolution if the analysis is to provide the understanding necessary for further comparison. Specifically, this means that, unlike Chinese and Islamic chapters, Western analysis cannot concentrate on particular primary sources. Therefore, this analysis will follow the historical advances of the theories in their modern manifestations, and will concentrate on the theory of just war mainly in this context. To keep this chapter manageable in size, the analysis will draw on three developments in the broad historical spectrum of theories of justice, state and war. These three are: the works of Augustine, the preparation and consequences of the Treaty of Westphalia, and modern interpretations of the doctrine of just war.

### Just War Theory

The modern theory of just war is ruled by two sides: traditionalist and revisionist. Traditionalists could also be referred to as legalists. Their view of the morality of war is largely guided by international law, and in particular the law of armed conflict. They aim to establish a morally defensible basis for these laws. Provinces (and only states) are allowed to travel to war just for home defence, defence of other countries, or to

<sup>1</sup> Chadwick (1996) Self-determination, terrorism and IHL, 1st ed. Hague: Martinus Nijhoff Publishers.

intervene to avert “crimes that impact the moral conscience of humanity”).<sup>2</sup> Civilians may not be targeted in war, but all combatants, whatever they are fighting for, are morally allowed to target one another, even when doing so foreseeable harms some civilians (so long as it does not do so excessively). The theory of just war deals with the justification of the way and the reason why wars are conducted. The justification may be conceptual or historical. The theory concerns the ethical justification of war and forms that war may or may not take. The historical aspect, or the “just war tradition”, is the historical set of rules or understandings that have been applied in various wars throughout ages. The just war tradition may also study the opinions of several philosophers and lawyers through the historic periods and examine both their philosophical visions of war’s ethical limits (or absence of) and whether their ideas have contributed to the body of rules that have evolved to guide war and war.

Historically, the tradition of fair warfare a set of mutually agreed rules of warfare can be considered to be routinely evolving between two culturally similar foes. That is, when a range of values is shared between two warring nations, we often see that they implicitly or explicitly agree on the limits of their war. But when enemies differ greatly because of their religious beliefs, race or language, and therefore regard themselves as “less than human,” war conventions are seldom applied. It is only when the foe is regarded to be a person, sharing a moral identity with whom one will do business in the following peace, that tacit or explicit rules are made for how wars should be fought and who they should take and what sort of relations should

apply in the aftermath of warfare. Irrespective of the rules that have historically formed, it has been the concern of majority of just war theorists that the lack of rules to war or any asymmetrical morality between belligerents should be stigmatized, and that the patterns of war should apply to all equally.

That is to say, the theory of just war should be universal, binding on all and capable, in turn, of evaluating the actions of all parties beyond all historical conventions. However, more and more, the rule of law the need to hold offenders and transgressors accountable for their acts of war and thus after the battle is moving forward on the battlefield. At chivalrous times, the Christian crusader could seek priestly absolution for atrocities committed in war, a stance supported by Augustine, for example; today, the law courts are seemingly less forgiving: a violation of the conventions assumes that the soldier is responsible and accountable and should be blamed for a criminal offence. Nevertheless, the idealism of those who seek the imposition of right and responsibility on the battlefield, often runs ahead of the traditions and customs, or plain state interests that demean or weaken the *justum bellum* that may exist between warring factions. And in some cases, no just war conventions and thus no potential for legal acknowledgment of malfeasance, exist at all; in such instances, the ethic of war is counted, or is implicitly applied to be, beyond the norms of peaceful ethics and so deserving a separate moral realm where “fair is foul and foul is fair”. In such cases (e.g., Rwanda, 1994), a person’s justification of destructiveness and killing to whatever relative degree they apply to be justifiable triumphs over

<sup>2</sup> Cian O’Driscoll (2015) “Rewriting the Just War Tradition: Just War in Classical Greek Political Thought and Practice,” *International Studies Quarterly*.

attempts to base the laws of peaceful interaction into this separate bloody realm; and in some wars, people fighting for their state or nation prefer to pick up the cudgel rather than the rapier, as Leo Tolstoy notes in *War and Peace*, to sidestep the etiquette of war in favour of securing their land from occupational or invading forces. Against these two ethical positions, the theory of fair war offers a series of principles aimed at maintaining a plausible moral framework for war. From the just war (*justum bellum*) tradition, theorists distinguish between the principles that govern the justice of war (*jus ad bellum*) from those that govern justly and fair conduct of war (*jus in bello*) and the responsibility and accountability of warring parties after the war (*jus post bellum*). The three aspects are by no means mutually exclusive, but they provide a set of ethical guidelines for conducting a war that is neither unrestricted nor overly restrictive. The problem of ethics is to expose the guidelines in specific warfare or situations.

### **International Humanitarian Law**

International humanitarian law (IHL), also known as the law of armed conflict, is the rule of law governing the conduct of war. It is a branch of international legal philosophy that attempts to limit the effects of armed conflict by protecting individuals who are not taking part in hostilities, and by restricting and regulating the substance and methods of war available to combatants.<sup>3</sup> International humanitarian law operates according to a strict division between the rules that apply in international armed conflicts and domestic armed conflicts. This dichotomy has been extensively

criticised. The relationship of international human rights law to international humanitarian law is questioned by international legal experts. This discussion forms part of a larger discussion of fragmentation of international law while pluralist scholars conceive international human rights law as being distinct from international humanitarian law, advocates of the Constitutionalist approach regard the latter as a subset of the previous.<sup>4</sup> In short, those in favour of separate, autonomous regimes underline the differences in applicability; international humanitarian law applies only in times of armed conflict. On the other hand, a more systemic perspective explains that international humanitarian law represents a piece of international human rights jurisprudence; it includes general norms that apply to everyone at all time as well as specialized norms which give to certain spots such as armed conflict and military occupation or specific groups of persons, such as refugees (e.g., the 1951 Convention on Refugees), Children and Prisoners of War.

### **Significance of the study**

War and international law are important as one of the main subspecies in the field of international relations. These scopes are topics that are inherent in the broad and complex research process. The complex nature of war in today's world and its impact on mankind is not limited. At the same time, the emergence of war theories can be said to be the result of a timely need. The analysis of the significance and usefulness of the war theories that were created was very important. This research examines just war theory, which is considered a

<sup>3</sup> Robinson, Paul F.; Robinson, Paul (2003). *Just War in Comparative Perspective*. ISBN 9780754635871. Retrieved 25 April 2015.

<sup>4</sup> Galicki, Z. (2005), *International law and terrorism*, *American Behavioral Scientist*, 48(6):743-757.

fundamental theory of war. The main reason for this is that in international humanitarian law, to control global conflicts, to satisfy one's national aspirations through war, the impact of war on humanitarian law, and whether humanitarian law is truly secured by theories of war.

It is justifiable to consider the fundamental importance of research to respect humanity. This research primarily discusses the rigidity of the theory of war to international humanitarian law. The importance of the study of war theory, apart from being one of the disciplines in international relations, is its timely urgency. The theory of war is divided into three broad frameworks:

1. War,
2. Control of war,
3. and prevention of recurrence

But it is very difficult to study the in-depth scope of this process. This research also provides a special analysis of the importance of humanitarian law and its impact on the protection of human rights. Analysing the theoretical concepts embodied in just war theory to the extent that it contributes to the strength of humanitarian law and whether it is a successful theory can enhance the existing quality of theory. The practical significance of war theory, which is the mainstay of this study, can be illustrated by the accurate explanations that emerge in an academic study that protect international humanitarian law as well as human rights. It is also through these academic studies that it can be deduced that humanitarian law should be given more space in wars presents and in the future.

### **Research problem**

Research problem is what is the impact of just war theory of international humanitarian law? And whether the impact of war theories on international

humanitarian law was qualitative. And also, how theories of war are gaining ground to strengthen international humanitarian law.

### **Research Objectives**

The analysis of the theory of war and international humanitarian law also shows where military theory forms part of wider academic discipline. Although other humanities subject areas like history can support military theory, its focus on applied theory gives it strong links to other applied social sciences like political science, international relations and political economy. These other disciplines overlap with military theory and offer a way to advance military theory's understanding of the power, influence, and broader links of war with conflict. These links contribute to expanding the body of knowledge of military theory a body of knowledge that is not codified but rather shaped by basic theorists. The main purpose of the research is to provide an in-depth analysis of the impact of war theories and just war theory of international humanitarian law. It also studies and analyses the relevance of just war theory as a major war theory in international humanitarian law today, as well as the role of international humanitarian law and the impact of war debt on its existence.

### **METHODOLOGY**

The Research methodology is qualitative research. Secondary data were collected through literature review and referring sources such as statutes, international treaties, academic writings, journal articles and sources. The quality research methodology was used primarily for this research. This research studied the impact of war theories on the basic tenets of humanitarian law. It provided a tripartite analysis of the basic

theories of just war theory, thereby evaluating the broader concepts of international humanitarian law. Furthermore, historical phenomena were used in the research process to make the research information-based. Finally, the satisfactory nature of the correlation between the theory of war and international humanitarian law was studied.

## RESULTS AND DISCUSSION

This concept accurately expresses the cause or purpose for which the prosecution may warrant the use of war. According to traditional doctrine, the chief just cause was to correct a wrong. It could even involve taking back a subtracted asset, or defending an act of aggression. In more recent times the rule of just cause has undergone a progressive evolution that has contributed to an ever-increasing focus on the serious and systematic violations of fundamental human rights. Therefore, it appears today largely accepted, at least among the liberal democratic countries, that the passing of human lives on a big scale or ethnic cleansing, real but also only anticipated, can justify military intervention for humanitarian uses. The alteration of view implicit in the concept of The Responsibility to Protect contains a fresh understanding of state sovereignty: sovereignty should not be read merely as a right, but it also implies substantial responsibilities. And if a state does not protect its population, its sovereignty may be put into question.

**Fairness in authority.** War can only be declared by those with good authority in that regard. According to medieval doctrine, this authority belonged exclusively to the rightful ruler who had temporal power. In the current context, the appropriate authority is usually seen as the United Nations Security Council.

**Well intended.** It involves not only the pursuit of appropriate targets, but also considerable attention to the reasons behind the intervention.

**Final recourse.** This concept implies that war can only be used where it is clear that any other means of non-violent persuasion or coercion would not be effective. As a last resort, it is not necessary for all other possible measures to have in fact been used.

The theoreticians of right war combine both a moral aversion to war and a willingness to accept that war may sometimes be necessary. The criteria of the fair war tradition are used to determine whether recourse to arms is permissible. Just War theories are attempts "to distinguish between justifiable and unjustifiable uses of organized armed forces"; they seek "to conceive of how the role of arms might be kept, made more humane, and ultimately directed towards the objective of building lasting peace and justice." The Just War tradition addresses the ethical motive and, today, the legality of the utilization of force in two parts: when it is proper to resort to armed force (the concern of *jus ad bellum*) and what is acceptable in using such military unit (the concern of *jus in Bello*). In more recent years, a third category *jus post bellum* has been appended, which governs the justice of war termination and peace accords, as easily as the prosecution of war criminals. Just war thinking and the law of war constitute intersecting, interwoven conversations that often reflect each other like mimes in a mirror: just war thinkers cite legal arguments to defend ethical intuitions while lawyers turn to ethics and philosophy to operate close to the strictures of the jurisprudence. This significant overlap is not surprising given their history. In the West, the thought of just war appeared in the fourth century as a theological and

political response to a fundamental issue of the world order. Threatened internally and externally, the newly Christianised Roman Empire had to face the question of whether or not force could be used permissively for political purposes. But a little over a millennium later, the thought of just war had practically disappeared from western political speech.

### **International humanitarian legislation and the prohibition of the use of war.**

Most of the rules of humanitarian law were passed even though the use of war was legal. War was an attribute of sovereignty and was lawful when conducted at the sovereign's command. A state that went to war was the only judge of the motives for taking up arms. That was the legal opinion of the states and the dominant view of legal doctrine before the French Revolution and in the 19th century. While the first theory is the sole one that gets all the legitimate ends of any subordination of *jus in Bello* to *jus ad bellum*, it must yet be turned down out of hand. Whether at national or international level, the fact is that one purpose of the law is to regulate situations resulting from wrongful acts. Furthermore, since there can be no war under the system laid down in the United Nations Charter, save in response to an aggression, it would have to be admitted that the States had drawn up rules lacking any field of application, and that would be silly. Finally, this hypothesis opens the way to total anarchy and a degree of savagery beside which the horrors of previous wars pale insignificant. As a result of an abdication of the rule of law, the first hypothesis would end up with absurd and monstrous results.<sup>5</sup> But war, feeling that the recourse to armed force (*jus ad*

*bellum*) is warranted under certain conditions; also, the notion that the role of such force (*jus in Bello*) should be defined in certain ways. But war is a Western concept and should be differentiated from the Islamic concept of *jihad* (Arabic: "striving"), or holy war, which Muslim legal theory is the solitary character of just warfare.

Most scholars agree that, to be regarded as righteous, a war must meet several requirements of *jus ad bellum*. The top 4 conditions are:

- (1) War must be overtly declared by an appropriate sovereign authority.
- (2) War needs a just cause.
- (3) The state at war has to have just intentions.
- (4) The aim of warfare must be to establish a just peace.

Since the end of World War II, it has been the custom to add three more conditions:

- (1) The chances of success are likely to be reasonable;
- (2) The force is to be of last resort;
- (3) The anticipated benefits of the war are to outweigh the costs of the war.

Since the Peace of Westphalia (1648), which ended the Thirty Years' War, there has been a concerted effort in international legal philosophy to develop binding laws of warfare and military codes of behaviour. Since the 1860s these have increasingly adopted the course of written rules governing the conduct of warfare, including regulations of engagement for national military forces, the Geneva Conventions and their protocols and various treaties, accords, and declarations limiting the means allowable in war.

Today's moral debate has often focused on issues of *jus in Bello*, particularly the question of whether the use of nuclear weapons is always fair. The Hague Convention (1899 and 1907) and the Geneva Conventions aimed at regulating

<sup>5</sup> ICRC (2008), How is the term armed conflict defined in international humanitarian law, Opinion Paper, Geneva.

conflict and the treatment of POWs and civilians by imposing international standards. There are three principles established by the conventions that govern conduct in times of war:

(1) Targets should only include bona fide combatants and military and industrial complexes

(2) Combatants should not use unfair methods or weaponry

(3) The force employed shall be commensurate with the aim pursued.

Since the end of the Cold War, several international military responses have been undertaken to address perceived human rights abuses (e.g., Somali and Yugoslav countries in the 1990s). As a consequence of the increased attention paid to human rights abuses and the significant growth in international human rights law, the traditional notion that a mind of state enjoys sovereign immunity for human rights abuses perpetrated by the armed forces of his nation has been disputed.<sup>6</sup> Correspondingly, since the 1990s, many just-war theorists have contended that the need to stop and punish such abuses constitutes a just cause for the economic consumption of military force and that the intention to execute so well expresses the just-war aim of responding to serious injustice and restoring peace. However, there is still no consensus among the right war theorists on these issues, and their implications for international law are yet to be seen.

### **Doctrine of Just War and Contemporary Humanitarian Interventions.**

Central to just war theory, and extending back to Augustine, is an emphasis on legitimizing a war undertaken by a society's leader if and only if it serves a

just reason. For Augustine, war could only be waged for the sake of peace, and the just cause meant, in particular, preventing harm from the innocent. This thought from early just war thought, and stemming from religious ethics of charity, that armed conflict should be launched first and foremost to serve human beings in need, contrasts with the accent of contemporary international legal philosophy on self-defence as the justifiable cause for warfare. Indeed, the emphasis on the justification of war in terms of the protection of the lives of other peoples might delegitimize self-defence as a motive for war. On the other hand, making the protection of innocent lives the prime element in deciding the authenticity of an armed conflict sets up a humanitarian crisis as the typical, rather than unusual, cause for a justifiable war.

Just war theory shifted generally from a morally-grounded calculus that subjects rulers' decisions to make war to limiting questions of justice in war primarily to whether the means used are relative. The worldwide general disgust for patterns of human rights violations has animated and legitimized the work of human rights NGOs. These NGOs operate with a plausible claim of neutrality, documenting and promoting policies to address human rights concerns. This, in turn, provides an essential resource for judging when such problems might require military solutions. This NGO documentation also allows for the quantification of comparative measures of states' violations of their citizens' human rights, such as those supplied by Charles Humana, or, more controversially, Freedom House. In addition, the interconnected nature of just war theory itself contributes to the problem of clarification when

<sup>6</sup> ICRC (2007), *International Humanitarian Law and the challenges of contemporary armed conflicts*, Geneva, (30IC/07/8.4)

widespread rights abuses are a just cause. A crusade that may seem just can only actually legitimate war when an additional five considerations are satisfied of legitimate authority, right intention, a reasonable hope of success, war as the last resort and just means. Each of these conditions is the subject of complicated, questionable and fallible deliberative processes. For this understanding, in an approach similar to my own, one recent discussion of just war theory, in fact advocates that all of the traditional just war standards for judging a war should be merged into the assessment of when a cause for war is just. Reinserting just war arguments into contemporary international legal doctrines about war could therefore articulate and reify the prospect for law to privilege considerations of justice in interstate conflict, sooner than render up this terrain entirely to amoral concerns for state integrity or, even, power.<sup>7</sup> The growth of human rights laws and transnational actors means that just considerations of war must not amplify the political nature of international deliberations on war.

Despite the stands till the UN faced during the Cold War, there were instances where the deployment of forces established to be effective, such as the UN Mission in Palestine, Lebanon and other offices which were pulled asunder by warfare. The Korean War is another instance of the action undertaken at the stratum of the UN, even this aspect must be considered from the perspective of refusal from USSR to vote on the issue. After the end of the Cold War, it may be said that the situation has changed. With the downfall of the USSR, the stresses

were reduced and cooperation became more attainable, yet other elements determined the continuous failure of the UN in peace related issues. Cases where the UN has not acted have pointed to another series of flaws in the UN Charter and in the system as a whole. It has proven that humanitarian crises and basic interventions in war zones are a difficult task to accomplish with no casualties. Many western heads of state refused to commit their troops and made themselves complicit in some of the worst massacres of the 21<sup>st</sup> century.

With the dangers facing the United Nations and the world, the conflicts raging in parts of Kosovo, Eastern Europe, the Middle East and Darfur present a new challenge. Even if we pay more and more attention to these regions, the response is late for a large part of the population of the region. The Kosovo crisis has turned into a civil war, while the situation in the Middle East has long been viewed as out of reach of the United Nations. This raises questions about his ability to face new threats such as inter-ethnic tensions, internal terrorism and the humanitarian crisis.<sup>8</sup> The question of just war is viewed from the perspective of the UN Charter that guarantees the sovereignty of the state. In the conditions in which a humanitarian crisis, such as the one in Rwanda required international assistance, this was not a possibility because it would have interfered with the sovereignty of the nation. The right to intervene in states for humanitarian reasons came as a result of race murder in Rwanda, with the underlying possibility that this right may be abused and invoked for other fundamental causes for interference. While these

<sup>7</sup> Vite, S. (2009), Typology of armed conflicts in international humanitarian law: legal concepts and actual situations, *International Review of the Red Cross*, 91(873): 69-95

<sup>8</sup> Sassoli, M. (2006), Transnational armed groups and international humanitarian law, Harvard University, 6:1-50

necessities coexisted during the Cold War years, where political determination and the capacity for consideration did not take shape. Although in that respect have been attempts to address this issue throughout time, for purely political perspective, the scheme was intended to transcend the principle of sovereignty by providing backing for those in need of help who were open to ethnic cleansing.<sup>9</sup> From a declarative point of view, genocide is considered to be one of the worst atrocities committed within the borders of humanity, and more countries are ready to actively commit themselves to stopping it. Over the past decade, there have been numerous examples around the world where the United Nations has failed to avert the deaths of millions of people. One of many significant examples is Rwanda, where a worldwide trend among the Security Council members was to limit the commitment of national military personnel for a consistent UN presence in Kigali. The arguments against a humanitarian intervention to end the fighting between the Hutu and Tutsi, revolved round the conditional relations of actions might have suffered on the neighbouring lands and their undermining of authority in the area, as considerably as the inability to ensure security for the UN force. The final decision was not to send combat troops to the area, which has resulted in a visible humanitarian crisis to this day. Developments in areas such as the Darfur region of Sudan point to a slight shift in approach to genocide and the invocation of fair war theory. Due to constant public pressure, countries are more willing to deploy troops to areas that are troubled by conflict. Therefore,

despite the limited presence of United Nations troops in Darfur, the global organization is diplomatically and politically supportive of stabilizing the situation. The State concerned, be it Rwanda or Haiti, enjoys sovereignty and independence. Intervention may not take place without the agreement of the State. Otherwise, the international community, whatever happens in the country, cannot violate that sovereignty unless it is mandated by the UN Charter. If these limits were reinterpreted, they would indicate possible abuses under international law. As a result, the situation in Rwanda signifies one of the most significant genocides in history, with the inability of the international community's right to intervene. Following the events, the right to humanitarian intervention was granted subject to total respect for the sovereignty of the country. The right to respond to the humanitarian crisis was used especially after the Cold War was over. In places such as Kosovo and even Sudan, people had to react to save lives. The task of reconstruction is crucial in the sense that while lives are saved, they have no purpose in a war-ravaged country. UN missions around the world are aimed at accomplishing those tasks. In the Congo or in Haiti, the missions are tasked with maintaining peace between the warring parties. Yet, in the final stage, disregarding of the international law, on the just war theory and principles, humanity is not even set up to provide a comprehensive description of the offices in which sovereignty can be collapsed and foreign military groups can enter a country to protect the civilians. The just war theory and the intervention in the name of humanitarian crisis is a confident

<sup>9</sup> Roper, Lynne. (2001). "Feminism is NOT Pacifism: A Personal View of the Politics of War." *Feminist Media Studies*, 2(1): 150-51.

contribution to humanitarian law, even so it is still not sustainable in the current conditions of war situations.

## CONCLUSIONS

This research examined the conceptual basis and rules governing the use of armed force sanctioned by the individual and the state. The paper noted the difficulty in determining the legitimacy of certain types of disputes. States are torn between opposing war in principle and sanctioning wars of national liberation, which has created difficulties in gaining international consensus on the legitimacy of armed conflict. The theory of just war gave the place of choice to international statist law on definitive arguments on the use of force in the 21<sup>st</sup> century world for a simple reason. Formerly the original demand of just authority lost resonance in the just war tradition, its concerns about justice seemed more subject to manipulation by leaders than did legal principles in a post Westphalia world, in which governments did not necessarily partake in common values other than sovereign self-preservation. Yet international law has changed to incorporate into treaties and perhaps customary practice a genuine claim that human rights are common moral values that can trump sovereignty. It was a universal experience of humanity. The preceding analysis demonstrated the crushing similarities of three war theories arising in very different environments. In many respects, the theories are close to one another, supporting the notion of the historically universal use of war as a social tool of the state for certain circumstances. What conflicts do arise, are primarily brought on by considerations of certain elements as subsumed within the theory as a whole, and hence not necessitating a separate lot of governing laws. In addition, this

research has described the main principles of just war theory and some of the problems involved. Some of these hands-on aspects have been mentioned here. Other fields of involvement are: hostages, innocent threats, international blockades, sieges, and the utilization of weapons of mass destruction or of anti-personnel weapons, and the morality and practicalities of interventionism. The basic argument of this essay is that the international legal order can respond to humanitarian challenges without abandoning its standards or institutions. Alternatively, the unification of the ethical tradition of just war theory and the contemporary legalization of human rights norms allows for a discrete set of criteria for directing the usage of force that expands the growing tendency to pierce the statist, the amoral veil of international jurisprudence. Whether grafting a specific and legalistic reformulation of just war theory onto contemporary international law can provide principles when states may lead to war, which favour genuine humanitarian justice over great-power "Infinite Justice" is open to debate. What is clear, however, is that contemporary international law, without rethinking or reforming, shows no hope to do so. The policy of classifying armed conflicts has often failed international humanitarian law to play its role. As a result of state interests, there continues to be conflict over human rights violations and destruction of assets. For international humanitarian law to play a crucial role, it must continually adapt and evolve to keep pace with the changing dynamics of today's conflicts.

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## Fighting New Demons with Older Weapons: Countering Online Harassment with *Actio Injuriarum* under the Law of Delict

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### ABSTRACT

Online harassment has undoubtedly become a menace that has severe negative impacts on victims and the society at large. Owing to its grave nature, jurisdictions around the world have utilized different branches of law such as criminal law, tort law and the intellectual property law to redress the victims of online harassment as well as to penalize the perpetrators. This paper attempts to analyse whether actio injuriarum under the law of delict can be employed as a corrective justice mechanism to provide solatium to victims of online harassment, considering the severe emotional distress they undergo due to harm caused to their dignity, reputation and privacy. The paper adopts the view that actio injuriarum provides an effective remedy to plaintiffs for impairment of dignity, person and reputation, caused by insult and thereby analyses how it could be utilized as a general remedy for sentimental damages suffered by the victims of online harassment. It concludes with a finding that the principles and elements of actio injuriarum are broad enough to redress the victims of online harassment, which is releatively a new phenomenon, although there may be little to no case law illustrating the exact position upto date.

## INTRODUCTION

In this digital world, an inseparable connection between humans and technology is a constant. Technology has surged into modern day businesses, communities, and the lives of individuals, altering the means of communication, studying, working, and interaction. Covid-19 pandemic has not only proven the same but taken it to an extent beyond imagination. Undoubtedly, it is the technology that enabled human connections with the outer world during these trying times. Unfortunately, reliance on technology and its advancements has not only done good but have also become a medium for various forms of online misconducts such as harassing, intimidating, stalking and extorting individuals or group of persons.

Existing literature identifies a series of abusive online conducts using the umbrella term 'online harassment', which is also known as cyber harassment.<sup>1</sup> Moreover, many studies have been carried out to assess the nature, prevalence and impacts of online harassment and these studies exemplify that online harassment has become a growing menace that causes serious harms, including severe emotional distress, loss of employment, physical violence and even death.<sup>2</sup> The grave nature of online harassment has compelled legal systems around the

world to employ various mechanisms to combat this online threat to effectively, minimize and eventually eradicate it, and to provide redress to its victims. Moreover, existing literature discusses the possibility of using different branches of law such as criminal law, intellectual property law, tort law and the law of delict to regulate online harassment.<sup>3</sup> In light of the above, this paper attempts to analyze whether *actio injuriarum* under the law of delict can be utilized as a corrective justice mechanism to compensate the victims of online harassment in Sri Lanka.

## An Overview of Online Harassment

As complex as the occurrence of incidents of online harassment can be, it is also difficult to provide a uniform definition as to what constitutes 'online harassment'. The complexity in the forum in which its occurring, being relatively a new phenomenon and the absence of a precise terminology to define the term 'online harassment' has led to various definitions and interpretations to it.

Drawing inspiration from various definitions available among scholars and particularly those by Nancy S. Kim<sup>4</sup>,

<sup>1</sup>Michele Ybarra and Myeshia Price Feeney 'Online Harassment, Digital Abuse, And Cyberstalking In America' (Data Society. net 21 November 2016)

<[https://www.datasociety.net/pubs/oh/Online\\_Harassment\\_2016.pdf](https://www.datasociety.net/pubs/oh/Online_Harassment_2016.pdf)> accessed 11 June 2021.

<sup>2</sup>Michele L Ybarra and Kimberly J Mitchell, 'online aggressor/targets, aggressors, and targets: a comparison of associated youth characteristics' (2004) Journal of Child Psychology and Psychiatry 45.

<sup>3</sup>Louise Ellison and Yaman Akdeniz 'Cyber-Stalking: The Regulation Of Harassment On The Internet' [1998] Criminal Law Review <[https://www.cyber-rights.org/documents/stalking\\_article.pdf](https://www.cyber-rights.org/documents/stalking_article.pdf)> accessed 12 June 2021; Subhajit Basu and Richard Jones 'Regulating Cyberstalking'(2007) 2

JILT<[https://warwick.ac.uk/fac/soc/law/elj/jilt/2007\\_2/basu\\_jones/](https://warwick.ac.uk/fac/soc/law/elj/jilt/2007_2/basu_jones/)> accessed 10 June 2021.

<sup>4</sup> Nancy S Kim, 'Web Site Proprietorship and Online Harassment' (2009) Utah L Rev 993

Burke Winkleman<sup>5</sup>, Laura Macomber<sup>6</sup>, this paper identifies online harassment to be a catch all term referring to any intentional conduct that is committed via network or telecommunication media, to threaten, humiliate and harass victims by engaging in activities such as, but not limited to, the repetitive posting of inflammatory or hateful comments (trolling), the repeated and unwanted online messages and threats (cyber stalking), the publishing of sexually explicit images and video clips without consent (revenge porn), the public posting of private information of personal, embarrassing, or intimate nature (doxing) and creating fake social media accounts to manipulate victims (cyber deception).

The grave nature of online harassment has also impacted the lives of individuals in many detrimental ways. According to the existing literature, online harassment leads to physical and mental health problems including anxiety, depression, suicidal tendencies substance abuse etc.<sup>7</sup> Studies further reveal that cyber victimization on the internet and social media is a unique form of peer victimization and an emerging mental health concern among teens who are digital natives'.<sup>8</sup> Given the prevalence and the severity of the harms caused by online harassment, it is crucial

to provide adequate mechanisms to provide redress to victims of cyber harassment.

### **Current Status of Online Harassment in Sri Lanka**

Evidently, the development in information technology has embraced the lives of Sri Lankans to a great extent. With the increased computer literacy, the number of abusive conduct occurring in cyber space has proportionately increased. As indicated by the latest report of CERT<sup>9</sup> 15,895 social media related incidents have been reported in 2020 and the majority of these relates to abusive conducts via facebook, the most common social media among Sri Lankans.<sup>10</sup> The study also notes that the increased use of social media, due to COVID-19 pandemic situation has resulted in more abusive online conduct in the Sri Lankan context. According to this survey, of all complaints 11% were on hacking of social media accounts and 9% were on photo abuse.<sup>11</sup> Despite these distressing incidents, 71% of respondents have not taken any action against the perpetrators.<sup>12</sup> Victims' lack of understanding about the remedies available and the fear of social stigmatization are some of the factors that prevent them from seeking legal

<sup>5</sup> Burke Winkelman and others, 'Exploring Cyber harassment Among Women Who Use Social Media' (2015) 3(5) Universal Journal of Public Health <[http://www.hrpub.org/journals/article\\_info.php?aid=2974](http://www.hrpub.org/journals/article_info.php?aid=2974)> accessed 09 June 2021

<sup>6</sup> Laura Macomber, 'A New Manual for Writers and Journalists Experiencing Harassment Online', (2018) Columbia Journalism Rev <<https://www.cjr.org/analysis/online-harassment-manual.php>> accessed 8 June 2021.

<sup>7</sup> Ellen M Selkie, Jessica L Fales and Megan A Moreno, "Cyberbullying Prevalence among United States Middle and High School Aged

Adolescents: A Systematic Review and Quality Assessment' (2016) J Adolesc Health 125.

<sup>8</sup> Misol Kwon, 'Cyber Victimization and Depressive Symptoms: A Mediation Model Involving Sleep Quality' (2019) 42 <<https://doi.org/10.1093/sleep/zsz067.800>> accessed 14 June 2021.

<sup>9</sup> Sri Lanka Computer Emergency Readiness Team.

<sup>10</sup> The National CERT of Sri Lanka, *Annual Activity Report 2020 Sri Lanka CERT CC* [http < http://cert.gov.lk/documents/Sri Lanka CERT Annual Activity Report 2020.pdf >](http://cert.gov.lk/documents/Sri%20Lanka%20CERT%20Annual%20Activity%20Report%202020.pdf) accessed 10 June 2021.

<sup>11</sup> Ibid.

<sup>12</sup> Ibid.

protection.<sup>13</sup> Many other studies also indicated proliferation of online harassment within Sri Lanka.<sup>14</sup>

Nevertheless, Sri Lankan legal regime does not contain any specific legislation that tackles online harassment, mostly owing to its relative novelty. Therefore, it is important to assess the adequacy of the existing legal mechanisms to redress the victims of online harassment. Despite the lack of legal research that has been carried out in this area, some authors are of the opinion that a few provisions of existing legislations such as Sections 345 and 348 of the Penal Code of 1885, Section 2 of the Obscene Publication Ordinance No.4 of 1927, sections 2 and 17 of the Prohibition of Ragging and Other Forms of Violence in Educational Institutions Act No. 20 of 1998 and the Section 3 of Computer Crimes Act No.24 of 2007 can be employed to prosecute cases of cyber harassment to a certain extent.<sup>15</sup> However, there is no research to date about the applicability of civil law remedies to redress the victims of online harassment in Sri Lanka. Therefore, this study attempts to analyse the possibility of employing *actio injuriarum* of law of delict to provide monetary compensations to victims of cyber harassment, considering the severe emotional distress they undergo due to harm caused to their dignity, reputation and privacy.

<sup>13</sup> As suggested by the interviews conducted with the victims of online harassment at CERT, for the study on Online Harassment and the Sri Lankan legal regime as a part of the AHEAD operation of the Ministry of Higher Education funded by the World Bank

<sup>14</sup> Studies conducted by UNDP (post Covid-19, more recent), UNICEF and other NGOs such as Women in Need also indicates the same

<sup>15</sup> Aparrajitha Ariyadasa, 'Harassment Beyond Borders; Can Victims Be Protected By Cyber Bullying In Sri Lanka?' (Colombo Telegraph, 15 April 2019)

## ***Actio injuriarum* in Sri Lanka**

Sri Lankan law does not recognize specific causes of action for civil wrongs as in the case of the English common law of torts. Thus, civil liability is determined by the law of delict consisting of the rules and principles of the Roman Dutch law as interpreted and developed by Sri Lankan courts and as modified by the statute law.<sup>16</sup> The Roman Dutch Law provides two remedies for civil wrongs; namely, *aquilian action* based on the Roman *lex aquilia* and *actio injuriarum*. As illustrated in ***Matthews v Young***<sup>17</sup> patrimonial damages are claimed under the *actio legis aquiliae*, while the *actio injuriarum* and its derivative actions, including the action for defamation, are only available for sentimental damages.

Thus, a claimant in an aquilian action, to be successful, must prove pecuniary loss or harm to his person or property by the wilful (*dolus*) or negligent (*culpa*) conduct of the defendant. On the other hand, *actio injuriarum* is the general remedy for damages against personality. This cause of action, recognised since the classical Roman period, protects a range of personality rights under the Latin terms *corpus*, *fama* and *dignitas* – which can loosely be translated respectively, as physical and mental integrity, good name and dignity understood in a broad sense.<sup>18</sup> Nevertheless, some scholars are of the opinion that *actio injuriarum*,

<<https://www.colombotelegraph.com/index.php/harassment->> accessed 18 June 2021.

Harasgama K.S, Munasighe P 'Specific Offence of Cyber Sextortion for Sri Lanka', (2020) Proceedings of SLIIT International Conference on Advancements in Sciences & Humanities 1-10.

<sup>16</sup> LJM Cooray, 'Common Law in England and Sri Lanka' (1975) INT'L & COMP L Q 553.

<sup>17</sup> *Matthews v Young* [1922] AD 492.

<sup>18</sup> *O'Keeffe v Argus Printing and Publishing Company Ltd and Another* [1954] 3 SA 244.

focuses more on the intentional and unjustified hurting of another's feelings than the damage to public reputation.<sup>19</sup>

According to Dr. Amarasinghe, *actio injuriarum* has been something of a maid of all work in Roman Dutch Law.<sup>20</sup> Moreover, he has explained a series of instances where *actio injuriarum* can be employed to obtain damages, including instances such as abuse of legal process, invasion of privacy, defamation, assault, false imprisonment and cases of general interference with the dignity of a person.<sup>21</sup> However, *actio injuriarum* is a personal action and can be brought only by the victims of the particular action, as pronounced in the case of **Appuhamy v Kirihamy**<sup>22</sup> where it was decided that 'a father cannot sue for damages for slander of his daughter, although he may have felt pained by such slander'.

### Elements of *Actio Injuriarum*

As stated by Innes CJ in **R v Umfaan**<sup>23</sup>, 'an *injuria* is a wrongful act deliberately done in contempt of another, which infringes his dignity (*dignitas*), his person (*corpus*) or his reputation (*fama*).' Accordingly, Innes CJ categorically stated that *Injuria* entails three essential ingredients, namely; the act complained of must be wrongful; it must be intentional; and it must violate one or other of those real rights, those rights *in rem*, related to personality, which every free man is entitled to enjoy. Moreover, in **Delonge v Costa**<sup>24</sup>, the court held that for liability to be established, the plaintiff must show that

the defendant performed an intentional act which led the plaintiff subjectively to experience loss of dignity and that the conduct complained of would have offended the dignity of a person of ordinary sensibilities. In other words, that the conduct was offensive to dignity from an objective point of view. Therefore, *actio injuriarum* must be based on actual intention to harm (*animus injuriandi*) and is available to the person who suffers indignity against the person who caused it. This position was further maintained in the more recent case of **Roux and others v Dey**<sup>25</sup> as well.

In **Sinha Ratnatunga v The State**<sup>26</sup>, the Sri Lankan Courts ruled that 'every human has a right to remain in society as a human being with human dignity'. In doing so, although it referred to the law of defamation under the common law, *inter alia* it manifests that a remedy against a breach of individual privacy, dignity is crucial. In light of the limitations under law of defamation, Roman Dutch law, *actio injuriarum*, in the form of an action for injury is a saviour in many cases although not limited to online harassment.<sup>27</sup>

In this regard, it is pertinent to note the difference between defamation under the English law of Tort and *actio injuriarum*. While true statements although derogatory and harming a person's reputation would not be considered to be defamatory under the English law, *actio injuriarum* holds a conduct actionable if it is injurious to

<sup>19</sup>Bonnie Docherty, 'Defamation Law: Positive Jurisprudence' (2000) 13 Harv Hum Rts J 263.

<sup>20</sup>Chittharanjan Amerasinghe, *Defamation and other Aspects of the Actio Injuriarum in Roman-Dutch Law* (Lake House Investments Ltd 1966) 197.

<sup>21</sup>Chittharanjan (n17) 198.

<sup>22</sup>**Appuhamy v. Kirihamy** (1886) 7 SCC 154.

<sup>23</sup>**R v Umfaan** 1908 TS 62.

<sup>24</sup>**Delonge v Costa** 1989 (2) SA 457 (A).

<sup>25</sup>**Roux and others v Dey** [2011] ZACC 4.

<sup>26</sup>**Sinha Ratnatunga v The State** [2001] 2 SLR 172.

<sup>27</sup>Althaf Marsoof, 'The Right to Privacy in the Information Era: A South Asian Perspective' (2008) 5 SCRIPTed 55.

person provided other elements are met, despite its truthfulness. In simple terms, action injuriarum makes no reference to the validity or truthfulness of the statement. Although, to the bare mind Defamation may appear to be the English counterpart for *actio injuriarum*, the latter is much broader in terms of considering the rights attached to privacy and dignity, thus, making it broad enough to accommodate modern issues like online harassment.

### **Applicability of Actio Injuriarum to cases of online harassment**

As mentioned above, *actio injuriarum* provides a general remedy for victims whose personal rights have been infringed in respect of dignity, reputation and honour. It offers a strong and efficient protection against injuries to immaterial interests and in particular against insulting behaviour of any kind<sup>28</sup>. Existing literature and judicial precedence also prove that the protection of human dignity under the *actio injuriarum* is undoubtedly one of the most impressive and enduring legacies of Roman law, and a feature which places the South African law of delict at the forefront of the protection of what is arguably the most fundamental of all human rights.<sup>29</sup> Through the development of case law in South Africa, the *actio injuriarum* has been extended to allow recovery of damages for impairment of dignity in a wide range of circumstances. Online harassment too, as demonstrated above, indisputably injures the human privacy and dignity indicating it to be possibly covered under *actio injuriarum*. Although, there may be little to no case law illustrating

the exact position, the principles, and elements of *actio injuriarum* appears assumingly broad enough to embrace the new phenomenon of online harassment.

For instance, in ***O’Keeffe v Argus Printing and Publishing Co Ltd***<sup>30</sup>, O’Keeffe brought an *actio iniuriarum* against Argus, the newspaper for publication of her image and name for advertising purposes without her consent. She alleged that in the circumstances the publication of her photograph and name had constituted a violation of her dignity. In this case, Watermeyer J held that the ‘*actio iniuriarum* protected person, dignity and reputation, and the unauthorized publication of a person’s photograph and name for advertising purposes could constitute an aggression upon that person’s dignity where this was understood to incorporate a wide range of personality interests, including her interest in privacy. As mentioned earlier in this paper, harassment in cyber space covers various forms of actions such as cyber trolling, revenge porn, cyber stalking, doxing and cyber deception. Applying the principles discussed in ***O’Keeffe***, in the modern context, online harassment; be it sexual or non-sexual, involves an invasion of privacy and dignity, and instead of the traditional platforms of communication, it surfaces online, arguably getting a wider coverage.

In ***NM and others v Smith and others***<sup>31</sup> applicants, diagnosed with HIV, sued the defendants on *actio iniuriarum* for the violation of their rights to privacy, dignity and psychological integrity

<sup>28</sup>R Zimmerman, *The Law of Obligations: Roman Foundations of the Civilian Tradition* (Oxford: Oxford University Press 1996) 1062.

<sup>29</sup>Bede Harris, 'A Roman Law Solution to an Eternal Problem: A Proposed New Dignitary Tort

to Remedy Sexual Harassment' (2017) 42 Alternative LJ 200.

<sup>30</sup>*O’Keeffe* (n15).

<sup>31</sup> *NM and others v Smith and others* [2005] 3 All SA 457 (W).

resulting from the publication of their names as HIV positive, without their consent. The court upheld the contention referring to how the mass publication of private information of the the plaintiffs and the injury caused thereby. Categorically, the truthfulness of any of these publications were not considered as *actio injuriarum* is only concerned of the deliberate injurious conduct.

Analysing the cases of cyber trolling (the repetitive posting of inflammatory or hateful comments), cyber stalking (the repeated and unwanted online messages and threats) revenge porn (the publishing of sexually explicit images and video clips without consent) and doxing (the public posting of private information of personal, embarrassing, or intimate nature) it is observable that all these amount to deliberately inflicted wrongful acts which impair the dignity of the victim and cause severe emotional distress. The case law thereby, evidently supports that *actio injuriarum* in principle is adequately broad to accommodate all actions categorized to be online harassment. Therefore, undoubtedly victims of these types of conduct should be provided redress employing the *actio injuriarum*. There appears no reason why a progressive judicial system would be reluctant to accept the same to effectively counter these modern challenges.

However, due to the unconventional nature of online harassment characterised by features of the internet such as the ability to conceal one's identity, ability to commit crimes despite the geographical distance between the perpetrator and victim etc, application of *actio injuriarum* may not always be easy. In circumstances where the perpetrator of the offence could not be found or operates from a foreign jurisdiction, it may not be possible to bring a case based

on *actio injuriarum*. Nevertheless, where the perpetrator is found and is located within Sri Lanka, *actio injuriarum* can undoubtedly act as an effective relief to the victims of online harassment.

## CONCLUSIONS

Undeniably, online harassment is a growing menace to the modern world. Although many jurisdictions are attempting to combat online harassment utilising various novel mechanisms, it appears that old law, which arguably never envisaged such, is still capable of effectively providing remedies in the absence of specific legislation to the effect. *Actio injuriarum*, the action for injury under the law of delict thus becomes pertinent. Broad in scope, it only requires establishing the wrongful act committed with the intent of causing injury to another's dignity or his reputation.

Thus, as demonstrated above, it is evident that victims of situations falling within the ambit of online harassment undoubtedly could avail themselves of *actio injuriarum* to obtain effective relief for the injury they have suffered. *Actio injuriarum*, therefore, holds an effective security against the challenges posed by the proliferated use of internet despite some limitations posed by the nature of all online related offences.

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## Vaccination Policies: A Contemporary Threat to Human Rights?

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### ABSTRACT

The Coronavirus commonly referred as Covid-19 swept the world in 2019. As the disease was declared a pandemic, the world needed to develop vaccines to battle Covid-19 in order to mitigate the rapid spread of its infection. States including Sri Lanka immediately enforced quarantine laws as they enforced special measures prioritizing health and safety of their citizens. Enforcement of vaccination policies was prominent in such special measures implemented by the states. The two of the foremost concerns which arose from the enforced vaccination policies were the vaccine hesitancy and equal distribution of the vaccine and in light of human rights. This research attempts to analyse those two concerns against human rights as to its success in striking a balance between the protection of human rights and safeguarding public health. The approach taken for this research will be qualitative and library-based. The research will be concluded by analyzing the consistency of the enforced vaccination policies in Sri Lanka with human rights and the extent to which the policies could be justified by law by the application of the proportionality test.

## INTRODUCTION

The Corona Virus (SARS-CoV-2, Covid-19) which was initially reported in Wuhan, China was declared a pandemic by the World Health Organization on March 2020.<sup>1</sup> As a result of the global quest to battle the pandemic, numerous measures were taken to mitigate the spread of the said virus. Among the measures taken by the Government and other administrative bodies the prominent response was the development of Covid-19 vaccines. However, there was deterrence in Sri Lanka in enforcing vaccination policies and the immediate response against the virus to safeguard public health was the imposition of strict lockdowns. Tensions arose questioning the enforced vaccination policies in Sri Lanka and their interference with the right to equality and right to life. The foremost concerns were vaccine hesitancy and discriminatory distribution of the vaccination.

Human rights are inalienable rights guaranteed to all human beings and fundamental rights are incorporated under Chapter III of the 1978 Second Republican Constitution of Sri Lanka. According to the Preamble to the Constitution, fundamental rights are recognized as "intangible heritage that guarantees dignity and well-being of citizens".<sup>2</sup> Right to equality is a fundamental right guaranteed by the Constitution of Sri Lanka.<sup>3</sup> On the other hand, the right to life is not expressly recognized as a fundamental right under the Sri Lankan Constitution.

Nevertheless, the right to life is implicitly recognized under Chapter III of the Constitution when Article 13(4) which provides that "no person shall be punished with death or imprisonment except by order of a competent court", is read in light of Article 11 which guarantees freedom from torture.<sup>4</sup>

Proportionality test is an inquiry into the enforced measure's purpose, the relationship between the measure and limitation of the right, necessity of the measure to achieve its purpose and the benefit gained by the measure and loss suffered due to the enforcement of the said measure.<sup>5</sup> The concerns regarding vaccination policies and their justifiability will be tested by the application of the proportionality test which ensures that the interference with the exercise of human rights is justified by law.

## Significance of the study

This study will assist to review the two of the foremost concerns arising from vaccination policies in Sri Lanka and its consistency with the human rights guaranteed under the Universal Declaration of Human Rights, International Covenant on Civil and Political Rights and fundamental rights granted under the Constitution of Sri Lanka. Furthermore, the study will direct academics and future researchers towards a new path whilst studying the vaccination policies enforced within Sri Lanka.

<sup>1</sup> 'WHO Director-General's Opening Remarks At The Media Briefing on COVID-19 - 11 March 2020' (Who.int, 2021) <<https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19--11-march-2020>> accessed 14 August 2021.

<sup>2</sup> The Constitution of the Democratic Socialist Republic of Sri Lanka 1978, Preamble.

<sup>3</sup> The Constitution of the Democratic Socialist Republic of Sri Lanka 1978, A 12.

<sup>4</sup> Rathnayake Tharanga Lakmali V Niroshan Abeykoon [2019] The Supreme Court of Sri Lanka, SC Appeal 134/2019 (The Supreme Court of Sri Lanka).

<sup>5</sup> M Khosala, 'Proportionality: An Assault On Human Rights?: A Reply' (2010) VOL 8 International Journal for Constitutional Law.

## LITERATURE REVIEW

The available literature on the topic is inclusive of legislation, scholarly articles and journal articles which are followed as sources for this study.

The first concern arising from enforced vaccination policies is vaccine hesitancy. The scholarly article published by Gostin (2020) recognizes a comprehensive vaccination program to be the key to unlock herd immunity in a society. However, the article fails to mention how the Government alongside with administrative bodies should respond to this concern.<sup>6</sup> One such concern is vaccine hesitancy present among a significant part of the population. According to the study conducted by T. Callaghan (2020) reasons for such hesitancy include religious beliefs, lack of health insurance and potential side effects.<sup>7</sup> This reluctance as reported by P. Ball (2020) will ultimately give birth to anti-vaccine campaigners.<sup>8</sup> Nevertheless, the available literature does not provide any reference or analysis as to interferences with fundamental right to equality by the vaccination policy, in the Sri Lankan context. Limited literature is available for unequal distribution of vaccines in Sri Lanka. The enforced National Immunization Policy provides guidelines for enforcement of vaccination policies.<sup>9</sup> However, the policy does not address the guideline for distribution of vaccines,

when the risk of the virus is simultaneously spreading nationwide such as the present Covid-19 virus outbreak. Thus, the available literature fails to address concerns regarding the vaccination policies within the Sri Lankan jurisdiction alongside its consistency with the fundamental right to equality and the right to life which is an implicit right recognized under the Constitution. The Covid-19 Vaccination - Sri Lankan approach<sup>10</sup> and Summary of the National Deployment and Vaccination Plan<sup>11</sup> are the two documents referred to, in order to identify vaccination prioritization due to the absence of a circular or a regulation directing how administration of vaccines are to be prioritized.

The primary sources referred to, in order to conduct this research are; the Constitution of the Democratic Socialist Republic of Sri Lanka, National Medicine Authority Act No. 05 of 2015, Vaccination Ordinance No. 20 of 1886, Universal Declaration of Human Rights and the International Covenant on Civil and Political Rights.

## OBJECTIVES OF THE RESEARCH

The objective of the research will be to assess the vaccine hesitancy and unequal distribution of vaccines as two of the foremost issues arising from vaccination policies enforced in Sri Lanka and its

<sup>6</sup> Lawrence O Gostin, Safura Abdool Kareem and Benjamin Mason Meier, 'Facilitating Access To A COVID-19 Vaccine Through Global Health Law' [2020] Journal of Law, Medicine and Ethics.

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<sup>8</sup> University (UHC) and others, 'Anti-Vaccine Movement Could Undermine Efforts to End Coronavirus Pandemic, Researchers Warn' (Nature.com, 2021) <<https://www.nature.com/articles/d41586-020-01423-4>> accessed 18 August 2021.

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<sup>10</sup> Covid-19 Vaccination Sri Lankan Approach (Researched and Conceptualized by State Intelligence Service 2021)

<[http://www.presidentsoffice.gov.lk/Documents/Concept%20Paper-COVID%2019\\_Vaccination-Sri\\_Lankan\\_Approach.pdf](http://www.presidentsoffice.gov.lk/Documents/Concept%20Paper-COVID%2019_Vaccination-Sri_Lankan_Approach.pdf)> accessed 24 October 2021.

<sup>11</sup> Summary Of The National Deployment And Vaccination Plan (Ministry of Health 2020). Covid-19 Vaccination Sri Lankan Approach (Researched and Conceptualized by State Intelligence Service 2021)

<[http://www.presidentsoffice.gov.lk/Documents/Concept%20Paper-COVID%2019\\_Vaccination-Sri\\_Lankan\\_Approach.pdf](http://www.presidentsoffice.gov.lk/Documents/Concept%20Paper-COVID%2019_Vaccination-Sri_Lankan_Approach.pdf)> accessed 24 October 2021

consistency with the fundamental right to equality and right to life.

## MATERIALS AND METHODS

The qualitative research paradigm will be followed to study the concerns and along with a library-based approach. An epistemological approach will be taken to study primary and secondary sources inclusive of the Constitution of Sri Lanka, The Universal Declaration of Human Rights and International Covenant on Civil and Political Rights.

### Limitation of the Study

The study will be limited to the Sri Lankan jurisdiction to achieve the aforementioned objectives of the research.

## DISCUSSION

The Covid-19 pandemic has caused to be more than a health crisis to the nation as this led to a social and an economic crisis. The Coronavirus also known as Covid-19 or SARS-CoV-2 is a state of pneumonia caused through human-to-human transmission of droplets of saliva or discharge of nose as an infected person coughs or sneezes<sup>12</sup>. The rapid transmission rate of the virus has prompted the governments to enforce special measures to minimize the spread of the infection. The enforcement of quarantine laws such as strict lockdowns and implementation of vaccination policies are the main measures taken by the government to minimize the transmission rate.

<sup>12</sup> 'Coronavirus' (Who.int, 2021)  
<[https://www.who.int/health-topics/coronavirus#tab=tab\\_1](https://www.who.int/health-topics/coronavirus#tab=tab_1)> accessed 14 August 2021.

<sup>13</sup> Lawrence O Gostin, Safura Abdool Kareem and Benjamin Mason Meier, 'Facilitating Access To A COVID-19 Vaccine Through Global Health Law' [2020] Journal of Law, Medicine and Ethics.

<sup>14</sup> Universal Declaration of Human Rights

<sup>15</sup> The Constitution of the Democratic Socialist Republic of Sri Lanka, Preamble

A comprehensive vaccination program born from an effective vaccination policy is a cornerstone of good public health which will create herd immunity against the high rate of transmission of Covid-19<sup>13</sup>. Nevertheless, the enforced vaccination policies created tensions between citizens and administrative authorities due to its tendency to interfere and at some instances infringe their exercise of right to equality and right to life which is expressly and implicitly recognized as a fundamental right, emphasizing that human rights are inalienable rights guaranteed to all human beings<sup>14</sup> and the Constitution of Sri Lanka recognize fundamental rights as "intangible heritage that guarantees the dignity and well-being" of citizens<sup>15</sup>.

### The National Immunization Policy<sup>16</sup>

The National Immunization Policy in Sri Lanka ensures vaccination to all citizens. The National Immunization program follows the schedule approved by the National Advisory Committee on Communicable Diseases (NACCD) of the Ministry of Health.<sup>17</sup> The immunization of vulnerable groups during disease outbreaks stands as an essential category of the National Immunization Policy alongside the recommendations for special vaccines and immunization schedules for the vulnerable populations who can be protected from vaccine-preventable diseases<sup>18</sup>. Numerous vaccinations have been developed and manufactured which are imported and supplied to Sri Lanka under section 109 of the National Medicines Regulatory Authority Act No.05 of 2015 which

<sup>16</sup> 'The National Immunization Policy' (2014)  
<[http://www.health.gov.lk/moh\\_final/english/public/elfinder/files/publications/publishpolicy/5\\_Immunization.pdf](http://www.health.gov.lk/moh_final/english/public/elfinder/files/publications/publishpolicy/5_Immunization.pdf)> accessed 16 August 2021

<sup>17</sup> Policy Repository - Ministry of Health - Sri Lanka, 'The National Immunization Policy' (2014).

<sup>18</sup> 'The National Immunization Policy' (2014)  
<[http://www.health.gov.lk/moh\\_final/english/public/elfinder/files/publications/publishpolicy/5\\_Immunization.pdf](http://www.health.gov.lk/moh_final/english/public/elfinder/files/publications/publishpolicy/5_Immunization.pdf)> accessed 16 August 2021.

permits the “import and supply of a particular medicine, medical device or borderline products in specific quantities under special circumstances such as to save life or to control an outbreak of an infection or an epidemic”.<sup>19</sup> The vaccination was provided according to the National Deployment Vaccination Plan and the Covid-19 vaccination-Sri Lankan approach concept paper.<sup>20</sup> The vaccination was initially provided to frontline healthcare workers followed by tri-forces. Adults over 60 years of age with non-communicable diseases were subsequently prioritized.<sup>21</sup>

### Vaccine hesitancy

As the vaccination policies urge citizens above thirty years of age to get vaccinated a significant portion of citizens exhibited vaccine hesitancy. Vaccine hesitancy implies the reluctance or refusal to receive the vaccination despite the availability of vaccination services.<sup>22</sup> According to an online descriptive survey launched by the Health Promotion Bureau only 54% of participants were ready to obtain the offered vaccine.<sup>23</sup> Unknown long-term effects, cultural beliefs and misinformation were the leading reasons behind the vaccine hesitancy which was reflected by people.<sup>24</sup> Vaccine

hesitancy was high within marginalized community that are at a higher risk of being impacted by the virus. From a human rights perspective, every person has an inherent right to life which is implicitly recognized by the Constitution of Sri Lanka which is reinforced by international instruments.<sup>25</sup>

Another reason causing vaccine hesitancy is faith and religious beliefs. Conservative ideologies discourage people from getting vaccinated. Performance of various rituals and consumption of various syrups were popular among citizens who were reluctant to get vaccinated within the past few months.<sup>26</sup> Although right to belief cannot be restricted since it forms a part of freedom of thought, conscience and religion, the right to manifest the belief could be restricted by the State. Lack of health assurance is another reason behind vaccine hesitancy as a sector of the population believes in the tendency of the vaccine being more harmful to the health of the individual due to its unknown long term effects more than the Covid-19 infection.<sup>27</sup> From the human rights perspective, any death which maybe caused as consequence of the vaccination received to comply with the policies enforced despite of the individual's reluctance is a violation of the individual's right to life.

<sup>19</sup> National Medicines Authority Act No.05 of 2015, s109.

<sup>20</sup> Summary Of The National Deployment And Vaccination Plan (Ministry of Health 2020). Covid-19 Vaccination Sri Lankan Approach (Researched and Conceptualized by State Intelligence Service 2021) <[http://www.presidentsoffice.gov.lk/.Documents/Concept%20Paper-COVID%2019\\_Vaccination-Sri\\_Lankan\\_Approach.pdf](http://www.presidentsoffice.gov.lk/.Documents/Concept%20Paper-COVID%2019_Vaccination-Sri_Lankan_Approach.pdf)> accessed 24 October 2021.

<sup>21</sup> Covid-19 Vaccination Sri Lankan Approach (Researched and Conceptualized by State Intelligence Service 2021) <[http://www.presidentsoffice.gov.lk/.Documents/Concept%20Paper-COVID%2019\\_Vaccination-Sri\\_Lankan\\_Approach.pdf](http://www.presidentsoffice.gov.lk/.Documents/Concept%20Paper-COVID%2019_Vaccination-Sri_Lankan_Approach.pdf)> accessed 24 October 2021.

<sup>22</sup> Noni.E MacDonald, 'Vaccine Hesitancy: Definition, Scope And Detriments' (2015) 33 Vaccine.

<sup>23</sup> MDS Wijesinghe and others, 'Acceptance Of COVID-19 Vaccine In Sri Lanka: Applying The Health Belief

Model To An Online Survey' (2021) 33 Asia Pacific Journal for Public Health <<https://pubmed.ncbi.nlm.nih.gov/34000877/>> accessed 21 October 2021.

<sup>24</sup> MDS Wijesinghe and others, 'Acceptance Of COVID-19 Vaccine In Sri Lanka: Applying The Health Belief Model To An Online Survey' (2021) 33 Asia Pacific Journal for Public Health <<https://pubmed.ncbi.nlm.nih.gov/34000877/>> accessed 21 October 2021.

<sup>25</sup> International Covenant on Civil and Political Rights, A 10

<sup>26</sup> 'Sri Lanka's Challenge to The Gods' (Sunday Island online, 2021) <<https://island.lk/sri-lankas-challenge-to-the-gods/>> accessed 21 October 2021.

<sup>27</sup> Timothy Callaghan and others, 'Correlates And Disparities of COVID-19 Vaccine Hesitancy' <[https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3667971](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3667971)> accessed 18 August 2021.

Furthermore, right to life, liberty and security guarantee one the opportunity to make decisions which concern his life. Any person hesitant to receive the vaccination due to religious beliefs is protected under Article 10 of the Constitution which guarantees freedom of thought, conscience and religion<sup>28</sup>.

### **Unequal Distribution of Vaccines**

Equality and non-discrimination build the foundation of human rights<sup>29</sup>. In that light, the other issue regarding vaccination policies embraces unequal distribution and allocation of vaccines. Adhering to the National Immunization Policy, the government of Sri Lanka has prioritized the distribution of vaccines to vulnerable groups and high-risk areas. However, the rapid spread of the virus and increasing death rates have caused tensions within the rest of the population challenging the vaccination policies. As of early August 2021, only citizens above 30 years of age are entitled to get vaccination unless under exceptional circumstances accelerating the spread of the virus within young adults. From a human rights perspective, every person is entitled to a standard of adequate living for health and well-being which is inclusive of medical care and necessary social services.<sup>30</sup> Furthermore, creating adequate standards of living is an objective guaranteed by the State under Directive Principles of the Constitution.<sup>31</sup> Thus, the State should provide the vaccination for young adults where the virus could be detrimental for life, health and safety in living.

By 2020 numerous vaccines were developed and manufactured, providing different levels of efficacy against Covid-19 infection. Due to the availability of different types of vaccines different vaccines were provided across the country. As unequal access and vaccine availability risks lead to health inequalities, distribution of vaccines and prioritizing groups for the distribution should be carefully taken. Equality within citizens is ensured by Article 12 of the Constitution. However, the provision of different vaccination with different efficacy levels indicates higher protection of certain individuals violating provisions ensuring equality in the human rights regime<sup>32</sup>.

### **Proportionality Test**

Protection of human rights is essential during a public health crisis and States are obliged to protect human rights under three headings; to respect (refrain from interfering with the enjoyment of the right), to protect (prevent others from interfering with the enjoyment of the right) and to fulfill (adopt appropriate measures towards full realization of rights)<sup>33</sup>. Despite the said interferences of human rights, State actions could be justified by the application of the proportionality test<sup>34</sup>. Proportionality test is an inquiry into the enforced measure's purpose, the relationship between the measure and limitation of the right, necessity of the measure to achieve its purpose and the benefit gained by the measure and loss

<sup>28</sup> The Constitution of the Democratic Socialist Republic of Sri Lanka, A10.

<sup>29</sup> The Right to Equality And Non-Discrimination In The Administration Of Justice (The Office of the High Commissioner for Human Rights in Corporation with the International Bar Association 2003).

<sup>30</sup> Universal Declaration of Human Rights, A5.

<sup>31</sup> The Constitution of the Democratic Socialist Republic of Sri Lanka, A 27(2) (c).

<sup>32</sup> The Constitution of the Democratic Socialist Republic of Sri Lanka, A12.

<sup>33</sup> 'OHCHR | What Are The Obligations Of States On Economic, Social And Cultural Rights?' (Ohchr.org, 2021)

<<https://www.ohchr.org/en/issues/escr/pages/whataretheobligationsofstatesonescr.aspx>> accessed 25 August 2021.

<sup>34</sup> Kai Moller, 'Proportionality: Challenging And Critics' (2012) 10 International Journal for Constitutional Law.

suffered due to the enforcement of the said measure.<sup>35</sup>

The application of the proportionality test to the current Covid-19 virus outbreak demonstrates that the vaccination policies were enforced to mitigate the rapid spread of the Covid-19 virus. In order to achieve herd immunity, citizens must be fully vaccinated as vaccinated people are protected from Covid-19 virus and passing on the pathogen ultimately breaking the chain of Covid-19 virus transmission.<sup>36</sup> Thus, the enforced vaccination policies are necessary to achieve the purpose of herd immunity. The importance of the vaccination policies was demonstrated in a study conducted on Covid infected patients and death which revealed that almost 95% of them have not been vaccinated.<sup>37</sup> Thus the proportionality test reveals that interferences of enforced vaccination policies with the exercise of individual fundamental or human rights is justified in law.

In the present circumstances, the overbearing interest is the protection of public health from the Covid-19 infection thus the restrictive Article on fundamental rights is applied. Accordingly, the operation of fundamental rights could be restricted for the protection of public health.<sup>38</sup> The international human rights regime rights can be derogated during an instance of public emergency which threatens the lives of the nation<sup>39</sup>. Furthermore, according to the National Deployment and Vaccination Plan for Covid-19,

population receiving the vaccination should be prioritized based on the availability of Covid-19 vaccines, the epidemiology of Covid-19 pandemic and the country's need.<sup>40</sup>

The infringement of right to life, freedom of thought, conscience and belief, freedom of choice and unequal treatment by law would be regarded as violations of human rights under normal circumstances. However, under the prevailing circumstances of the pandemic, the State had to prioritize safeguarding public health hence the above State actions are justified as per the proportionality test.

It is essential to defeat vaccine hesitancy to achieve herd immunity together with prioritizing vulnerable groups and high-risk areas during the distribution of the vaccine which holds a rapid spread of Covid-19 infection.

## CONCLUSIONS

All promised human rights cannot be ensured during a pandemic situation. The foremost concerns arising out of vaccination policies enforced in Sri Lanka are vaccine hesitancy and unequal distribution of vaccines and its interference with human rights. The above interferences with the exercise of human rights are justified by the application of the proportionality test as such policies are based on resources available and number of cases reported in the area and not always based on wants of people. However, all violations of human rights cannot be justified by

<sup>35</sup> M Khosala, 'Proportionality: An Assault On Human Rights?: A Reply' (2010) 8 International Journal for Constitutional Law.

<sup>36</sup> 'Coronavirus Disease (COVID-19): Herd Immunity, Lockdowns And COVID-19' (Who.int, 2021) <<https://www.who.int/emergencies/diseases/novel-coronavirus-2019/question-and-answers-hub/q-a-detail/herd-immunity-lockdowns-and-covid-19>> accessed 22 October 2021.

<sup>37</sup> 'A Survey on Those Who Have Not Taken COVID-19 Vaccines' (Presidential Secretariat, 2021) <<https://www.presidentsoffice.gov.lk/index.php/202>

1/07/31/a-survey-on-those-who-have-not-taken-covid-19-vaccines/> accessed 23 October 2021.

<sup>38</sup> The Francisco J Urbina, 'A Critique Of Propotionality' (2012) 57 The American Journal for Jurisprudence

.Constitution of the Democratic Socialist Republic of Sri Lanka, A15(7)

<sup>39</sup> International Covenant on Civil and Political Rights, A4

<sup>40</sup> Summary Of The National Deployment And Vaccination Plan (Ministry of Health 2020).

the application of the proportionality test. The government is responsible not only to strike a balance between the exercise of human rights and safety of public health but also between equality and equity. Measures should be taken to make people understand the importance of vaccination and how their support will help the herd immunization process. Furthermore, the citizens need to be encouraged to voice any infringement of human rights which would not be able to withstand the proportionality test. The study will assist future researchers to receive a better understanding of vaccine hesitancy and equal distribution of the vaccine.

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## Striking a Balance: Conscientious Objection and Reproductive Health Care from the Sri Lankan perspective

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### ABSTRACT

Immorality has always been a feature of abortion, and it frequently calls into question the morality of the procedure itself. Taking one's life is regarded as a sin and a demonstration of immorality by major religions around the globe, such as Buddhism, Christianity, Islam, and others, and has religious implications. In comparison to other nations with more liberal attitudes to abortion, Sri Lanka's present legislative framework is considered a stringent criminalization of abortion. Sections 303 through 307 of Penal Code No.02 of 1883 make abortion illegal. This antiquated legislation only allows abortion to save a woman's life if her life is in jeopardy. Conscientious Objection to abortion has been increasingly problematic throughout the world since Europe's abortion laws were liberalized. As a political compromise or a utilitarian requirement, several of these legislation included clauses allowing medical practitioners and other healthcare workers to refuse to perform abortions based on conscience. The conscientiousness of pharmacists, midwives, nurses, and Medical Practitioner in the execution of abortion according to their particular religious views in the Sri Lankan setting is scrutinized in this study using English Law and case law of several European jurisdictions as reference. The primary objective of the study is to explore the significance of Conscientious Objection reserved for Healthcare Professionals which is a possible legal challenge that could arise in liberalizing the abortion law in Sri Lanka. The findings of the study depict that it is feasible to accommodate those who are opposed to abortion while ensuring that women have access to legal health care.

## INTRODUCTION

Due to legislative restrictions, access to abortion services is restricted in numerous jurisdictions. It encourages the practice of criminal abortion, which is harmful to the mother. Unsafe abortion, according to the World Health Organization (WHO), is when a pregnancy is terminated by someone who is not a Medical Practitioner and does not have the necessary abilities, or when it's done in an environment that does not meet minimum medical standards or both.<sup>1</sup> This technique is a life-threatening procedure for the woman unless it is performed by qualified medical practitioners.<sup>2</sup> Sections 303 to 307<sup>3</sup> of the Penal Code of Ceylon No.02 of 1883 makes it illegal to have an abortion. Restricted abortion laws constitute a “silent pandemic” that is already affecting Sri Lankan women.

The accessibility of permitting or denying the right to exercise conscientious objection, which is a prominent clause attached to abortion legislation in many jurisdictions, is not mentioned in the provisions of the Proposed Bill titled ‘Law To Provide For The Medical Termination Of Pregnancy In Cases Of Rape And Foetal Impairment’ (Proposed Bill) in Sri Lanka drafted by the Law Commission in 2013. However, there is a reference in the miscellaneous chapter of the proposed law of not being allowed to bring any suit or prosecution based on a report or against a medical practitioner for performing responsibilities within the scope of this Proposed Bill.<sup>4</sup>

Majority of the Sri Lankans are Buddhists, while, minority religions such as Hinduism, Christianity, and Islam are also practiced. The impact of religion is one of the biggest roadblocks to establishing an abortion law. Over the years, the

implementation of the Medical Termination of Pregnancy (MTP) Act in Sri Lanka has proven difficult. Even if one believes that the legal system is efficient and fair, the lack of a Conscientious Objection Clause may cause problems for a variety of reasons; the most common of which are the personal religious beliefs of the Healthcare Professionals. The Proposed Bill is ambiguous and blank on whether the provision on its Miscellaneous Chapter ‘No Suit or Prosecution clause’ also applies in circumstances of Healthcare Professionals invoking Right to Conscience. The following are two significant problems concerning healthcare professionals’ conscientious objection:

1. Can a Healthcare Professional be prosecuted upon refusal to perform an abortion on a patient in a legalized context?
2. To what extent is it legal to impose a mandatory duty on healthcare professionals (Medical Practitioners, Nurses, and Pharmacists) to perform abortions when the Right to Conscience is a Fundamental Right upheld by the constitution?

The study emphasizes the efficiency and acceptability of Sri Lankan legislation and policies that allow for conscientious objection while providing continuous access to authorized abortion services. Throughout, major aspects such as the ingredients that appear to be necessary for a functional health system that guarantees access to abortion while still allowing conscientious objection are discussed using various literary sources and case law, including clarity about who can object and to which components of care, ready

<sup>1</sup> ‘Preventing Unsafe Abortion’ (Who. int) <<https://www.who.int/news-room/fact-sheets/detail/preventing-unsafe-abortion>> accessed 26 April 2021.

<sup>2</sup> ibid.

<sup>3</sup> Penal Code of Ceylon No 02 of 1883.

<sup>4</sup> Proposed Bill titled ‘Law To Provide For The Medical Termination Of Pregnancy In Cases Of Rape And Foetal Impairment in Sri Lanka’ 2017 , Miscellaneous Chapter

access by mandating referral or establishing direct entry, and assurance of a functioning abortion service through direct provision or contracting services.

## MATERIALS AND METHODS

The study is a 'Library-based Legal Research' of the 'Doctrinal Approach'. The author carried out a forecast analysis utilizing both Primary and Secondary data that were qualitatively assessed. Primary sources such as legal statutes, international instruments, academic expressions, other judicial decisions, and library-based secondary resources were pursued in extracting information.

## RESULTS AND DISCUSSION

### **Circumstances under which a woman can be prosecuted in Sri Lanka for terminating her pregnancy**

Sec 303<sup>5</sup> defines the offence of 'causing miscarriage'. The offence is committed when a person voluntarily causes a woman with a child to miscarry unless the miscarriage is caused in good faith to save the life of the woman.<sup>6</sup> It will be constituted as 'voluntarily' when he or she causes it at the time and he/she knew or had reason to believe to be likely to cause it. Moreover, nothing is said to be done or believed in 'good faith' which is done or believed 'without due care and attention'.<sup>7</sup> It is fair to state that, Sri Lankan Criminal Courts have accepted that the term 'Miscarriage' in this context is similar to the dictionary meaning of the term 'Miscarriage' i.e. "premature expulsion of

the contents of the womb before the term of gestation is complete"<sup>8</sup> or "the spontaneous or unplanned expulsion of a foetus from the womb before it can survive independently"<sup>9</sup>. Under Sec 306<sup>10</sup>, it describes an offence under which a person engages in an act with the intent to prevent a child from being born alive or to cause it to die after birth.<sup>11</sup> The *actus reus* for the offence under sec 306 is to prove before the court that the accused prevented the birth of the child or caused it to die after birth. The *mens rea* resides in the intention. The intention can be either the intention of preventing the birth of the child or the intention of causing the child's death before birth.<sup>12</sup> Under Sec 307<sup>13</sup>, the offence of causing the death of a quick unborn child is explained. This amounts to Culpable Homicide<sup>14</sup>. The elements of this offence are as follows,

1. The doing of an act, if death was caused, that would be synonymous to culpable homicide and,
2. As a result of the above act, the death of a quick unborn child should take place

As a result, any bodily part of the infant must have been removed from the mother to commit an offence under Sec 307's definition of Culpable Homicide. It's not required to figure out if the infant hasn't breathed or if the delivery hasn't been finished.<sup>15</sup> Nevertheless, the cause of the death of the child in the mother's womb is not homicide according to Sri Lankan Law.<sup>16</sup> It may thus be argued that the 'sole exception' or 'ground' upon which abortion is permitted in Sri Lanka is to save the woman's life.

<sup>5</sup> Penal Code of Ceylon No 02 of 1883

<sup>6</sup> *ibid* Sec 303

<sup>7</sup> Gamini Lakshman Peiris, *Offences under the Penal Code of Ceylon (Sri Lanka)* (Lake House Investments 1982).

<sup>8</sup> 'Pregnancy - Abortion' (Encyclopedia Britannica) <<https://www.britannica.com/science/pregnancy/Abortion>> accessed 15 August 2021.

<sup>9</sup> Dictionary on Lexico.Com Also Meaning of Miscarriage' (Lexico DictionariesEnglish)

<<https://www.lexico.com/definition/miscarriage>> accessed 15 August 2021.

<sup>10</sup> *ibid* Sec 306.

<sup>11</sup> *ibid*.

<sup>12</sup> See (n6).

<sup>13</sup> See (n 9).

<sup>14</sup> See (n9) Sec 293.

<sup>15</sup> See (n 6).

<sup>16</sup> *ibid*.

### **Attempts to liberalize the Law on Abortion in Sri Lanka**

In Sri Lanka, legislative enactment is the only available method of modifying the Penal Code. Justification for the requirement of a regulatory statutory body in Sri Lanka is that the existing law fails to address the social realities of our country. In 1991, the government drafted the Women's Charter based on the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW). It was presented to the parliament in 1993 but it continued to remain only as a commitment on paper thereon. It was the responsibility of the government to bring the national law on par with the commitments the state agreed to in ratifying CEDAW. In September 1995, the Sri Lankan Minister of Justice, Professor GL Peiris, moved the second reading of the MTP Act bill to amend the Penal Code in Parliament. This bill proposed to relax the abortion laws under grounds of rape, incest, and foetal abnormalities. The bill was unsuccessful and failed to continue on the second day of reading as it was termed contradictory to the culture and religion of Sri Lanka.

The third effort on liberalizing the abortion laws came in 2013 when the Minister of Child Development and Women's Affairs, Tissa Karaliyadda, appointed a commission back in 2011 to inquire into the status quo of abortion. The law commission's proposal on MTP was not seriously considered back then in 2013 and even in 2017 the fourth effort by the Special Committee under Justice Aluwihare and the Sri Lanka College of Obstetricians and Gynecologists (SLCOG) now remains as a mere piece of paper. The completion of the Proposed Bill was put on hold as the Former President

Maithreepala Sirisena wanted to consult with religious leaders, who showed strong opposition to the reform.

### **Conscientious Objection by Healthcare Professionals**

Conscientious Objection according to Medico-Legal terms is quite easy to understand. It means that a medical practitioner will abstain from a particular procedure as a result of his or her religious beliefs.<sup>17</sup> This form of objection was firstly seen among the military personnel with their refusal to kill combatants due to soldiers' Moral or Religious beliefs.<sup>18</sup> However, at present, this objection has manifested medico-legal issues such as Euthanasia and Abortion, etc. which are deemed to be rather morally and ethically debatable medical procedures.

Conscientious Objection draws its roots from religion and particularly from the notion of Pacifism. The Pacifist nature is depicted in Buddhism, Christianity, Hinduism, and Islam which are some of the major religions followed among the communities living in Sri Lanka. Buddhism is universally understood to be an anti-war, conciliatory pacifist religion.<sup>19</sup> This philosophical framework conceptualizes its foundation on the concept of Absolute Non- Violence. According to the first precept of Buddhism i.e.

*"Paa-naa-thi Paa-tha Vera-mani Si-k-kaa Pa-dhan Sama-dhi Ya-mii"*

It is a sin to take away another's life  
According to the 6<sup>th</sup> Commandment of the bible, i.e.

*"Thou shalt not kill"*<sup>20</sup>

It means that one has no right at all to kill another person

According to the 6<sup>th</sup> Commandment of the Holy Bible, it is extensively agreed that the term "kill" should be interpreted as

<sup>17</sup> Clayton O'Neil, *Religion, Medicine, and the Law* (Routledge 2018)169.

<sup>18</sup> *ibid.*

<sup>19</sup> Neil DeVotta, *Sinhalese Buddhist Nationalist Ideology* (East-West Center Washington 2007)2.

<sup>20</sup> *The Holy Bible.*

“murder”. Therefore, the exclusion is against ‘unjust killing’.

Sri Lanka has ratified the CEDAW, the International Covenant on Economic, Social and Cultural Rights (ICESCR), and the International Covenant on Civil and Political Rights (ICCPR). Article 18(1) of the ICCPR guarantees the right to freedom of thought, conscience, and religion, while Article 18(3) explicitly authorizes restrictions on the exercise of conscience when necessary to protect public safety, order, health, or morals, or the fundamental rights and freedoms of others. Article 12 of the ICESCR enshrines the right to health, and Articles 16(e) and 12 of the CEDAW affirm the reproductive rights of women and access to family planning care, respectively.

International and Regional human rights organizations tasked with implementing these laws and monitoring state compliance have decided that the ability to express one's religion or views can be limited. According to such organizations' observations, laws and policies allowing Conscientious Objection must apply to people rather than institutions and objecting professionals must direct women to substitute accessible and willing providers.

Hence, the foremost legal challenge is to determine the nature of the legally binding duty imposed on Healthcare Professionals in performing an abortion. Given that religion is a subtle matter within Sri Lankan communities, it is also pertinent to understand the nature in which the MTP Act must be construed in a manner that does not impede the ‘Right to Reproductive Justice’ of a woman over the ‘Right to Conscience’ of Healthcare Professionals.

### **Legal Validity in rejecting to perform an abortion by healthcare professionals in Sri Lanka**

Under Art 10<sup>21</sup> of the Fundamental Rights Chapter of the Constitution, “Every person is entitled to Freedom of Thought, Conscience, and Religion, including the freedom to have or adopt a religion of their choice.”<sup>22</sup>

Any aggrieved citizen can file a Fundamental Rights case in the Supreme Court invoking Article 10 along with Article 17 and Article 126 of the Constitution. Any aggrieved individual could argue that by the mandatory nature of the duty to carry out an abortion on the health care professionals as stipulated by an MTP Act, their ‘Right to Freedom of Conscience’ and the ‘Right to abstain from performing the abortion’ thereon, is infringed or is in the danger of being imminently infringed due to the actions of the public authorities in this situation the Ministry of Health. Henceforth, Medical Practitioners, Nurses, and Pharmacists who are directly participating in the abortion procedure could object to taking part based on personal religious grounds under Article 10 of the Constitution.

There exists an outright likelihood that a Conscientious Objection based on religion could arise when professionals in the medical field defy to act per the law stipulated on the MTP Act if legalized.

Furthermore, the proposed law titled ‘Law to Provide for the Medical Termination of Pregnancy in Cases of Rape and Foetal Impairment’ makes no mention of whether the right to conscientious objection should be retained for Sri Lankan healthcare practitioners. It only alludes to the inability to bring charges or lawsuits against those who are directly involved in it, but it is unclear on the consequences for those who refuse to

<sup>21</sup> 1978 Constitution of Republic Socialist Democratic Sri Lanka.

<sup>22</sup> *ibid* Art 10.

conduct abortions on purpose if the Bill is approved in the future.

### **Ratio Decidendi in *Grimmark and Steen v Sweden***

The *ratio decidendi* of the decision in *Grimmark and Steen v Sweden*<sup>23</sup> can be applied beyond midwives, to all medical professions. As long as the medical act in dispute is legal under the national law, the patient should not be denied exercising their right.

The ECtHR in a double decision made by three judges of the court, deprived European midwives of the guarantee of their right to Conscientious Objection to abortion. The court based its decision on two factors i.e.

- Abortion is an ordinary medical practice/act and not one of an extraordinary nature
- General access to abortion must not be hampered by respect to personal freedom of conscience

The Conscientious Objection clause has already been granted to 22 member states of the European Union.<sup>24</sup> However, the state must guarantee that it is adequately regulated so the women who seek abortion are given access regardless of the operation of the protection clause. A resolution<sup>25</sup> by the council of Europe has found out that due to the Conscientious Objection clause several violations of the European Social Charter<sup>26</sup> i.e. Right to protection of Health under Art 11 of the charter for women seeking an abortion and the right to engage in the occupation of non-objecting medical practitioners under Art 1 of the charter because of different treatment and moral harassment.

Due to Conscientious Objection even if abortion is legal under national law, it is difficult for a woman to find non-objectifying medical practitioners to access abortion. Healthcare should focus on providing protection and care for the patient and not entertain the Medical Practitioner. However, in jurisdictions such as the United Kingdom and Australia, this legal issue is successfully regulated.

### **i. Recognition of Conscientious Objection in the United Kingdom**

Section 4 of the Abortion Act of 1967 of the United Kingdom prevents civil/ criminal actions from being filed against Healthcare Professionals.

Section 4<sup>27</sup> of the Abortion Act, 1967 of the UK provides the legal foundation for the Conscientious Objection of medical professionals practicing in the UK. This provision states that no person shall be under any duty, whether by contract or by any statutory or another legal requirement, to participate in any treatment authorized by this Act to which he has a Conscientious Objection, provided that in any legal proceedings the burden of proof of Conscientious Objection shall rest on the person claiming to rely on it.<sup>28</sup> Subsection (2) states that nothing in section 4(1) affects any duty to participate in treatment that is necessary to save the life or to prevent grave permanent injury to the physical or mental health of a pregnant woman.<sup>29</sup> Subsection (3) stipulates that in Scotland a statement on oath to the effect that one has a Conscientious Objection to participating in any treatment authorized by the Act is sufficient evidence to discharge this burden of proof.<sup>30</sup>

<sup>23</sup> [GC] No.62309/17 ECHR 12 March 2020.

<sup>24</sup> Quaker Council for European Affairs, 'THE RIGHT TO CONSCIENTIOUS OBJECTION IN EUROPE: A Review of the Current Situation' (United Nations Committee on Human Rights 2005).

<sup>25</sup> European Parliament Resolution 2001/2014.

<sup>26</sup> European Committee on Social Rights, Decision on the merits, Complaint 8/2000.

<sup>27</sup> Abortion Act 1967 of United Kingdom.

<sup>28</sup> *ibid* Sec 4 (1).

<sup>29</sup> *ibid* Sec 4(2).

<sup>30</sup> *ibid* sec 4(3).

### **The limitations to Sec 4 of Abortion Act 1967 of the UK**

To preserve the pregnant woman's life or prevent irreversible harm to her physical or mental health, a Medical Practitioner must conduct an abortion. This means that the Medical Practitioner cannot use Conscientious Objection to avoid acting if the patient is in danger of death or bodily or mental harm. However, in many situations, another Medical Practitioner will be able to perform an abortion.<sup>31</sup> Another limitation is that a Medical Practitioner cannot decline to offer advice to a patient based on Conscientious Objection. Without a doubt, section 4 does not influence the obligations owed to persons who have undergone an abortion.

The Conscientious Objection Clause, included in Section 4 of the Act, protects healthcare professionals. A suitable balance has been reached in English law that respects both the mother's basic rights and the rights of the professional who truly disagrees. This technique does not obstruct a woman's ability to obtain an abortion. It is impossible to conclude that the Medical Practitioner is purposefully delaying women to make abortion more difficult, or that the Medical Practitioner is purposefully making the women feel bad or immoral. This balance permits the Medical Practitioner to maintain his or her moral integrity without jeopardizing the health of his or her patients.

### **Regulation of Conscientious Objection through Case Law in Europe**

In *Barr v Matthews*<sup>32</sup>, the clinician who is asserting the Conscientious Objection Clause shall refer the patient seeking an abortion to a colleague as soon as possible.

It has also been claimed and established that a Medical Practitioner's referral responsibility to arrange abortion services for their patients constitutes a referral duty. As a result, the patient and the Medical Practitioner have an indirect contractual duty.<sup>33</sup> From the perspective of a Medical Practitioner with a Conscientious Objection to abortion, referral to another practitioner is like saying,

*'I can't rob the bank for you myself. But I know someone down the road who can.'*<sup>34</sup>

In other words, the meaning of transfer or referral incorporates 'becoming implicated in the process of abortion'.

The ECtHR in *RR v Poland*<sup>35</sup>, it was decided that a person who is legally entitled to an abortion should not be denied that right owing to the personal conscience of another person. As a result, if one practitioner refuses to do the procedure, the patient must be sent to another and given access to safe abortion options.

*Pichon and Sanjous v France*<sup>36</sup>, concerned two French pharmacists who argued that their right to freedom of conscience as stated under Article 9 of the ECtHR was infringed by Section 4 of the Abortion Act of 1967 of the UK. The two pharmacists declined to give oral contraceptives to female clients who had been given medication to start the abortion procedure by qualified medical practitioners. The ECtHR dismissed the case as inadmissible, concluding that the rejection did not fall within the scope of Article 9 of the ECHR or Section 4 of the Abortion Act. The Court ruled that the pharmacists' personal opinions could not take precedence over

<sup>31</sup> Jonathan Herring, *MEDICAL LAW AND ETHICS* (5th edn, Oxford University Press 2020) 306.

<sup>32</sup> [1999] 52 BMLR 217.

<sup>33</sup> Ian Kennedy and Andrew Grubb, *Medical Law* (Butterworths 2000) 1446.

<sup>34</sup> Christian Fiala and Joyce H. Arthur, "Dishonourable Disobedience" – Why Refusal to Treat in Reproductive

Healthcare Is Not Conscientious Objection' (2020)

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<sup>35</sup> Application No. 27617/04, ECtHR.

<sup>36</sup> [2001] ECHR 898.

their professional obligations as long as the selling of contraceptives is lawful and occurs only on medical prescription at a pharmacy.<sup>37</sup> In this instance, the fact that contraceptives were legal and could only be administered in a pharmacy meant that the petitioners could not place their religious views above everyone else, and so there was no violation of Article 9.

*Glasgow Health Board v Doogan and Others*<sup>38</sup> is a case involving two Catholic midwives who worked in a Scottish labor hospital and claimed they had the right to refuse to take part in abortions. The Greater Glasgow Health Board objected, claiming that delegating, monitoring, and support responsibilities did not include 'participating' in the treatment, and so dismissed their complaints. This judgment was challenged in court by the midwives. The court rejected the Midwives' claim to right to Conscientious Objection. The Supreme Court ruled that the midwives were not being asked to "engage in any treatment permitted by this Act" since they were under no duty to actively participate in the abortions. They were only viewed as having a supervisory and administrative function, such as making calls to schedule medical terminations or designating ward staff to support the operation, none of which were deemed direct enough to be an influence on the abortion's performance. Finally, the Supreme Court agreed on a definition that limited the right to object, as well as direct and hands-on engagement in the operation.

Regardless of the objection clause, the English Courts define the phrase "participate" under Section 4 with an unmistakable distinction between the requirements of the patient and the moral integrity of Medical Practitioners to act on

medical judgment. Medical Practitioners in the National Health Sector cannot circumvent their legal obligation under the Act to conduct an abortion if the patient requests one. The objection clause, on the other hand, is in force when a Medical Practitioner works in the private health sector or private practice. The Medical Practitioner is then free to manage the affairs according to the preferences of his patients. A government or National Health Service Medical Practitioner must always keep in mind that it is his or her principal obligation to provide legally binding services to the state and serve the public.<sup>39</sup> Under the UK's Abortion Act 1967, this demonstrates a successful balance between the patient's needs and rights and the rights of health care providers.

## RECOMMENDATIONS

As per the author, Medical Practitioners should be able to refuse the process if it is not medically necessary. A procedure that has been clinically recommended is beneficial to a patient's health and is appropriate for the condition being treated. As a result, requiring Medical Practitioners to compromise their moral integrity for procedures that aren't medically necessary, even if they are within their area of practice, is unjust. Citizens cannot be denied the enjoyment of their constitutional rights and freedom of conscience is a fundamental right. As a result, it is recommended that the Proposed Bill contain a "Conscientious Objection provision". This guarantees that the Specialist or Medical Practitioner will be protected by the law. If a medical professional refuses, the patient must be referred to another medical practitioner, and the patient's entitlement to health care must not be refused.

<sup>37</sup> Clayton O'Neil, *Religion, Medicine, and the Law* (Routledge 2018) 177.

<sup>38</sup> [2014] UKSC 68.

<sup>39</sup> Ian Kennedy, *Treat Me Right: Essays in Medical Law and Ethics* (Clarendon Press 2001) 29.

Furthermore, it is recommended that Medical Professionals be denied Legislative protection under the Conscientious Objection Provision if they attempt to claim the clause while the mother's (patient's) life is in danger. In such a circumstance, the medical practitioner must take all necessary efforts to conduct the abortion if it is essential to preserve the patient's life. Any Medical Professional who fails to comply with this must be held accountable, and the Act must state if civil or criminal actions can be brought against him or her. Nurses and pharmacists should not be permitted to seek statutory protection under the indemnification clause, it is suggested. These medical experts are not directly involved in the abortion procedure.

As a result, they should not be able to decline to carry out their responsibilities under the Act merely because of their participation. If the MTP Act legalizes a pharmaceutical treatment and introduces Misoprostol and Mifepristone, for example, the patient will only be able to obtain that exact tablet from a pharmacy. And if the pharmacists refuse to give the medication to the patient, he or she has no other option. As a result, it is suggested that Nurses, Pharmacists, and Midwives be exempt from the provision.

## CONCLUSIONS

To summarize, the option to abort should be available without a doubt. Women should not be denied a basic right enjoyed by women all over the world in the name of religion. The dispute over the Right to Conscience vs. Right to Healthcare is the significant topic covered above. However, the right of one person should not be allowed to hinder the rights of the general public. Particularly when domestic legislation imposes a one-of-a-kind responsibility that can only be distributed

by a few select persons, such as Medical Practitioners, Nurses, and Pharmacists, the greater good of society must take precedence. Most jurisdictions' medical, nursing, and midwifery associations promote the option of Conscientious Objection, but they also demand refusing providers to be transparent about their objection, give alternatives, and treat patients in clinically critical patients.

Through different case laws and statutory arguments, the analysis in this paper was centered on the approach followed by the United Kingdom and the European Union. A medical practitioner, a nurse, or a midwife can refuse to conduct an abortion if it is against their conscience, according to the English Abortion Act of 1967. Pharmacists, on the other hand, are in a different scenario. A pharmacist is legally obligated to supply the needed contraceptives to a patient even if it goes against their conscience. If an MTP Act is established in Sri Lanka, it is advised that it adopt the United Kingdom's approach, which is effective in addressing the medico-legal difficulties of abortion. As a result, enacting an MTP Act is a viable strategy for combating rising maternal mortality rates, provided that legal problems are addressed correctly.

The right to exercise a Conscientious Objection is not always absolute. The above facts demonstrate the importance of the larger context in claiming Conscientious Objection. If abortion is legalized in Sri Lanka, it is necessary to take precautions to protect medical practitioners' moral integrity and freedom of conscience on legitimate grounds, while also assuring women's access to abortion. Freedom of conscience of an individual must not curtail women's rights to access reproductive healthcare. When it comes to how Conscientious Objection should be implemented, there are no simple solutions, but the author believes that the

study has addressed some of the challenges and advanced the argument ahead.

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# **Nursing & Health Sciences**



## What Does Your Physical Activity Level Say About the Flexibility of Your Body?

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### ABSTRACT

Physical inactivity is a leading risk factor for global mortality with flexibility being the key factor for determining an individual's health status. This study explored the impact of physical activity on the flexibility of the lumbar spine and the lower extremities of undergraduates. A sample of 60 undergraduates from the Faculty of Allied Health Sciences, University of Peradeniya was selected using stratified random sampling method. The students were divided into three categories (low, moderate, and high) based on their physical activity level. Modified Schober test was used to measure the flexibility of the lumbar spine while Sit-and-Reach and Groin Flexibility tests were used to measure the flexibility of lower limbs. It revealed a weak positive correlation ( $r=0.236$ ,  $p = 0.048$ ) between physical activity and flexibility of lower limbs whereas nonsignificant correlation ( $r = -0.179$ ,  $p = 0.701$ ) was found in between physical activity and flexibility of the lumbar spine. It explored a strong positive correlation between the flexibility of lumbar spine and lower limbs in subjects who were low in physical activity but not in subjects with moderately and highly physically active. In addition to that, the study indicated the males to be more flexible in both lumbar spine (22.26) and lower limb (7.46) compared to females (21.4), (6.66) respectively. This study concluded by emphasizing the fact that being physically less active may reduce the flexibility irrespective of its specificity to each joint or area of the body. Thus, importance should be given clinically to alleviate physical inactivity in order to improve the general status of health.

## INTRODUCTION

Notwithstanding the fact that our daily lives have been revolutionized with the improvement of technology, such advancements are believed to have negatively influenced the physical and mental health of people (Kardefelt-Winther, 2017). In particular, young adults: students and undergraduates, who spend a large part of a day glued either to a screen or to a chair may at risk of developing serious health consequences due to being physically less active (Vandelandotte, Sugiyama, Gardiner & Owen, 2009). Therefore, this study is aimed at addressing the importance of being physically active and how it influences the flexibility of the lumbar spine and lower limbs of undergraduates. Exploring the amount of physical activity performed by the individuals and identifying to which extent it influences the flexibility of the different regions of the body, would enable the students to understand their physical health status better and it would pave a path to address the deviations promptly if there are any abnormalities.

As far as physical activity is concerned, World Health Organization (WHO) (2010) defined it as “any bodily movement produced by skeletal muscles that requires energy expenditure” and it includes all the common activities people perform as part of their activities of daily living (ADL). Studies showed that the youth who are physically active are more likely to report good physical and mental health status (Uusitupa et al., 2000) with a better quality of life (Warburton, 2006).

Pate, Oria and Pillsbury (2012) defined flexibility as “the intrinsic property of body tissues which determines the range of motion achievable without injury at a joint or group of joints”. Considerable number of studies have investigated a

positive association between flexibility and injury prevention (McHugh & Cosgrave, 2009) and improved performances (Kay & Blazevich, 2012) as well.

Even though the literature consists of evidences correlating the flexibility to the general health, it failed to accurately point out how the flexibility is influenced by general physical activities of daily living of a healthy individual. Besides that, flexibility measures often were included in a study because of its association with a different objective that is being measured (i.e. back pain) rather than being assessed directly. Therefore, the need of exploring the effect of general physical activity on the flexibility of a healthy individual gains importance.

Hence, this study is aimed at finding out any impacts of physical activity level of the young individuals on the flexibility of their lumbar spine and lower limbs. It further addresses the relationship between the flexibility of the lumbar spine and the flexibility of the lower limbs among the subjects who share the same physical activity level. In addition to these two objectives, this study intends to assess the impact of gender on the flexibility as well.

## MATERIALS AND METHODS

This is a cross sectional study using the stratified random sampling method, targeting the total population of students (649) from the Faculty of Allied Health Sciences (FAHS) of the University of Peradeniya (UOP).

At a 0.05 statistical significance and the power of 0.90, the minimum sample size for the study was calculated to be 68 using the G\*Power statistical analysis application.

The total population of (649) students was first stratified into males (205) and females (444). Then for each stratum, the lottery sampling method was applied with the registration number of the students. Sample subjects were informed individually and recruited for the study to make each stratum have 35 participants. Subjects with apparent factors that may restrict mobility (i.e. back pain, leg pain, recent surgery, fracture) were excluded. After obtaining written consent, the general physical activity level of each participant was assessed by self-administering International Physical Activity Questionnaire – Short Form (2016) (IPAQ – SF) to divide them into three categories: Low, moderate and high, according to their physical activity levels. The flexibility of the lumbar spine was measured using Modified Schober Test and the subjects who reached the threshold flexibility distance (21cm) were considered to have a flexible lumbar spine (Rezvani, Ergin, Karacan, & Oncu, 2012).

The flexibility of the lower limbs was measured using both Sit-and-Reach and Groin Flexibility tests. The subjects were divided into 7 levels of flexibility (7-high, 1-low) according to the Sit-and-Reach test (Wood, 2012) and the 5 levels of flexibility (5-high, 1-low) according to the Groin Flexibility test (Wood, 2008). The sum of the above mentioned levels from both tests was considered in dividing the subjects into the three final categories: good, average and poor, according to the flexibility of their lower limbs.

During all the flexibility measurements, each procedure was repeated thrice and the final average score was calculated. In addition to that, the subjects were not asked to undergo a warm-up stretching program prior to the flexibility measurement to alleviate the effects of stretching on the flexibility.

Having collected the data, an appropriate pooled t- test was performed to assess the impact of gender on the flexibility. The chi-square tests were used to address the impact of physical activity level on the flexibility of different regions of the body and to address the relationship between the flexibility of the lumbar spine and the flexibility of the lower limbs among the subjects who share the same physical activity level.

## **RESULTS AND DISCUSSION**

### **General distribution of the subjects**

Distribution of the subjects according to their physical activity level measured using the IPAQ indicated that most of the students (50%) were moderately physically active while 34.3% were low in physical activity and 15.7% of them were highly physically active while the flexibility of the lumbar spine and the lower limbs were normally distributed.

### **The impact of physical activity level on the flexibility of the lumbar spine and the lower limbs**

A correlation coefficient of  $r = -0.179$  observed with the P-value of 0.701 (P-value > 0.05), showed that there was no correlation between the physical activity level and the flexibility of the lumbar spine in the subjects. Anyhow, a correlation coefficient of  $r = 0.236$  observed with the P-value of 0.048 (P-value < 0.05), showed a weak positive correlation between the physical activity level and the flexibility of the lower limbs in both genders.

As per the results of the study, general physical activity levels of individuals were found to have no impact on the flexibility of lumbar spine. Literally, no large scale studies were designed specifically to assess the relationship between physical activity and the lumbar spine flexibility in

the available literature except a very few studies that indirectly measured it.

Arab and Nourbakhsh (2014) postulated that lumbar lordosis is not affected either with different physical activity levels or different work settings. On the other hand, Gordon and Bloxham (2016) in a systemic review showed that aerobic exercise can help in reducing low back pain by minimizing the stiffness of lumbar spine through improved blood supply to the back. Yet this indirect measure cannot be considered accurate since the low back pain could have also been caused by reasons other than the lack of flexibility of the lumbar spine at times, such as reduced endurance and weakness of the musculature around the lumbar spine (Arab et al., 2014).

Unlike the flexibility of the lumbar spine, the flexibility of the lower limbs were found to have a weak positive correlation with the physical activity levels of healthy individuals. It is in consonant with many studies that suggested, that the sedentary lifestyle can be the leading factor for developing tightness in hamstrings that could result in reduced flexibility in the lower limbs among healthy individuals. (Vandelanotte et al., 2009; Qamar, Fatima, Ul Hassan, & Basharat, 2017).

On the opposite note, there are a very few evidences that do not support the finding of this study. Arab (2014) in his previously mentioned study indicated that hamstring muscle length does not seem to be affected by different work settings and lifestyles.

The major reason for the divergent results on the impact of physical activity level on the flexibility of both the lumbar spine and the lower limbs is the different choices of outcome measures that have been chosen to measure the lifestyle, physical activity level and the flexibility of different areas of the body. Unlike the present study that has

used linear tests for their time efficiency and easiness in administration (Castro-Piñero et al., 2009), many studies used either Straight Leg Raise (SLR) or popliteal angle test (Youdas et al., 2005; Marshal et al., 2014) for the measurement of hamstring tightness while different questionnaires validated for different populations were considered for the measurement of physical activity. The present study used IPAQ questionnaire which was considered to be the most widely used, self-reported measurement tool that could be adapted according to different cultures across various populations in the world (Craig et al., 2003).

In addition to that, the choice of subjects could have influenced the outcome. It can be emphasized by the differences observed in genetics, environmental factors, different body anthropometries observed for different ethnicities and geographic locations, and patterns of physical activity.

#### **Relationship between the flexibility of the lumbar spine and the lower limbs among the subjects who shared the same physical activity level**

No correlation was found between the flexibility of the lumbar spine and the lower limbs of subjects who were highly ( $r=0.203$ , P-value of 0.549) and moderately ( $r=0.160$ , P-value of 0.366) physically active. On the contrary, the subjects who were categorized having low physical activity level the correlation coefficient of  $r=0.536$  with P-value (0.008)  $< \alpha$  (0.05) showed a strong positive correlation between the flexibility of the lumbar spine and the lower limbs.

In the literature, even though the integration of the flexibility of two different regions demands more extensive approaches and multivariate analysis, a comparison can still be possible. As far as

the subjects who were highly and moderately physically active were concerned, no significant correlation was found in between the flexibility of the lumbar spine and the lower limbs. This finding is supported by Stutchfield and Coleman (2006) which showed no association between the hamstring flexibility and the lumbar flexion. In addition to that, Johnson and Thomas (2010) also found no significant correlation between lumbar excursion and hamstring tightness during forward bending tasks. However, on the opposite note, Carregaro and Gil Coury (2009) observed increased trunk movements in subjects with reduced hamstring flexibility. The contentious result of these studies might be due to the inconsistency of authors on defining the flexibility of lumbar spine. Some might have considered only the motion of lumbar spine while others might have considered the combined motion of the pelvis and lumbar spine. Apart from that, the choice of different test measures for measuring the different areas of the body must have played an important role in the results too.

The most important finding of this study is the strong positive correlation between the flexibility of the lumbar spine and the lower limbs in people who were low in physical activity levels but not in subjects with high and moderate levels of physical activity. To our knowledge, no studies have explained this relationship previously. It showed that being physically less active may affect the flexibility of different body regions (i.e. lumbar spine and lower limbs) of a person regardless of the specificity of flexibility to each joint or muscle. Thus, physical inactivity in young adults should be considered as a major concern to ensure optimal status of health.

### **The impact of gender on the flexibility of the lumbar spine and the lower limbs**

Mean lumbar spine flexibility for males measured with the modified Schober test was 22.26cm ( $\pm 1.25$ ) while for females, it was 21.4cm ( $\pm 1.25$ ). With the p-value (0.005) of the t-test is being smaller than  $\alpha$  (0.05), the mean lumbar spine flexibility of males can be considered as significantly higher than that of females at 5% significance level. On the other hand, the mean lower limb flexibility score measured using the sum of the scores obtained from both Sit-and-Reach and Groin Flexibility tests, for males is 7.46 ( $\pm 1.29$ ) while for females is 6.66 ( $\pm 1.43$ ). With the p-value (0.017) of the t-test is being smaller than  $\alpha$  (0.05), the mean lower limb flexibility of males is significantly higher than that of the females at 5% significance level.

This study found that the flexibility of both the lumbar spine and the lower limbs were higher in males than their female counterparts in contrast to many studies that addressed the flexibility in favor of female gender. With regard to the flexibility of the lower limb, studies performed in adults showed that females tend to have longer muscle length (Youdas, Krause, Hollman, Harmsen, & Laskowski, 2005) and higher extensibility (Marshall & Siegler, 2014) in hamstring muscles and to have lesser musculotendinous stiffness of calf muscles as well (Hoge et al., 2010). Yet, the flexibility of hamstring muscle alone cannot be considered for the flexibility of the lower limbs since the hip adductor muscle stiffness also has become a major concern in adults (Sedaghati, Alizadeh, Shirzad, & Ardjmand, 2013). Since the current study considered both hamstring and hip adductors for the flexibility of lower limbs, this deviation in the results compared to previous studies is expected. Moreover, this study found no significant difference (P-value of 0.605) in physical

activity between two genders. Hence, the amount of physical activity cannot be considered to attribute in increased flexibility in males. On the other hand, with regard to the flexibility of lumbar spine, Sullivan, Dickinson and Troup (1994) found greater flexion angle of the lumbar spine in males compared to females, which is in consonant to the finding of this study that measured the flexion angle of the lumbar spine with modified Schober test. Anyhow, it is suggested that, for a more comprehensive outcome for the flexibility of the lumbar spine and the lower limbs of an individual, each joint with each set of muscles working on the joint should be evaluated for tightness, separately.

Having evaluated all the aspects of the study, it is important to acknowledge the methodological limitations as well. Merging the scores of flexibility of hamstring and hip adductors to indicate the lower limb flexibility needs more mathematical and statistical concern. In addition to that, the IPAQ-SF questionnaire used to assess the physical activity level does not include the time spent in sitting or lying without doing any activities. Inclusion of such sedentary sitting time might have influenced the final outcome of the study.

## CONCLUSIONS

This study showed that physically being less active may reduce the flexibility of lower limb and lumbar spine irrespective of its specificity to each joint or area of the body. Therefore, improving the physical activity level would positively affect the overall flexibility of the body and the health of an individual.

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## Development and Validation of a Record Sheet for the Fibreoptic Endoscopic Evaluation Of Swallowing

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### ABSTRACT

Fibreoptic Endoscopic Evaluation of Swallowing (FEES) is an emerging assessment in speech therapy practice in Sri Lanka. Lack of consensus of reporting the findings of FEES across different clinical settings and failing to conduct essential sub-areas of the assessment process has been noted as major issues due to the lack of an appropriate documentation system. Therefore, this study is focused on developing and content validating a documentation system for FEES for patients who have not undergone any clinical examination on swallowing. Modified Delphi method was conducted on 7 speech therapists who are involved in conducting FEES in government hospitals and private sectors. Online questionnaires were used to finalize and content validate the developed record sheet. The record sheet for FEES got finalized with the accepted components and suggestions from two Delphi panels. The Delphi panellists agreed on the content with an excellent content validity index score. The finalized record sheet was designed in a user-friendly manner, and consisted of 3 subsystems; pre FEES, FEES findings, and post FEES.

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## INTRODUCTION

Fibreoptic Endoscopic Evaluation of Swallowing (FEES) is one of the gold standard instrumental assessments to assess swallowing functions of pharyngeal and oesophageal phases. The flexible endoscopic camera which is inserted through the nasal cavity gives a clear picture of the anatomy and the working of the nasopharynx, the hypopharynx, and the larynx during swallowing different textures of foods and drinks (Boaden, 2011; Kuo, Allen, Huang & Lee, 2017). FEES enables the otolaryngologists and speech therapists to make judgments about the aspiration and penetration of food, determines recommendations for oral or non-oral feeding, and finds the risk of aspiration pneumonia (Kelly, Drinnan, & Leslie, 2007; Colodny, 2002).

FEES is considered to use under both speech therapists' and otolaryngologists' scope of practice (Langmore, Kenneth & Olsen, 1988). According to the American-Speech-language and Hearing Association (ASHA) code of ethics, clinicians who achieve the certificate of clinical competence in Speech-Language therapy after special training of FEES can practice FEES independently. However, depending the clinician, the patient, and the work setting, their role and the level of involvement may differ (ASHA, n.d.). In Sri Lanka, a very few speech therapists were trained to conduct FEES. Otolaryngologists perform it in collaboration with the speech therapists while speech therapists diagnose according to the observations.

When a consensus procedure is not followed in different work settings with different clinicians, the results might differ leading to misdiagnoses and omission of significant details during the procedure (Viviers et al., 2016). Hey et al. (2011) stated that having a documentation sheet

will help the clinicians in managing time for documentation and improving the quality of records, as well as diagnostic examinations. Also, when working as a member of a multi-disciplinary team, documentation may help in improving the quality and presentation of the findings to another professional (Jevon, Ewens & Pooni, 2012).

Therefore, considering the literature and practice methods in Sri Lanka, the present research aimed to develop a record sheet for FEES and obtain construct validity of the developed record sheet through committees of experts.

## MATERIALS AND METHODS

A validation study using the Delphi technique was conducted to fulfil the aims of this study. Studies with limited participants (E.g. Delphi studies, adaptation, developments or translations, etc.) highly prefer the validation study design than using a cross-culture adaptation study design (Arafat, 2016). The ethical approval for the study was obtained from the Ethical Review Committee of Faculty of Medicine, University of Kelaniya (reference No: P/75/09/2020-D).

Speech therapists in Sri Lanka who conduct FEES were invited to participate in the study which was conducted under 2 phases.

Phase 1 consisted of a needs assessment that included a semi-structured online questionnaire using Google forms. The questions consisted of details related to the workplace, years of involvement in the FEES procedure, the method used to keep records, areas usually assessed in FEES, problems/concerns faced during records

keeping, and suggestions for the record sheet.

The needs assessment was conducted to identify the necessity of a documentation system, and the generally followed procedures at different hospitals.

A documentation form/record sheet for FEES was developed considering the data gathered from previous international research on FEES and suggestions from the needs assessment. The first draft of the record sheet consisted of three sections; (a) pre FEES section where the clients' eligibility to undergo FEES examination, (b) FEES examination result section which discusses the direct findings of the examination and, (c) post FEES section which gives descriptions of complications, the success of manoeuvres, and recommendations.

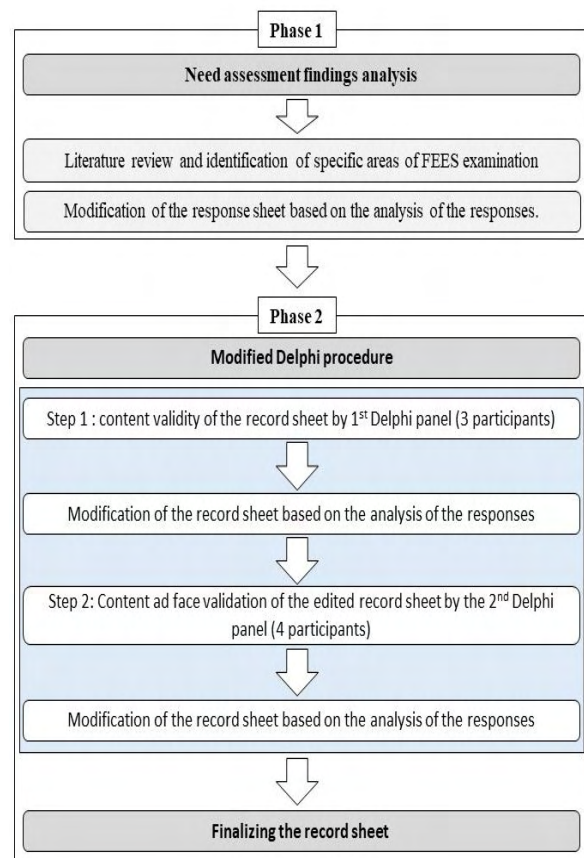
In phase 2 Delphi technique was used to investigate whether the record sheet covers all the aspects of the assessment and whether the form is user-friendly. Delphi panel 1 mainly focused on the content of the developed record sheet for the FEES examination. The draft of the record sheet with a questionnaire on the appropriateness of the content and user-friendliness of the drafted FEES record sheet was sent via email to the participants. A summary of the recommendations of the first panel and the revised tool was sent to Delphi panel 2 with a questionnaire which was developed based on the responses from the first questionnaire and additional questions for the face validation and further comments for developments.

The content validity was measured using the Content Validity Index (CVI, Shi et al., 2012). During the procedure, the Item-Content Validity Index (I-CVI) was calculated to measure the most acceptable ratings of the panel members. Items rated with 1 and 2 were considered not applicable, hence, either removed or

edited with the comments received (Polit & Beck, 2006; Rodrigues et al., 2017). The Scale Level Content Validity Index-Average (S-CVI/ Average) and the Universal Agreement (UA) was reckoned to find the ratio of the items given the “most relevant” by the rates.

The procedure is depicted in figure 1.

**Figure 1.** Flow chart of the data collection procedure.



## RESULTS AND DISCUSSION

Currently, in Sri Lanka, there are only 9 speech therapists involved in FEES. Though all of them were invited, only 7 therapists gave consent to participate. All the participants have been conducting FEES for more than three years. Three speech therapists were randomly assigned to the Delphi panel 1, whereas the rest 4 therapists were assigned to panel 2.

### Draft of the record sheet

The first draft of the record sheet consisted of 3 sections;

- (a) Pre FEES – Client details, referral details, attention, oral-motor examination, four, finger examination, cervical auscultation (dry swallow, 5ml water test), tolerated food consistencies)
- (b) FEES test findings – Dry swallow (number of swallows, airway signs, signs of aspirations, other complications), water (equipment used, amount, speed, no of swallows, signs of aspirations, other complications), pureed (trial 1, trial 2, equipment used,

amount, speed, signs of aspirations, other complications), solids (3 trials: amount, speed, signs of aspirations, other complications), blue dye test (3 trials: amount, speed, signs of aspirations, other complications), improvement when manoeuvres incorporate, manoeuvre used: (eg: supra-glottic swallow), place and the level of food pooling (bird's eye view) and comments, awareness of residue, amount of residue, effectiveness of clearing forces.

- (c) Post FEES findings – complications after manoeuvre, recommendations, and referral.

**Table 1.** Summary of the recommendations for the record sheet

Section	Subsections removed from the tool	Subsections added to the tool
<b>Pre FEES</b>	Attention scale, Removed the commenting space and added subsections to the oral motor examination (face, jaw, lip, drooling, dentition, tongue, Buccinators muscle)	Current feeding methods, current nutrition intake, habitual behaviours (head and trunk), clearing manoeuvre, volitional cough, salivation, pharyngeal and laryngeal movement, voice quality
<b>FEES examination findings</b>	Three trials with every consistency, place and level of food pooling (cross-sectional view) and comments	velopharyngeal closure, velar & lateral wall movements, back tongue tongue propulsion, premature spillage, pharyngeal movements, vocal folds, Sensory awareness of the endoscopy, aspiration and penetration scale (Rosenbek et al., 1996).
<b>Post FEES</b>		manoeuvres trialled, types of consistencies that the patient could have orally

### **Phase 2 – Step 1**

All three panellists accepted the order of section 1 (Pre FEES), the inclusion of cervical auscultation, and the 4-finger examination. The suggestions given were: simplify the attention subsection, elaborate the oro-motor examination by adding checkboxes, limit the trials to 2 attempts, include the typical diet consistency in addition to other examining consistencies, and change the diagram to represent horizontal plane to mark areas of food residual. The subsections suggested to add are presented in Table 1.

### **Phase 2 – step 2**

All 4 panellists of Delphi panel 2 agreed that the revised draft of the record sheet is convenient and gathers necessary aspects in the FEES procedure. Three panellists agreed that the final record sheet for FEES should be comprised of all the elements and subsections while all strongly agreed to the user-friendliness, and convenience of the record sheet to use in Sri Lanka.

### **Content validation**

The final record sheet received an S-CVI/Average of 0.94. And the S-CVI/UA value of the developed record sheet was 0.8. According to Rodrigues *et al.* (2017), a value greater than 0.9 in the S-CVI/Average and greater than 0.8 in S-CVI universal agreement (S-CVI /UA) is indicative of excellent content validity.

All the participants had the opportunity to argue the questions and appraise the included details and the affability of the record sheet.

The items in the record sheet were in the order of structures that can be observed during an endoscopic assessment from the nostrils where the camera is inserted and sent to the vocal folds. The tools developed by Murray *et al.* (1999) and Hey *et al.* (2011) focuses only on FEES examination which is usually conducted after a bedside evaluation. In Sri Lanka, the majority of

patients who undergo FEES are from the outpatient department. Therefore, using the tools developed by Murray *et al.* (1999) and Hey *et al.* (2011) in the Sri Lankan context overlook the patients' past histories of problems and present abilities. The record sheet designed in the present study examines all the prime factors of a patient, past and present complaints and FEES findings, to give a conclusion about the interventions that need to be conducted. Apart from the content of the record sheet, the user-friendliness, persistence, and reliability of the included questions/sections were validated. The record sheet was accepted with an excellent score according to CVI.

### **CONCLUSIONS**

To fulfil the lack of a proper documentation system for the FEES procedure conducted in Sri Lankan clinical settings, a record sheet was designed to carry out the task easily even on the outpatients. This record sheet was designed and validated to find the eligibility to undergo the test, to evaluate the structures and functions from the nostrils to the vocal folds during the FEES procedure, and to document the details to propose the intervention without missing any essential details to diagnose the type and severity of dysphagia.

The record sheet will be useful to reduce the challenges the speech therapists found while diagnosing and sharing the results and conclusions with a multi-disciplinary team and to minimize any uncertainty among newly graduated speech therapists during the clinical training of FEES.

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## Translation and Adaptation of a Dysarthria Assessment Tool to Be Used in the Sri Lankan Clinical Context

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### ABSTRACT

Dysarthria is one of the common communication disorders that arises due to neuromuscular damage. To address this long-felt need of a formal Dysarthria tool to be implemented in the Sri Lankan clinical context, the Newcastle Dysarthria Assessment Tool (N-DAT) was adapted and validated using a normative sample during this research study. The adaptation and validation were done using three phases: (I) Identification of the most appropriate tool to adapt to SL context, (II) Translation and adaptation of the assessment tool, and (III) Identification of the face, content, and concurrent validity of the tool. At the end of the phase II, the original N-DAT assessment tool was translated and adapted to Sinhala language using WHO guidelines and Delphi methodology. The content was satisfactorily adapted and translated with the same conceptual meaning, semantics, idiomatic, score equivalences with one additional section related to the International Classification of Functioning model. The face validity and content validity were confirmed with the Delphi group's input. The normative sample exhibited a predicted negative correlation between age and speech- articulation, respiration, phonation, voice, pitch, and Diadochokinetic rates. The concurrent validity of the SLN-DAT was compared with another informal Dysarthria assessment that is used at National Hospital, Sri Lanka, and found to have high ICC for all subsystems. Each subsystem had higher Intra Class Correlation value ranging between  $r = 1.0 - 0.7$  ( $p < 0.01$ ). However, this validation was done only among the normative sample where the SLN-DAT could be recommended to Sri Lanka after it was validated among the dysarthria population.

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## INTRODUCTION

Dysarthria is a neurological disease of the muscular-skeletal system caused by the damage to the cortical/subcortical or the lower motor neuron. The term “Dysarthria” is a collective name given for a group of motor speech disorders resulting from abnormalities in breathing, phonation, resonance, articulation, and prosody, which are identified as subsystems of speech by Duffy, in 2013 (Duffy, 2013; Cera et al., 2019). Based on the site of the lesion, the type of dysarthria could vary as Flaccid, Spastic, Ataxic, Hyperkinetic, Hypokinetic, and Mixed dysarthria. The incidence and prevalence of dysarthria vary across countries and settings. Based on the causes of dysarthria, 8% - 60% of dysarthria cases were diagnosed secondary to stroke, 10% - 65% were diagnosed due to traumatic brain injury, 70% - 100% were diagnosed due to Parkinson's disease, 25% - 50% were diagnosed secondary to multiple sclerosis and 30% cases were diagnosed due to amyotrophic lateral sclerosis (ASHA, 2020). Diagnosing dysarthria requires an effective assessment by a Speech and Language Therapist (SLT) along with a neurological examination. However, currently in Sri Lanka standardized or validated assessment tools are not used with the clients who are having dysarthria where clinicians depend on informal assessments or self-translated tools which are not validated to the clinical context of Sri Lanka. The paucity of standardized and validated tools to diagnose dysarthria negatively affects the clinical practice in Sri Lankan clinical context.

How to adapt and validate a resalable dysarthria assessment to identify dysarthria reliability in Sri Lankan clinical context using a valid assessment is the main research question that is identified in the present research. The research problem focuses on identifying the most

suitable dysarthria assessment to be used in the Sri Lankan clinical context, and preliminary validated using normative participants.

At present, the evaluation of the severity and the impact of the dysarthria are diagnosed based on informal assessments. Thus, the results of the assessments can defer based on the therapist's level of experience. Therefore, it is difficult to gather context-based evidence related to Dysarthria in Sri Lanka (SL). On the other hand, having no normative data for clinicians on dysarthria-related assessments to compare norms could affect the quality of measures as well. This research study attempts to fulfil this gap by adapting the most suitable dysarthria tool to the Sri Lankan context. Having a clinically valid tool could influence the reliability of the diagnosis of dysarthria in the Sri Lankan clinical context, while it could directly influence the intervention process as well. Any dysarthria assessment tool that has specific steps and guidance can be useful for newly qualified Speech and Language Therapists and this was also considered when choosing a tool to adapt.

Out of many dysarthria assessments that were available in western countries, three main tools were selected for the present study after extensive literature and empirical data reviews (currently used in Sri Lankan context but no adaptation/translations were done).

Frenchay Dysarthria Assessment (FDA) was the first one to choose and it was validated using 100 clients with different neuromuscular impairments. McKinstry and Perry (2003) investigated that the clinical usage, reliability, and validity of FDA among patients with head and neck cancer. The developers of the FDA

modified the tool again in 2008 as FDA 2 (Enderby, 2008) and this was translated to different languages. A study done by Cardoso et al. identified higher feasibility, face validity (0.94), construct validity (81%), convergent and inter-rater reliability (0.96) among 80 clients who had Parkinson's Disease (Cardoso et al., 2016). There were more researchers who used FDA2 for translations and adaptations such as French adaptation of the "Frenchay Dysarthria Assessment 2" speech intelligibility test (Ghio et al., 2019), Frenchay dysarthria assessment (FDA-2) in Parkinson's disease: cross-cultural adaptation and psychometric properties of the European Portuguese version (Cardoso et al., 2017).

The second tool identified in the present study was the Robertson Dysarthria Profile (RDP) (Pert, 1995). Pert in 1995 has validated the tool by assessing RDP's sub-sections and he identified that the RDP findings are helpful in diagnosing the severity of the dysarthria. The reliability and validity of RDP were investigated by Defazio et al. in 2015 among 85 participants. They compared other dysarthria tools (Frenchay Dysarthria Assessment, Radboud Dysarthria Assessment, and Revised Robertson Dysarthria Profile) and RDP with 48 clients who have dysarthria secondary to degenerative disorders and 37 normative population. The study has discovered, RDP had higher validity as a dysarthria assessment tool to assess speech and voice disturbances of clients with dysarthria (Collis & Bloch, 2012; Altaher et al., 2019; Defazio et al., 2015).

The other tool that was selected for the current study was Newcastle Dysarthria Assessment Tool (N-DAT) (Hackney & Vietch, 2015) which was validated with 48 SLTs by providing a survey about the N-DAT. John Rosenbek identified that the N-DAT is rich with normative data,

descriptive findings of the sub-tests, more convenient to differential diagnosis, shorten the number of assessment tasks and recommendations but poor with reliability (Hackney & Vietch, 2015). This was developed recently compared to the other two assessments and still the research is emerging related to the N-DAT tool.

There were no previously published research studies on formal dysarthria assessments that were adapted and translated to be used in the Sri Lankan context. The present study is the first formal dysarthria tool that was adapted and translated to be used in the Sri Lankan clinical context and the findings of this research could directly influence the speech and language therapy clinical practice related to the adult population.

The general objective of the present research study was to translate and adapt a formal dysarthria assessment tool to use in the Sri Lankan clinical context.

The specific objectives were as follows.

- Identify a most suitable formal dysarthria assessment tool applicable to the Sri Lankan clinical context for adaptation and translation.
- Translate and adapt the identified formal dysarthria assessment tool using a Delphi method to the Sinhala Language
- Identify the face validity, content validity, and criterion validity of the adapted formal dysarthria assessment tool.

## **MATERIALS AND METHODS**

The research study was based on the adaptation and validation of a tool and it had quantitative descriptive elements with tool validation methodology including the Delphi method. The

convenience setting for the participants of the study and standardized precautions in the Sri Lankan health care system were selected due to the pandemic environment. The followed phases of the study procedure are summarized in figure 01.

**Figure 1.** Phases of the study procedure

<b>Phase 01</b>	<b>1<sup>st</sup> part</b>	1. Literature survey –to identify 4 tools 2. Views of the students (all final year students - 20) 3. Views of the therapists (20 SLTs work with dysarthria)
	<b>2<sup>nd</sup> part</b>	Tool identification
<b>Phase 02</b>	<b>1<sup>st</sup> part</b>	Tool translation and adaptation
	<b>2<sup>nd</sup> part</b>	Adapted tool
<b>Phase 03</b>	<b>1<sup>st</sup> part</b>	Face and content validity – Delphi group (10 SLTs)
	<b>2<sup>nd</sup> part</b>	Criterion validity – using normative population (20-40, 41-60, 61-70, 71-80, 80 and above 80)

Phase one was used to identify the relevant tool to be adapted and translated to the Sri Lankan context. For this; 20 Speech and Language Therapists (registered at the Sri Lanka Medical Association) who were working with adults with dysarthria having one year or above experiences were selected and 20 final year undergraduates in the Speech and Language Therapy degree program were also selected to get the views of student's with regards to the assessment tool that is easy to use and easy to interpret even for a student clinician. For phase one, a self-administered questionnaire was used to gather data.

Phase two was based on translation and adaptation of the assessment tool into the

Sinhala language. The initial translation and adaptations were done by the principal investigator, based on World Health Organization tool translation guidelines; The forward translation to the Sinhala language and back-translation to the English language was done by a linguistic specialist. The translated and preliminary adapted tool version 01 was sent to the Delphi group for their feedback. With the feedback, the tool was changed and adapted further as version 02. The final tool was used in identifying its face validity and content validity and concurrent validity. Content validity was analyzed based on expert views using a self-administered questionnaire and item validity was measured using Cronbach's Alpha values. The content validity identified by the expert group consists of 10 Senior and qualified Speech and Language Therapists in Dysarthria who are working in with dysarthria clients. To identify the tool's feasibility a pilot test was carried out using 05 subjects.

Phase three was used to identify the concurrent validity of the tool. 50 Sinhala speaking, healthy adults with normal speech and language skills were selected based on purposive sampling. Purposive sampling was used to make sure the subjects will not have any other speech /cognitive disorders that could affect the results. Subjects who pass the Montreal Cognitive Assessment test were recruited to the research and excluded persons with hearing or visual defects, cognitive and mental health issues, and any communication disorder.

SLTs and Student participants were selected by using Simple random sampling selection (using open-epi software add the website). Delphi group members were selected based on purposive sampling. References from previous studies were also used when deciding the sample size calculation (Tongco, 2007; Bernard,

2002). 50 healthy Sinhala speaking adults were categorized based on the age ranges of 20-40, 41-60, 61-70, 71-80, 81, and above. Simple descriptive statistics and validity measures were used for the analysis of quantitative data in the study.

## RESULTS AND DISCUSSION

### Demographic features of participants

**Table 1.** Demographic data of the normative sample of subjects

Variable		Control	
		n	%
<b>Age , Years</b>	▪ 20 – 40	10	20
	▪ 41 – 60	10	%
	▪ 61 – 70	10	20
	▪ 71 – 80	10	%
	▪ 80+	10	20
			20 %
<b>Gender</b>	▪ Male	25	50
	▪ Female	25	50 %
<b>Education</b>	▪ Not educated	0	00
	▪ Up to Ordinary Level	10	20 %
	▪ Up to Advanced Level	33	66 %
	▪ Higher studies	7	14 %

**Table 2.** Demographic data of SLTs and SLT students

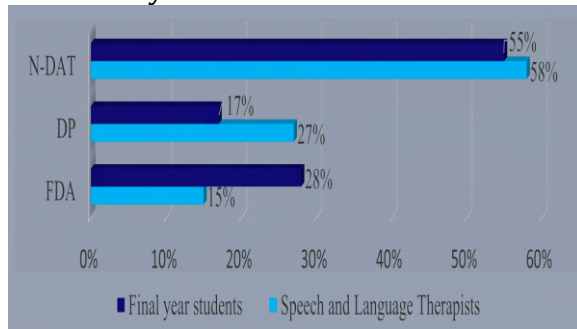
Variable	Frequency (%)
<b>Clinical setting</b>	
▪ Government hospital	10 (50%)
▪ Private hospital	05 (25%)
▪ Community setting	02 (10%)
▪ Government & Private hospitals	01 (05%)
▪ Private hospital & Community setting	02 (10%)
<b>Clinical experience</b>	
▪ 2 years	04 (20%)
▪ 2.2 - 4 years	12 (60%)
▪ 3.4 - 6 years	01 (05%)
▪ 4.6 - 10 years	02 (10%)
▪ 5.10 + years	01 (05%)
<b>SLT students mean age</b>	25 years old (4 <sup>th</sup> year)
<b>Currently used Assessment type</b>	
▪ Informal assessments only	01 (05%)
▪ Informal & formal assessments; Translated but not validated	15 (75%)
▪ Informal & formal assessments; Validated	03 (15%)
▪ Formal assessments only	01 (05%)

### Identifying a formal dysarthria assessment tool

Final year undergraduates and Speech and Language Therapists selected Newcastle Dysarthria Assessment Tool (N-DAT) as the most voted tool. They have recommended this tool as the most

relevant dysarthria assessment tool to be adapted and translated to the Sri Lankan context. Therefore, this tool was used for translation and adaptation in the next phase.

**Figure 2.** SLTs & students votes for the selected Dysarthria tool



## Translation and adaptation of the dysarthria tool

### Results of the Delphi Round one & two

The face validity was identified using Delphi questionnaire rounds. The Delphi questionnaire round one consisted of a likert scale (agreed /strongly agreed, not sure, not agree, strongly disagree) to scaling responses to the tool components. The round two Delphi questionnaire consists of yes /no questions and ratings scale (0-10). All participants 100% strongly agreed that the tool consists with face validity and confirms that the translated and adapted Dysarthria Assessment Tool carry out its purposes as it identifies the dysarthria. International Classification of Functioning (ICF) model based functioning assessment is the unique feature of the assessment tool and highly recommend by the Delphi. The adapted tool was named as Sinhala Language Newcastle Dysarthria Assessment Tool (SLN-DAT). The views of expert panel on adapted and translated tool are stated in table 03.

### Content validity of the Sinhala Language Newcastle Dysarthria Assessment Tool

To identify the content validity all 10 sub-components of the tool were analyzed based on Cronbach's alpha and the Cronbach  $\alpha$  (n=10) was 0.842 (p-value etc). The SLN-DAT presented with a higher internal consistency as the Cronbach's alpha was above 0.80.

**Table 3.** Views of expert panel on adapted and translated tool

Section	Changes	
	Round one	Round two
<b>Use of Sinhala translation for instructions (n = 7, 70%)</b>	<ul style="list-style-type: none"> <li>Instruction in OME</li> <li>Instruction of pitch glide</li> <li>Word "Negative" change</li> </ul>	<ul style="list-style-type: none"> <li>No changes</li> </ul>
<b>Additions (n = 4, 40%)</b>	<ul style="list-style-type: none"> <li>More questions on the impact of dysarthria in the functioning of a client in case history</li> <li>Mention about how to provide the resistance</li> <li>Breath-holding time &amp; more voice qualities</li> </ul>	<ul style="list-style-type: none"> <li>Phonetic sounds, words, phrases, and sentences in stimulus/aids</li> </ul>
<b>Materials (n = 4, 40%)</b>	<ul style="list-style-type: none"> <li>Coloured, black and white pictures</li> <li>Reading passages with different font sizes</li> </ul>	<ul style="list-style-type: none"> <li>No changes</li> </ul>

<b>Diagnosis criteria (n = 1, 10%)</b>	▪ No changes	▪ Add mixed criteria
<b>Format (n = 1, 10%)</b>	▪ No changes	▪ Change the order

Based on the views of the tool and internal consistency measures it was identified that adapted and translated tools had higher content validity.

### Identifying the concurrent validity of the adapted formal dysarthria assessment tool

The performances of the normative population

**Table 4.** The performances of the normative population

Overall severity for non-speech & speech subsystems	Mean performances for different age ranges (in years)				
	20 to 40	41 to 60	61 to 70	71 to 80	80 +
Jaw movements	5	5	5	4.5	4
Facial weakness	5	5	5	4.5	4.5
Lip movements	5	5	3.5	3.5	3.5
Tongue movements	5	5	4	3.5	3.5
Respiration	4	5	3	5	5
Voice	5	5	3.5	3	3.5
Pitch	5	5	3.5	3	3.5
Resonance	5	5	5	5	4.5
Stress	5	5	3.5	4	5
Intonation	5	5	3.5	4.5	5
Articulation	5	4.5	3	3.5	3.5
Intelligibility	5	5	5	5	4.5

Ratings; 0 = severe affected,  
1 = moderate to severe affected,  
2 = moderately affected,  
3 = mild to moderately affected,  
4 = mildly affected,  
5 = normal /not affected

### Norms

**Table 05.** Comparison of identified norms in the original N-DAT and translated and adapted Sinhala Language N-DAT

Norm	Identified norms of original N-DAT	Translated and adapted the Sinhala Language N-DAT
Breathing rate per minute	12–18 times	20–25 times
Maximum Phonation Time	Adult males 15.0–62.3s  Adult females 14.3–40.4s	Adult males 10.0–30.0s  Adult females 10.0–20.0s
Rate of movements	1–3s =Poor, 4–7s =Fair, 8–11s =Good, 12 – 15s = Normal	1–5s =Poor, 6–10s =Fair, 11–15s =Good, 16 – 20s = Normal
AMR per second	5.0	3.0
SMR per second	5.0	3.0

### Correlation SLN-DAT and DP

Dysarthria Profile (DP) was selected as a dysarthria assessment tool to identify the concurrent validity of the SLN-DAT since it is the second most voted tool and currently used at National Hospital Sri Lanka. The correlation was identified to the ordinary assessing areas in both Sinhala Language Newcastle Dysarthria Assessment Tool and Dysarthria Profile.

The correlations were computed among speech subsystems and normative age ranges of the normative population (20 – 40, 41 – 60, 61 – 70, 71 – 80, 80 +). The results suggest that 6 out of 10 sub-test correlations were statistically significant (negatively) and were greater or equal to  $r = -.39, p < .01$ , two-tailed.

The translated and adapted dysarthria assessment tool was selected out of three main tools: Frenchay Dysarthria Assessment (Pam Enderby, 1983 & Revised FDA, Pam Enderby and Rebecca Palmer, 2008), Dysarthria Profile (Robertson, 1982 & Revised RDA), and Newcastle Dysarthria Assessment Tool (Wendy Hackney & Kimberly Vietch, 2005). The most relevant assessment tool identified based on the views of both Speech and Language Therapists and students was N-DAT (Figure 2).

**Table 6.** Correlation & co-efficiency

Overall performances of SLN-DAT assessing areas	Correlation with Dysarthria Profile (r) ( $p < 0.001$ )
Jaw	0.857
Facial	0.700
Lip	0.968
Tongue	0.937
Respiration	0.924
Phonation	0.744
Resonation	1.000
Prosody	0.698
Articulation	0.951
Intelligibility	1.000

During the face and content validity analysis, the expert panel identified a few issues (Table 3) and those were addressed during version two of the tool adaptation. Similar issues were identified by other researchers also during their tool adaptation and translation processes such as issues on qualitative discourse levels, use of colloquialisms (Halai, 2007), transliteration (Prentice & Kinden, 2018),

the influence of linguistic specialist's knowledge and comprehension about the language and cultures (Birbili, 2000, p. 2) and ethics which are related to the social responsibilities in sciences such as medicine (Durgan, 2017). Those issues were addressed after several discussions and harmonization steps. Gunawardena, Hettiarachchi & Pillay in 2017 investigated the feasibility of adapting the Swallowing Quality of Life questionnaire into the Sri Lankan context and administering it to patients and they also discussed similar issues.

The present study used expert views to identify the face and content validity of the tool and a similar method was used by a few other researchers as well. Delphi panel was used to identify the face and content validity of their tools by Antonini et al, 2018; Knuijt S. et al, 2017; Nasstrom & Schalling, 2019. Cronbach's alpha was used on item validity as recommended by many researchers (Kaitelidou et al., 2019; Moores, Jones, & Radley, 2012). With regards to the content of the present adapted tool, an additional section was added with the recommendations of the experts in the Delphi panel based on the International Classification of Functioning. Collis and Bloch in 2012 discussed that most of the dysarthria assessment tools only focus on the impairment level except functional use of communication. Therefore, this tool added a new section to the original N-DAT using the International Classification of Functional model. ICF's conceptual framework can be integrated into everyday practice, serving as a tool for multidisciplinary client assessment and this can be useful in goal setting as well (McDougall et al., 2008). Therefore, SLN-DAT was adapted including the functional assessment section.

With regard to internal consistency/item validity in an assessment, researchers recommend that if a value is beyond 0.7 it is identified as a good internal consistency

(Cardoso et al., 2017; Cardoso et al., 2018). The SLN-DAT had .082 and it indicates the higher consistency of the items.

Finally to identify the concurrent validity the subtests of the tool (subsystems) were compared with another informal dysarthria tool and calculated intra class Correlation Coefficient, with 95% Confidence Interval and this showed excellent intra-rater reliability among both tools (Table 6).

Boateng et al., 2018 recommended using a normative sample to evaluate a newly developed tool as the initial step to identify its reliability and validity. The performance of the normative group in the present study showed a statistically significant (negatively) correlation between age and performances of each subsystem ( $r = -.39$ ,  $p < .01$ , two-tailed).

When compared to western norms and norms of the N-DAT original tool, there were a few changes observed in Sri Lankan population. For example, the Maximum Phonation Time calculation for the Sri Lankan sample was  $r = -.46$ , and among Australian healthy adults it was The S / Z ratio for SL population was  $r = -.39$ , where western norm shows and DDK rate was 3 times per second compared to that western norms showed 5 per seconds. Articulation was presented with a negative correlation to age in the rate of movement  $r = -.73$  Sequential Motion Rate of articulation  $r = -.52$  with the aging of the normative population.

4 out of 10 correlations were statistically negatively significant and were greater or equal to  $r = -.32$ ,  $p < .05$ , two-tailed for overall performances of the lip  $r = -.45$ , tongue  $r = -.40$ , voice  $r = -.32$  and articulation  $r = -.32$ . In general, the results suggested that with the aging from young to old, the speech sub-system performances were diminished.

Lee in 2015 explained the importance and significant differences of aging and speech. Burke and Shafto also discussed in 2004 the negative correlation of aging and speech production in their study and further they explained that the spoken forms of familiar words were also affected due to structural changes as well as due to failures in retrieving the sounds of the words (Burke & Shafto, 2004). The present research study provided evidence for the above statement, as there was a significant age-related decline observed in speech subsystems including respiration, phonation, resonance, prosody, and articulation.

## CONCLUSIONS

The absence of a formal dysarthria tool would negatively impact the reliability of the diagnosis of dysarthria. Apart from this, none of the informal dysarthria tools used International Classification of Functioning model-based assessments. This question was answered during the present research using an intense process of tool adaptation and translation method that resulted in a comprehensive dysarthria tool. Adding to this, the tool was validated using the normative sample it measures. One of the key limitations identified was within the validation process, as it was done only among the normative sample. Also, reliability measures were not analyzed during this study. It was recommended to analyze reliability and other criterion validity methods using clients with dysarthria to establish strong reliability and validity for this tool's measures. Therefore, the translated, adapted, and validated Sinhala Language Newcastle Dysarthria Assessment Tool (SLN-DAT) could fulfil a long-felt need in the clinical context of Sri Lanka.

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## The Relationship between Unexplained Infertility and Sedentary Lifestyle among Women in the Urban City of Colombo: Infertile Females Vs. Fertile Females

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### ABSTRACT

Infertility is defined as the absence of conception after 12 months of regular, unprotected intercourse. The objective of this study was to identify the relationship between unexplained infertility and sedentary lifestyle. A case-control study was conducted among 250 women (18 – 32 years), who were clinically diagnosed with infertility and fulfilled the inclusion criteria at Infertility clinics and Gynaecology wards at 3 hospitals in Colombo district. Required data were obtained from an International Physical Activity Questionnaire. Significant positive Association ( $P < 0.05$ ) were explored between the obesity category and female infertility. There was a significant influence of over fat (30.4%) level measured using SFT for female infertility. A significant positive correlation ( $P < 0.01$ ) was emphasized between low levels of IPAQ score (36.4%) and female infertility. Women aged  $\geq 28$  years, sedentary occupations and age at menarche were found to be associated with infertility ( $P < 0.01$ ). Sedentary life style behaviour among women in reproductive age, living in urban city of Colombo was found to be associated with female infertility.

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## INTRODUCTION

Infertility is defined as the absence of conception after 12 months of regular, unprotected intercourse. Unexplained infertility is infertility that is idiopathic, meaning that the cause is unknown even after a thorough examination. Any waking activity, such as sitting or leaning, with an energy expenditure of 1.5 metabolic equivalent task (MET) or less is considered as sedentary behaviour. Sedentary Life Style Behaviour may cause infertility in women. Female infertility can be an outcome of, physical issues, hormonal issues, and life style or natural components. Any condition that interferes with one or more of these factors will cause infertility. The relative prevalence of the aetiologies of infertility in a couple was defined by Burney, et al. in 2007.

- Male factor 25-40%
- Female factor 45-50%
- Both 10%
- Unexplained 10%

The prevalence of the causes of the female infertility are:

- Ovulatory dysfunction 30-40%
- Tubal/peritoneal 30-40%
- Unexplained 10-15%
- Miscellaneous 10-15%

Infertility is described as the inability to conceive by regular unprotected intercourse of at least one year. The couple was never able to conceive in primary infertility and there is trouble in conceiving after once conceived in secondary infertility.

Our research mainly focuses on infertility and association of sedentary life style among adult females in Sri Lanka. To attain our objective on how well the females are aware about their fertility difficulties, we will provide a standard questionnaire to females who are at Castle street hospital for women at Colombo, De

Soysa Maternity Hospital for women at Colombo and Colombo South Teaching Hospital, Kalubowila.

Our findings will help to identify how much females have awareness about their fertility and the association of day today lifestyle with infertility. From that we can develop programs to maximize awareness about female fertility, difficulties they face and individualized day to day life style status. This will be helpful to minimize fertility difficulties, maintain their activities of daily living by physiotherapy interventions and prevent secondary complications.

The main objective of this study was to identify the association between unexplained infertility and sedentary life style behavior among young female population in the urban city of Colombo. Specific objectives of the study are to assess and evaluate the sedentary life style behavior in the case study and the control study population, to assess and evaluate the fertility state of the case study and the control study population and to identify the association between unexplained infertility and sedentary life style behavior among women in the urban city of Colombo.

By researching on the awareness, we are hoping to encourage them to get to know more about the disease condition that they have and how to improve their lifestyle activities which are associated with fertility. This research will open up the pathways to spread awareness to adult females about how to adjust their lifestyle if/when they are expecting a child, we consider the process as a current social service that the country and world needs.

## MATERIALS AND METHODS

A case-control study was conducted among 250 women (125-fertile group/125- infertile group) in the age group of 18 – 32 years, infertile women who were clinically diagnosed as infertile and fulfilled the inclusion criteria at Infertility clinics and Gynecology wards and 1<sup>st</sup> trimester pregnant mothers who fulfilled the inclusion criteria of the control study as fertile women at 3 hospitals in Colombo district ; De Zoysa Maternity Hospital, Colombo, Castle Street Hospital for women (Teaching) and Colombo South Teaching Hospital, Kalubowila. We got the participant characteristics for both case study and control study populations. Inclusion criteria for case study population is only female subjects, the age group between 18-32 years, females who will give the consent only and females who were not diagnosed with a proper medical reason for their cause of infertility. Exclusion criteria for the case study population is women diagnosed with PCOS and other medical reasons, females with Family planning, females above the age of 32 years, females who refused to give consent , females who are illiterate, females with mental illness and couples with infertility due to male partner's medical reasons. Inclusion criteria for the control study population is only female subjects, the age group between 18-32 years, females who will give the consent only and females who were pregnancy positive. Exclusion criteria for the control study population is females above the age of 32 years, females who refused to give consent, females who illiterate and females with mental illness. For the study, our sample size would be 125 infertile women as a control group and 125 fertile women as a case group who fulfill the inclusion and exclusion criteria. Since we do not have statistics from the prevalence of infertility among women in Sri Lanka, we referred to the

journal article by Safarzadeh, A., Ansari, H. and Arbabisarjou, A., 2016. Comparison of the Life Style Between Secondary Infertile and Fertile Women: Considering Potential Socio-Demographic and Reproductive Confounding Factors in A Case-Control Study. And we consider the same sample size for our study.

A detailed paper with the information about the research, aims of the research, ethical issues which will be confidential throughout the research will be given to the participants. If the subjects need more details, the details will be explained clearly. The patient who has fulfilled the inclusion criteria and been referred by the consultant will be included in the study. A consent form and the information sheet containing all the necessary information regarding the research will be provided to the participants in all three languages: Sinhala, Tamil, and English. The information sheet contains the necessary details about the research, aims of the research, methods of the research, and ethical issues which will be protected throughout the research. Data collection will be performed under the supervision of the consultants, chief physiotherapist, and the chief nutritionist in the hospital. The convenient sampling method was practiced to recruit cases/ and controls upon completion of clinical diagnosis by Visiting Obstetricians and Gynecologists. Demographic details and medical history of the women were collected in an interview-administered female infertility questionnaire form. To evaluate activity level, International Physical Activity Questionnaire (IPAQ) short form was used. Height and weight were measured in all participants according to the standard methods. Then Body Mass Index (BMI) was calculated according to the standard equation and Skin Fold Thickness (SFT) was measured by using the skin fold caliper. Data were statistically analyzed using SPSS software version 23.0 using

Pearson Chi-Square test. Before conducting the data, collection and performing the test procedures on our study sample, a pre testing session was carried out to overcome the bias while performing tests and collecting data. This session was conducted using a randomly selected 10 infertile patients, from Colombo South Hospital, Kalubowila under the supervision of Dr. Rukshan C. Fernandopulle. This procedure was mainly aimed to improve the accuracy and the quality of the study by familiarizing the researchers regarding the performance of the measures; BMI and SFT and Infertility Interviewer administered questionnaire and IPAQ (short form) we used it in categorical method. IPAQ is validated in Sri Lanka by Dr. Charukshi Arambepola. This helped the Investigators to overcome the possible inconveniences and bias that could arise during obtaining data from patients and throughout the study period.

## RESULTS AND DISCUSSION

### Results

The study included 125 infertile females and 125 fertile females with the age of 18-32 years old. Sedentary life style among female groups were based on age, occupation, ethnicity and religion.

**Table 1.** Association of socio demographic characteristics with female regarding fertility state (n=250)

Characteristics	Category	Case - Infertile		Control - Fertile		P value
		Frequency	Percentage (%)	Frequency	Percentage (%)	
Age (Years)	18 - 22	6	2.4	12	4.8	0.0486
	23 - 27	49	19.6	47	18.8	
	28 - 32	70	28.0	66	26.4	
Ethnicity	Sinhala	115	46	101	40.4	0.029
	Tamil	5	2	9	3.6	
	Muslim	5	2	15	6	
Religion	Buddhist	101	40.4	91	36.4	0.051
	Catholic	14	5.6	10	4	
	Hindu	5	2	8	3.2	
	Islam	5	2	16	6.4	
Occupation	Sedentary	119	47.6	45	18.0	0.000
	Non sedentary	6	2.4	80	32.0	

As per age, the/a majority of respondents (both infertile and fertile women) were in the 28-32 years age category. The majority of infertile population were sedentary occupation category (47.6%). Most of the participants are Sinhalese (Case- 46% and Control - 40.4%) with a majority of Buddhist. (Case- 40.4% and Control - 36.4%).

Below Table 2 demonstrates the frequency and percentages of case and control population's independent variables of the 250 cases which are including the infertility interviewer administered questionnaire. Here we have mentioned independent variables: Age at 1<sup>st</sup> menarche, Interval between periods, regular or irregularity of menstrual cycle, contraceptive consumption and history of infertility.

When we consider an age at 1<sup>st</sup> menarche according to the results among 125 of case study or infertility population, no one in the < 8 year category of age at 1<sup>st</sup> menarche, 50%(125) of infertility females are in the 8-16 years category of age at 1<sup>st</sup> menarche, and no one in the >16 years category of age at 1<sup>st</sup> menarche. And when we consider about the control study or fertile female population among 125, 1.6%(4) fertile females are in the < 8 year category of age at 1<sup>st</sup> menarche, 48.4% (121) of fertility females are in the 8-16 years category of age at 1<sup>st</sup> menarche, and no one of fertile females in the >16 years category of age at 1<sup>st</sup> menarche.

When we consider an interval between periods, according to the results among 125 of case study or infertility population, no one in the less than 24 days category and 24-26 days category, 30% (75) of infertility females are in the 27-29 days category, 13.2% (33) are in the 30-32 days category, and 6.8% (17) are in the more than 32 days category. And when we consider about the control study or fertile

female population among 125, No one in the less than 24 days category and 2.4% (6) of fertile females are in 24-26 days category, 40%(100) of fertile females are in the 27-29 days category, 4.8%(12) are in the 30-32 days category, and 2.8%(7) are in the more than 32 days category.

When we consider the regularity of menstrual cycle, according to the results among 125 of case study or infertility population, 26% (65) of infertile females are in irregular menstrual cycle category and 24% (60) of infertile females are in regular menstrual cycle category. And when we consider about the control study or fertile female population among 125, 8.4% (21) of infertile females are in regular menstrual cycle category and 41.6% (104) of infertile females are in regular menstrual cycle category.

When we consider the contraceptive consumption, according to the results among 250 of cases and control population, no one uses Combined hormonal contraception, Vasectomy, IUCD – Intrauterine Contraceptive Device and Depo -Provera. According to the results among 125 of case study or infertility population, 35.6% (89) of infertile females do not use any contraceptive method, 5.2% (13) of infertile females use fertility awareness-based methods and 9.2% (23) of infertile females use male condoms. According to the results among 125 of control or fertile population, 46% (115) of fertile females do not use any contraceptive method, 1.2% (3) of fertile females use fertility awareness-based methods and 2.8% (7) of infertile females use male condom.

All those results are presented below in Table 02.

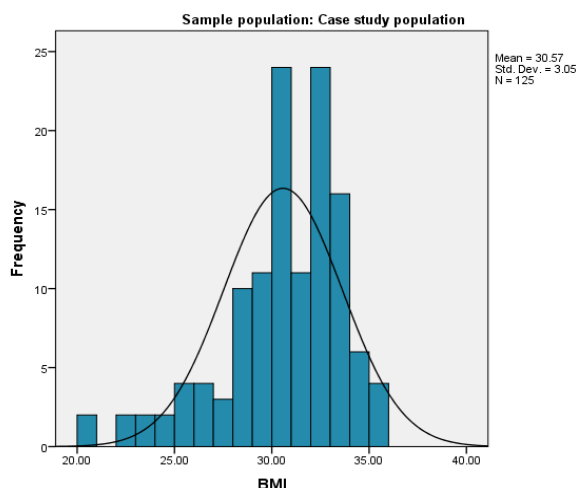
**Table 2.** Association of Fertility state of study population (n=250)

Independent variables	Categories	Cases-Infertile		Controls - Fertile		P Value
		Frequency	Percentage	Frequency	Percentage	
Age at 1 <sup>st</sup> menarche	<8 years	0	0	4	1.6	0.044
	8-16 years	125	50	121	48.4	
	>16 years	0	0	0	0	
Interval between periods	Less than 24 days	0	0	0	0	0.000
	24-26 days	0	0	6	2.4	
	27-29 days	75	30	100	40	
	30-32 days	33	13.2	12	4.8	
	More than 32 days	17	6.8	7	2.8	
Menstrual cycle	Irregular	65	26	21	8.4	0.000
	Regular	60	24	104	41.6	
Contraceptive consumption	1. No	89	35.6	115	46	0.000
	2.Fertility awareness-based method	13	5.2	3	1.2	
	3. Male condom	23	9.2	7	2.8	
	4.Combined hormonal Contraception	0	0	0	0	
	5. Vasectomy	0	0	0	0	
	6. IUCD – Intrauterine Contraceptive Device	0	0	0	0	
	7.Depo Provera	0	0	0	0	
	8. Others	0	0	0	0	
History of infertility in the family	Yes	12	4.8	2	0.8	0.006
	No	113	45.2	12	4.8	

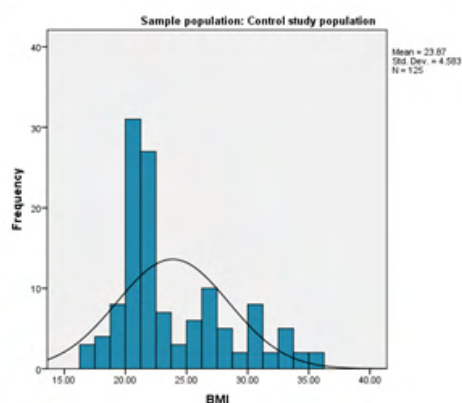
Body Mass Index (BMI) and Skin Folder Thickness (SFI) were analyzed under the descriptive statistics of physical characteristics of the study sample. (n=250) Mean of BMI of Infertility patients is 30.57 (SD – 3.05) and the mean of BMI of Fertility females - 23.87 (SD-4.583). According to the Figure 1. mean value of the BMI of the case study

population (Infertility females) is 30.57(SD=3.05). So that most of the infertile females are in the Obese category. According to the above Figure 2, The mean value of the BMI of the control study population (Fertility females) is 23.87(SD=4.583). So that most of the fertile females are in the Obese category. According to the Figures 15 and 16, there were significant relationship between BMI among the infertility and fertility groups. So that there is a significant influence of obesity category of BMI for infertility in females.

**Figure 1.** Frequency distribution of the BMI- Body Mass Index for case study population

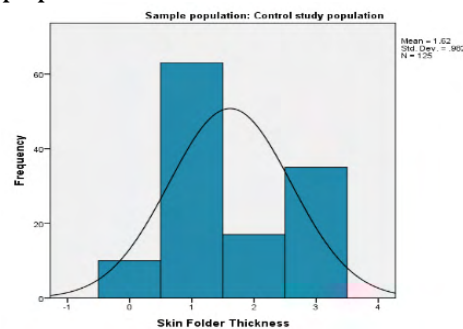


**Figure 2.** Frequency distribution of the BMI- Body Mass Index for control study population



According to the figure 3, the mean value of the infertile or case population is 2.55. (SD=0.602) Among 125 of case study population, a high frequency of infertile females are distributed in overfat range.

**Figure 3.** Frequency distribution of the Skin Folder Thickness (SFT) for case study population



According to the figure 4, the mean value of the fertile or control population is 1.62. (SD=0.982) Among 125 of case study population high frequency of fertile females are distributed in average range.

**Figure 4.** Frequency distribution of the Skin Folder Thickness (SFT) control study population

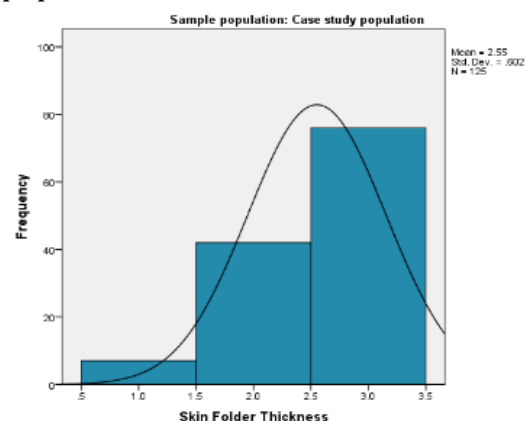
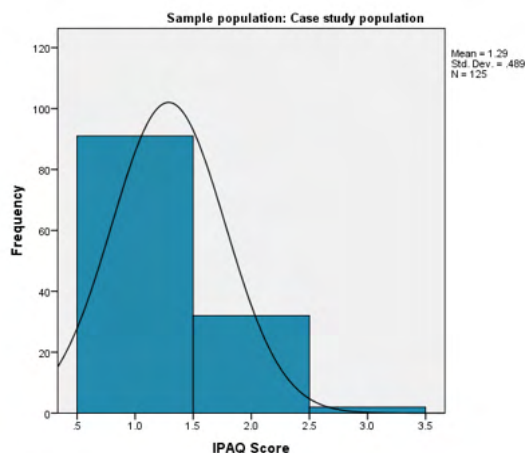


Figure 5 and 6 below demonstrate the Frequency distribution of the IPAQ-International Physical Activity Questionnaire score for case study population and control study population. According to the Figure 5, the analysis of IPAQ score and infertility relation, mean value of the IPAQ score of the case study population is 1.29(SD=0.489). Among 125

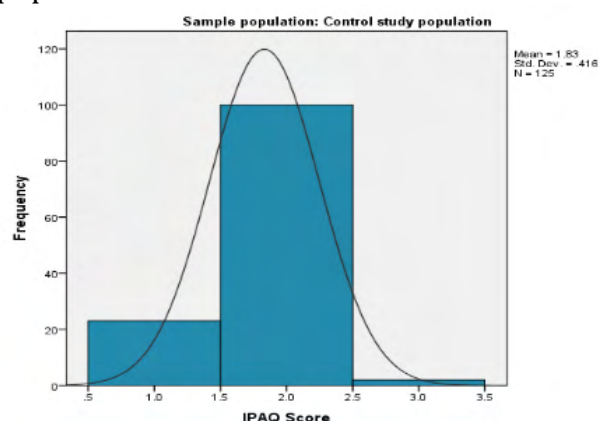
of case study population, a high frequency of females is distributed in low IPAQ score.

**Figure 5.** Frequency distribution of the IPAQ- International Physical Activity Questionnaire score for case study population



According to the Figure 6, the mean value of the IPAQ score of the case study population is 1.83(SD=0.416). Among 125 of case study population high frequency of females are distributed in moderate IPAQ score.

**Figure 6.** Frequency distribution of the IPAQ- International Physical Activity Questionnaire score for control study population



Finally we demonstrate the IPAQ score levels of case study and control study population. According to that among 125 of infertility population, 36.4% of infertility females are in the low level of IPAQ score, 12.8% infertility females are in the moderate level of IPAQ score and the

0.8% infertility females are in the high level of IPAQ score. So that there is a significant influence of low level of IPAQ score for infertility in females. And when we consider about the control study or fertile female population among 125 of fertile female population 9.2% of fertile females are in the low level of IPAQ score, 40.0% fertile females are in the moderate level of IPAQ score and the 0.8% fertile females are in the high level of IPAQ score. So that there is a high number of fertile females are in moderate level of IPAQ score.

A Pearson correlation test was performed statistically to find out the relationship between BMI and infertility, SFT and infertility, and IPAQ score and infertility.

Variable	P Value	Confidence Interval
BMI and Infertility	0.011	95%
SFT and Infertility	0.000	95%
IPAQ score and infertility	0.000	95%

BMI, SFT and IPAQ had significantly associated with infertility ( $P < 0.05$ ). Significant positive correlations ( $P < 0.05$ ) were emphasized between obesity category of BMI and infertility in females. There was significant influence overweight (30.4%) category of SFT for infertile females. Significant positive correlations ( $P < 0.01$ ) were emphasized between low level of IPAQ score (36.4%) and infertility. Age at 1st menarche, interval between periods, regularity/ irregularity of the menstrual cycle, contraceptive consumption family history of infertility had significantly associated with infertility ( $p < 0.05$ ).

## Discussion

A case-control study was carried out to identify the relationship between

unexplained infertility and sedentary lifestyle behavior among women aged 18-32 years in the urban city of Colombo.

The study conducted a sample of 250 subjects (125-Infertile females and 125 – Fertile females) based on the inclusion and exclusion criteria. Body Mass Index and Skin Folder Thickness were taken to analyze the data and all the other data were gathered by infertility interview-administrated questionnaire and IPAQ-International Physical Activity Questionnaire. The fertility rate for Sri Lanka in 2020 was 2.177 births per woman, a 0.77% decline from 2019.

As per age, the majority of respondents (both infertile and fertile women) were in the 28-32 years age category. The majority of the infertile population were sedentary occupation category (65.6%). Most of the participants are Sinhalese (Case- 46% and Control – 40.4%) with a majority of Buddhists. (Case- 40.4% and Control – 36.4%).

From the case population according to age category those infertility females are divided to 18-22 years 6(2.4%), 23-27 years 49(19.4%), and 28-32 years 70 (28%) accordingly in Case population. In the control population according to age category those fertile females are divided to 18-22 years 12(4.8%), 23-27 years 47(18.8%), and 28-32 years 66 (26.4%) accordingly in the Control population. The P-value for the age group category is 0.048.

In Ethnicity characteristics, according to the case population analysis results, there are 115 Sinhalese (46%), 5 Muslims (2%), and 5 Tamils (2%). According to the control population analysis results, there are 101 Sinhalese (46%), 15 Muslims (2%), and 9 Tamils (2%). The P-value for this category is 0.029. In the case of the population according to Religion

characteristics results were Buddhist 101 (40.4%), catholic 14(5.6%), Hindu 5(2%), Islam 5(2%) In case population Occupation category results are sedentary 119 (47.6%) and non-sedentary 6(2.4%). According to the results of this study, the age ( $P=0.0486$ , 95%CI), ethnicity ( $P=0.029$ , (95%CI), religion ( $P=0.051$ , 95%CI – Confidence Interval), and occupation ( $P=0.000$ , 95%CI) were significantly associated with fertility state.

According to the results of this study, the age at 1<sup>st</sup> menarche ( $P=0.044$ , 95%CI), the interval between periods ( $P=0.000$ , 95%CI), menstrual cycle ( $P=0.000$ , 95%CI), contraceptive consumption ( $P=0.000$ , 95%CI), and history of infertility in the family ( $P=0.006$ , 95%CI) were significantly associated with fertility state. Also, when considering the occupation of the study sample, in the case of population, the sedentary occupation frequency is 119(47.6%). non-sedentary frequency is 6(2.4%). When considering the control group, the sedentary population frequency is 45(18%). Also, the control group non sedentary population frequency is 80(32%). According to the above results, the control group non-sedentary population is higher than that of the case group non-sedentary population. It determines the sedentary behavior which directly has affected unexpected infertility among the female population.

## CONCLUSIONS

The study concluded that significant positive relationships were emphasized between infertility and sedentary lifestyle behaviour including activity level, BMI- Body Mass Index, and SFT – Skin Folder Thickness. A significant positive relationship was determined between infertility and the age of the patients. Furthermore, patients who were  $\geq 28$  years were more prone to be infertile. When considering the occupation, there is

a significant positive relationship between sedentary occupations and the infertile female population. A significant fair positive relationship was denoted between the age at menarche and infertility state. Additionally, high BMI, overfat SFT, and a low score of IPAQ – International Physical Activity Questionnaire are common among infertile female patients in Sri Lanka. Therefore, it is recommended that measurement BMI, SFT and IPAQ score of infertile women is an essential component in clinical practice in Sri Lanka in order to minimize further complications of infertility and to minimize the non-communicable diseases in Sri Lanka. Finally, we determined relationship between unexplained infertility and sedentary life style behaviour among women in the urban city of Colombo.

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## Reasons for Cessation of Exclusive Breastfeeding in the Asian Countries: A Systematic Review

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### ABSTRACT

Breastfeeding is the most cost-effective intervention in infant nutrition which also can prevent common childhood infections. This systematic review aims to explore the reasons for the cessation of exclusive breastfeeding in Asian countries. A literature search was carried out in electronic databases such as PubMed, CINAHL, Discover and Medline. Out of 590 research studies found, eight studies were selected for the systematic review using the PRISMA flow chart. When analyzing those studies, they were categorized under three main themes, such as factual or perceived insufficiency of breast milk, poor consecration by the mother, influence from traditions, customs and an unsupportive working environment that making breastfeeding impracticable. This systematic review suggested that intervention programs to improve exclusive breastfeeding in the Asian region should focus on promoting female nutrition and positive social attitudes towards exclusive breastfeeding. The intervention by the relevant governments is recommended to establish by law, a supportive working environment for exclusive breastfeeding.

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## INTRODUCTION

Breastmilk is the ideal nutrition for the human infant. It can prevent common childhood infections. The World Health Organization (WHO) (2003) has recommended that breastfeeding should be initiated within the first hour of life and continued exclusively for six months without other liquids or solids except for the vitamin supplements, medication and oral rehydration solution. Breastfeeding can be continued for up to two years or more with appropriate supplementary food (WHO, 2003).

Commercial production of infant formulae began in the 19<sup>th</sup> century which became a huge industry (Sethi et al., 1994). The manufacturers created an illusion that infant feeding formulae were comparable or even superior to breast milk. (Papastavrou, 2015) resulting in a wave of fashion ensued among women in the industrialized countries who, immediately adopted to formula feeding of their babies (Papastavrou, 2015). Although, the benefits of breastfeeding to the mother and the baby were shown during the late 20<sup>th</sup> century (Papastavrou, 2015), mothers throughout the world still keep out of breastfeeding for various reasons. The situation is much worse in developing countries in the Asian and African continents.

Consequently, the global rate of Exclusive Breastfeeding (EBF) remains around 34%, which is far below in developing countries of Africa and Asia. The WHO & United Nations International Children's Emergency Fund (2014) has planned to achieve the global target of 50% of babies at six months to be exclusively breastfed by the year 2025.

Malnutrition, being a significant health problem in the Asian region which houses almost 70% malnourished children of the world (Akhtar, 2016). The greater proportion of this is in the South Asian region; India alone accommodating 61 million of stunted children (Black et al., 2008), over 8 million of that having Severe Acute Malnutrition (SAM) (Ahmed et al., 2014). The WHO and the UNICEF have estimated that 820,000 children under 5 years can be saved annually by promoting EBF (UNICEF and WHO, 2016).

This systematic review, therefore, tries to explore the reasons for cessation of EBF in the Asian countries.

## METHODOLOGY

### Strategy and selection criteria

A systematic and comprehensive search of literature published between 2015 and 2020 was done on electronic databases such as CINAHL, PubMed, Discovery and MEDLINE using the terms; "breastfeeding", "cessation", "stop", "discontinuation", "early weaning", "early termination", "exclusive breastfeeding period" and "within six months of life". Due to the lack of the required number of studies the search was extended up to 2012. The search was limited to studies published in English, although, this would incur some selection bias (Smith & Noble, 2014).

### Inclusion and Exclusion Criteria

Research articles published in the Asian countries between 2015 to 2020 (qualitative, quantitative and mixed type studies) concerning the reasons for cessation of EBF were selected for the review initially. Since there was no adequate number of studies, the search

was extended up to 2012. Then, following the PRISMA chart (Kelly et al., 2016), newspaper articles, book chapters, secondary data research articles, systematic reviews and literature review articles were excluded.

The population of interest for the review was mothers of full-term healthy babies who ceased EBF early due to various reasons. Therefore, literature concerning mothers of twin, preterm or congenitally abnormal babies and chronic illnesses in mothers preventing EBF were excluded. The duration of EBF was determined according to the WHO definition (WHO, 2002). The time of initiation of breastfeeding was not considered in the study.

At the end of a systematic and comprehensive literature search, 590 articles comprising of 355 articles from PubMed, 29 articles from MEDLINE, 15 from CINAHL and 191 from Discover were selected for review. Out of these, there were 432 duplicate articles and 14 abstracts where the full articles were not available which were excluded from the study. Out of the remaining 144 articles, two were systematic reviews. From the remaining 142 studies, 124 articles did not contain reasons for cessation of EBF and were excluded. The remaining 18 studies were analyzed for the strength of the methodology and relevance to the topic of the review.

### **Quality assessment**

Articles of best quality and relevance were selected for the review using a standard appraisal tool (Higgins et al., (2011). In this systematic review, the Critical Appraisal Skills Program (CASP 2018) tool (Appendix 1), one of the best for critical appraisal of qualitative research

methodology (Kmet et al., 2004; CASP, 2018) was used. The tool consists of ten questions, each focusing on a different methodological aspect of the qualitative research study. It is considered user friendly for novice qualitative studies and is endorsed by Cochran and WHO for qualitative evidence synthesis (Long et al., 2020). Finally, eight articles were selected for the systematic review.

Perera et al. (2012) have conducted a prospective cohort study on 500 randomly selected babies in the Gampaha district, Sri Lanka. They were assessed at two, four and six months irrespective of their feeding practices. The reasons for cessation found in the study were, inadequate breastmilk 74.7%, inadequate weight gain by the baby 98.3% and mother returning to work 98%, while 28% cited other reasons for cessation of EBF.

Zhou et al. (2018) conducted a cross-sectional retrospective study to identify the factors affecting feeding practices among Chinese mothers in China and Ireland. Breastfeeding initiation was high in both groups being 87.2% in Chinese mothers in China (CMC) and 75.6% in Chinese mothers in Ireland (CMI). In CMI group, this rate dropped to 49.1% by three months and to 28.4% by six months ( $p < 0.05$ ). However, introduction of water within the first week was higher among CMC as opposed to CMI. Insufficient breastmilk, returning to work or study and mother thought it was time to stop breastfeeding were the main reasons in both groups of mothers to stop breastfeeding. The mothers of CMI group thought that formula feeding was easier and more convenient, but the mothers of CMC group thought otherwise. In contrast, the mothers of CMC group were more

motivated and determined to continue EBF as opposed to CMI group.

Nassar et al. (2014) have conducted an exploratory study to find out the determinant of breastfeeding practices in Kuwait in December 2012. According to this study, only 26.5% of the mothers had continued breastfeeding for six months or more. Separate family housing, higher maternal age, late initiation of breastfeeding, maternal employment, lack of breastfeeding facilities at work-place, breastfeeding information given after the birth and maternal and infant sickness were the factors influencing early cessation of breastfeeding. In contrast, father's support has been shown to encourage the practice.

Sun et al. (2017) have conducted a prospective cohort study to identify the self-reported reasons for cessation of EBF. Mothers were categorized into three groups according to the time they stopped EBF within one month, between two to four months and between five and six months. Lack of milk production being 38.5%, 56.7% and 52.4% respectively for the three groups was the main reason for cessation of EBF, returning to work was the next with 11.5% in group one, 38.3% in group two and 47.6% in group three.

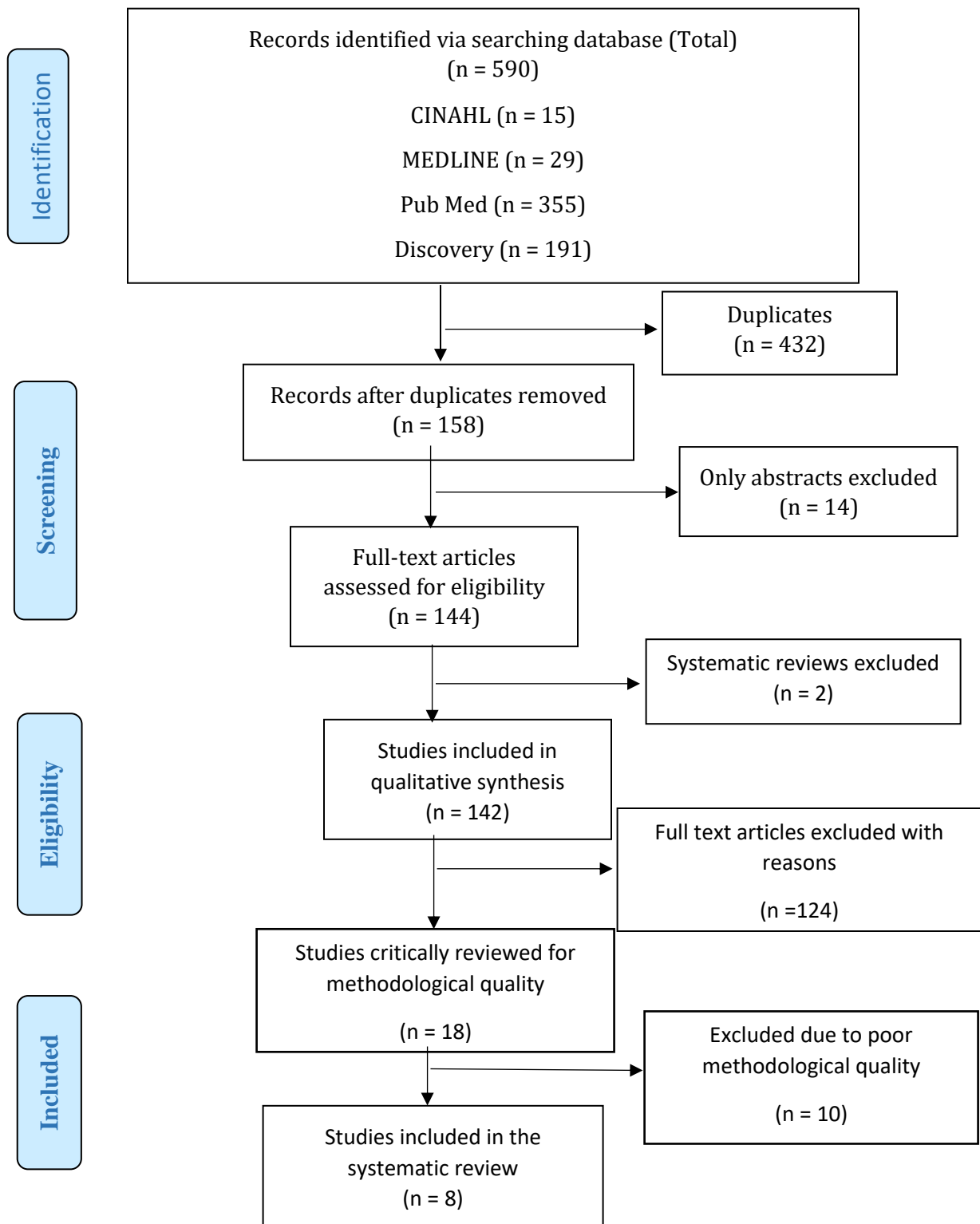
Mohite et al. (2018) have conducted a hospital based cross-sectional study to identify factors associated with cessation of EBF in Maharashtra, India. According to this study overall prevalence of EBF among primi-para was 22.85% with gradual and sudden cessation being 20% and 2.85% respectively. Insufficient milk production was the main reason for early cessation with infant illness and maternal

sickness contributing equally at 12.5% each.

Rathnayake et al. (2018) conducted a clinic based descriptive cross-sectional study in Kandy district in Sri Lanka on randomly selected 354 mothers. The estimated rate of EBF in the study population was 50.8% while 98.9% were aware of EBF but could not define it exactly. Perceptive inadequacy of breastmilk 52.9% was the main reason for cessation of EBF found in the study which has led most mothers in the study to introduce various supplementary foods and drinks such as water, fruit juices, mashed rice and formula milk. It also highlights the significance of peer influence on EBF which significantly modify the breastfeeding practices in the Asian region and the barriers in continuation of EBF for the working mothers such as difficulty in obtaining maternity leave and poor response and attitudes of the heads and the colleagues. Other key finding was the poor knowledge of how to store and feed babies with expressed breast milk among working mothers.

Chang et al. (2019) have conducted a hospital based prospective study in southern Taiwan to assess the infant feeding patterns and the reasons for cessation of EBF. The EBF rate at one month was 40.1% which dropped to 29.3% at two months. The major reasons for cessation of EBF found in the study were perceived low milk quantity, maternal choice, medical conditions in mother, inconvenience/fatigue due to breastfeeding, returned to work or school, sore breasts or nipples or 'too painful' and baby centered factors.

**Figure 1.** PRISMA Flow Chart of Article Selection



Adopted from Liberati et al., (2009).

## RESULTS AND DISCUSSION

### Results

**Table 1.** Summary of the results of the systematic review

No	Author	Participants	Results
1	Perera et al., 2012 Sri Lanka	A prospective cohort study on 500 randomly selected Babies	Not enough milk 74.7% Inadequate WT gain 98.3% Returning to work 98.0% Others 28.4%
2	Zhou et al., 2018 China and Ireland	322 Chinese mothers living in China (CMC) and Ireland (CMI)	Formula Feeding easier 2.5% (CMC), 9.1% (CMI) Insufficient breastmilk 32.5% (CMC), 53.4% (CMI), Went back to work 35% (CMC), 27.9% (CMI), No adequate time for sleep 35.0% (CMC), 27.9% (CMI), Child sent to China 1.9% (CMI)
3	Nasar et al., 2014 Kuwait	Explorative study	Fathers' encouragement, Mothers' sickness, Residence, Age Time of starting BF in the workplace Time of receiving breastfeeding Baby's sickness
4	Sun et al., 2017 China	Prospective cohort study	Insufficient milk supply 38.5% Medical reasons 30.8% Lactational factors 19.2% Return to work 11.5%
5	Mohit et al., 2018 India	Hospital based cross sectional study on 140 mothers	Lactational factors Nutritional factors Lifestyle factors Psychological factors Medical factors Infant determinants
6	Rathnayake et al., Sri Lanka	Clinic based cross sectional study on 354 mothers	Breastfeeding only is not enough 52.9% Given water 91.4% Given fruit juices 83.9% Given mashed rice 71.3% Started formula feeding 16.1%
7	Chang et al., 2019 Taiwan	Postnatal survey	Perceived low milk quantity Maternal choice Medical conditions in mother Inconvenience/fatigue due to breastfeeding Returned to work or school Sore breasts/nipples or 'too painful' Baby cantered factors
8	Olang et al., 2012 Iran	Retrospective study	The physician recommended 54% Insufficient breastmilk 28% Family recommendation 20% Baby excessively crying 17% Nonspecific reasons 17%

Olang et al., (2012) have conducted a retrospective study on 63,071 babies in all provinces of Iran between 2005 to 2006 period. The babies were separated into two groups, babies less than six months of age (n = 8,434) and more than six months (n = 52,637). According to the study, physician recommendation 54% was the key reason for the cessation of EBF before six months with insufficient breast milk 28%, family recommendation 20%, crying baby 17% and non-specific reasons 17% following successively. The study also stresses that urban living, using a pacifier and formula or other bottle feeding increased the risk of early discontinuation of EBF.

## Discussion

According to the results of our study, the main reason for cessation of breastfeeding in the Asian region is insufficiency of breast milk (Perera et al., 2012; Sun et al., 2017; Rathnayaka, 2018; Chang et al., 2019; Zhou et al., 2018; Mohite et al., 2018; Olang et al., 2012). Insufficient breast milk is a major reason for the cessation of EBF worldwide. Lewallen et al., (2006) stated that it causes cessation of EBF in 34.7% of the southern USA. Maonga et al., (2016) also have stated insufficient breast milk or perceived insufficiency caused 12.4% of mothers to cease EBF in Tanzania. Insufficiency of breast milk could be true insufficiency of breast milk or perceived insufficient milk production (Hill & Humenick, 1996). The most important step of intervention is the differentiation between the two. The healthcare providers should be able to differentiate the true insufficiency of milk production (WHO, 2003). If there is no true reduction of breast milk the mother should be reassured and advised on continuation.

True reduction in breast milk may be possible in the Asian region owing to more stress on the nutrition of male children in the agricultural communities in the region (Marcoux, 2002). Wagner et al., (2013), Teich et al., (2014) and Vijayalakshmi et al., (2015) also have stressed the effect of maternal nutrition on the cessation of EBF and the low quality of breast milk. It is high time to change those attitudes towards female nutrition because only a healthy female- can give birth to healthy offspring.

The second theme that emerged from the study was the poor motivation of the mother and dedication towards breastfeeding and to her child. (Mohite et al., 2018; Zhou et al., 2018; Sun et al., 2017). In the studies the mothers have stated that they are overwhelmed with household work (Mohite et al., 2018), return to work or studies (Zhou et al., 2018; Sun et al., 2017), formula feeding is easier (Zhou et al., 2018), worried about a child being attached to mother too much (Zhou et al., 2018). These reasons signify the poor desire to continue breastfeeding. When mothers are overwhelmed with household work, together with lack of family or partner support they tend to neglect to breastfeed (Ratnasiri et al., 2017). Further to that, Tsai, (2013) has also said that mothers cease EBF early due to the hostile work environment towards breastfeeding.

Else-Quest et al. (2003) state breastfeeding help develop mother-child bond. Furthermore, Kirkland & Fein, (2003) says breastfeeding enhances confidence and self-esteem in mother further increasing breastfeeding self-efficacy. Insufficient knowledge about breastfeeding and its benefits results in early cessation of EBF (Chezem et al.,

2003). Vijayalakshmi et al., (2015) have shown that with appropriate support and education majority of mothers overcome these problems. If the mother has the motivation and determination, she can overcome these barriers and continue breastfeeding longer (Sun et al., 2019; Lewallen et al., 2006). The Mother can express and store milk before she leaves for work and even during work. During work, a short break can be taken to express and store breast milk to feed the baby once she goes back home.

In line with the findings of our study, the third theme which negatively affects EBF practice was the lack of family and social support, the effects of traditions and culture and poor support from the healthcare workers (Rathnayke et al., 2018; Mohit et al., 2018). Traditional practices and beliefs, interferences by the relatives, friends and neighbors are the most important of them. Alianmoghaddam et al., (2018) also have shown the significance of peer influence and physician role in the modification of breastfeeding in New Zealand. In the majority of Asian countries, practices like pre-lacteal feed, giving various home remedies (Ghutty in India and Pakistan, "*Ratha kalkaya*" in Sri Lanka) to the baby are common (Papastavrou et al., 2015; Rathnayke et al., 2018).

Physicians also play an important part in breastfeeding cessation in the Asian region. Chang et al., (2019) stressed the mothers have ceased EBF due to poor approach by the healthcare worker, while Olang et al., (2012) stated that mothers have started formula feeding on physician recommendation. Traveras et al., (2004) also have shown that mothers will not cease breastfeeding within the first three months unless encouraged by physicians.

It has been shown that 26% of primary care physicians did not encourage breastfeeding (Leavitt et al., 2009). In contrast, in a study in France, Labarere et al., (2005) have shown that primary care physicians can increase the duration of breastfeeding. McFadden et al., (2017) stressed that lack of knowledge in healthcare providers is a significant problem forcing the mothers to seek advice from laypersons. Therefore, these studies highlight the need for breastfeeding education, which should not be limited to prenatal mothers only healthcare providers also need regular training and education.

No legislation is facilitating lactating mothers to take maternity leave even during the EBF period in a majority of Asian countries. The situation is worse in the private sector. In most of the review studies, mothers have to go to work has been mentioned as one of the main reasons for the cessation of EBF. Therefore, it seems necessary to have a community-oriented breastfeeding education on the benefits of EBF, the responsibility of the society to support lactating mothers and to alleviate the impact of traditional beliefs and myths about breastfeeding.

## **CONCLUSIONS AND RECOMENDATIONS**

The main reasons for Asian mothers to give up EBF are insufficient breast milk. Insufficiency of breast milk may be true or it may only be perceived to be inadequate by the mother which needs to be detected early.

The next group of reasons for the Asian mothers to cease EBF is poor maternal motivation towards breastfeeding because of unsupportive home environment, the mother is overwhelmed

with household work or poor support from the partner.

Social and peer influence also plays a major role in modifying feeding practices in the Asian region. The customs and traditions of the society, the hostile environment in the workplace with negative attitudes from the employers and colleagues and the lack of facilities and the knowledge of how to express and store breast milk prevent even the most motivated mothers from the continuation of breastfeeding following return to work.

### Limitations

The majority of the researches in the study are hospital-based in design. However, the majority of mothers in the rural areas of India, Pakistan and other South Asian countries, except for the affluent and well-motivated, do not come to hospitals for childbirth. Therefore, the true situation of the EBF state in some countries may not be reflected in those studies.

The retrospective studies have an inherent weakness of recall bias. There is also a lack of studies representing all the countries in the Asian continent, which may limit the generalizability of the findings of this study.

### Recommendations

The study recommends improving maternal nutrition, education about the benefits and advantages of EBF and its real meaning, and changing the attitudes to overcome negative influence by the traditions and customs in the communities. Government-led change of policies should be introduced to make the workplace environments friendly for breastfeeding. The private sector employers also have to be made compelled to comply with these policies and provide facilities to breastfeeding mothers. In

addition to that prenatal mothers and mothers in the EBF period should be taught how to express and preserve breast milk for baby while the mother is away at work.

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## A Systematic Review on the Effect of Music Therapy on Post-Operative Pain in Adult Patients

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ARTICLE INFO	ABSTRACT
<p><b>Article history:</b></p> <p>Received: 26 July 2021 Accepted: 26 September 2021</p> <hr/> <p><b>Keywords:</b></p> <p>Effect, Effectiveness, Music therapy, Post-operative pain, Post-surgical pain, Therapeutic music</p> <hr/> <p><b>Citation:</b></p> <p>Gangabadaarachchi, D.M. &amp; Wijedasa, P. H. S. (2021). A Systematic Review on the Effect of Music Therapy on Post-Operative Pain in Adult Patients. <i>Proceedings of SLIIT International Conference on Advancements in Sciences and Humanities, Colombo</i>, 555-565</p>	<p>The purpose of this systematic review is to identify the effect of music therapy on post-operative pain in adults through findings of critically appraised, selected literature. A systematic search of Cumulative Index to Nursing and Allied Health Literature (CINAHL), PubMed, and University of Liverpool John mores DISCOVER, Medline and Google Scholar was conducted using the key terms such as Effect, Effectiveness, Impact, Music therapy, Therapeutic Music, Post-Operative Pain , Post-Surgical Pain. Total number of 1177 records were identified through data base searching and forty three were selected following screening, Only twelve were eligible meeting inclusion criteria and total seven articles were finally selected after the critical appraising for methodological quality with using two tools. The findings of this systematic review indicated that music therapy was effective to reduce postoperative pain and analgesic consumptions in adults with significant positive effects to reduce post-operative analgesic consumptions, and postoperative blood pressure. Findings elaborated lead to emerge two main key themes: Music therapy is an effective intervention to reduce Post-Operative Pain reduction in adults, and music is an effective complementary therapy. All studies included in this systematic review highlighted that generally music therapy is not a standard procedure for reducing post-operative pain but as a complementary therapy that can be combined with standard pharmacological intervention.</p>

## INTRODUCTION

Post-operative pain is a result of a surgical tissue damage which can be considered as an acute nociceptive pain presenting with inflammatory responses (Elliott and Smith, 2011). According to the national survey in United States, in last five years, out of 300 adults who had undergone surgery, 86% of adults have experienced postsurgical pain and 75% of those reported pain severity as moderate to extreme (Gan et al., 2014). Adult patients have been prescribed with opioid medication post operatively (Cole and Biondo, 2014). But research findings show that patients do not receive optimal dose of analgesic or opioid for satisfactory post-operative pain control due to the risk of opioid related adverse events and fear of addictions (McCaffrey and Locsin, 2009; Gang, 2017). As stated by Mesuda et al. (2005) non-pharmacological therapies in combination with analgesics is effective to improve adult patients' satisfaction by reducing post-operative pain. Some of these complementary therapies are music therapy, relaxation techniques, guided imagery, acupuncture, nutritional therapy and massage therapy (Hinman, 2004). Music is one of the alternative therapies which has been used for surgical pain management since 1914 (Hole et al., 2015). It is also a nontraditional (Nilsson, 2008) and non-pharmacological intervention that can be used to reduce pain (Masuda et al., 2005). Further it is one of the adjunctive therapies among the other therapies (Good et al., 2010), music is one of the therapeutic interventions which has existed for centuries but nowadays it is increased a favor for using in hospital setting (Vaajoki et al., 2013).

The approach to music therapy for post-operative pain management in world health care settings supports principles of optimal healing environment that incorporates patients' mind – body connection (Lincoln and Johnson, 2009). Annually 266 to 360 million surgeries are done in the world and 40% to 65% patients suffer with moderate to severe post-operative pain (Rooij et al., 2018). Institute of Medicine of United States (2011) reported that 86% of adult patients undergoing surgery report postoperative pain, with 88% from moderate to severe intensity. Uncontrolled post-operative pain may cause dissatisfaction about treatments, prolong hospitalization, delayed wound healing/ recovery or morbidity, impaired function and quality of life (Allred et al., 2010). Moreover development of chronic pain is experienced in 10% to 60% of patients due to poorly managed acute pain after surgery (Wang et al., 2016). When pain control is inadequate, it may cause risk for impaired respiratory function, anxiety, atelectasis and prolong stress response (Crowe et al., 2008). In addition to that, increased hospital stay, immunosuppression due to prolonged body stress and surgical failure affect negatively on patients mental and physical wellbeing as consequences of uncontrolled post-operative pain (Economidou et al., 2012). Moreover, using music as a complementary therapy in combination with opioid medication has an effect to reduce post-operative pain and also it protects patients from adverse effects and abuse of opioid by minimizing opioid usage (Hole et al., 2015). With regards to that, the attention and favor for

adopting music as a therapeutic intervention is increased in hospital setting for operative or procedural intervention (Joanna Briggs Institute, 2014). Therefore among researchers and world health systems, there is a great concern about music therapy and its psychological, and physical effectiveness on post-operative pain for successful pain management (Kleiber and Adamek, 2013). Health care system has identified the importance of best practice guidelines of music therapy for evidence based practice (Miller et al., 2016). Studies done in European countries such as Greece (Sfakianakis et al., 2017), West India (Poulsen, 2017), United States (Clayton et al., 2018) have shown favor in music therapy practice in surgical settings for post-operative pain management.

Moreover Asian countries such as India (Jose et al., 2012), Malaysia (Santhana et al., 2015) and Cina (Mei et al., 2011) interest have shown about the effect of music therapy for adults' post-operative pain. There are some arguments with existing literature whether music therapy has a certain effect to reduce post-operative pain and related physical and psychological outcomes or not (Economidou et al., 2012; Sen et al., 2010; Robleda et al., 2014).

This topic yields few scholarly articles when searched in the World Wide Web. A thorough search would not show any result regarding studies done in Sri Lanka. The most appropriate research approach for this work would be a survey based on primary data. However, this will not be feasible due to cost and time constraints. Secondary data-based case study technique is also not practicable due to the lack of sufficient disclosed data. Systematic review is used as the data gathering and analysis strategy for this study considering the benefits and

drawbacks of the various research methodologies.

### **Significance of the study**

This study will be significant for two main reasons. First one is, findings of current systematic review can be used by health care professionals for evidence based practice with much confidence than primary research articles. This is because all included articles were critically appraised by valid appraisal tools. Second one is, studies done with music therapy guidelines for post-operative pain management are still in infancy level (Miller et al., 2016). Therefore this systematic review will help to improve best practices in line with national and international guidelines and protocols through high quality findings.

### **Aims and Objectives of the study**

The current review aims to weigh the existing findings of quality primary articles and get a clear conclusion on the problem; the effect of music therapy on post-operative pain in adult patients? The main purpose of the study is to identify the effect of music therapy on post-operative pain in Adult patients. Further specifically it is to identify the physical and psychological effects of music therapy on post-operative pain in adult patients. The current review will help clinical decision making and development of trustworthy clinical guidelines (Aromataris and Pearson, 2014) related to music therapy on post-operative pain management through a valid evidence base.

### **MATERIALS AND METHODS**

For conducting this systematic review, steps identified by Edoard and Alan (2014) were followed. They were formulating research question, searching for studies, study selection and critical appraisal, data extraction, interpretation

of findings and recommendation to guide nursing practice (Edoard and Alan, 2014).

### Formulating research question

PICO format (Stern et al., 2014) is used for formulating the research question for this review as it is most suitable for none other than “effectiveness reviews” (Tufanaru et al., 2015) which evaluate the effectiveness of intervention or therapy and its impact or outcome (Munn et al., 2018). PICO is the well-known approach to formulate the question (Stern et al., 2014) and comprehensive guidance (Higgins and Green, 2011) for this type of reviews.

**Figure 1. PICO**

Population	Outcome	Intervention
Adult Patients – above 18 years	Post – operative pain	Music therapy (Intervention)

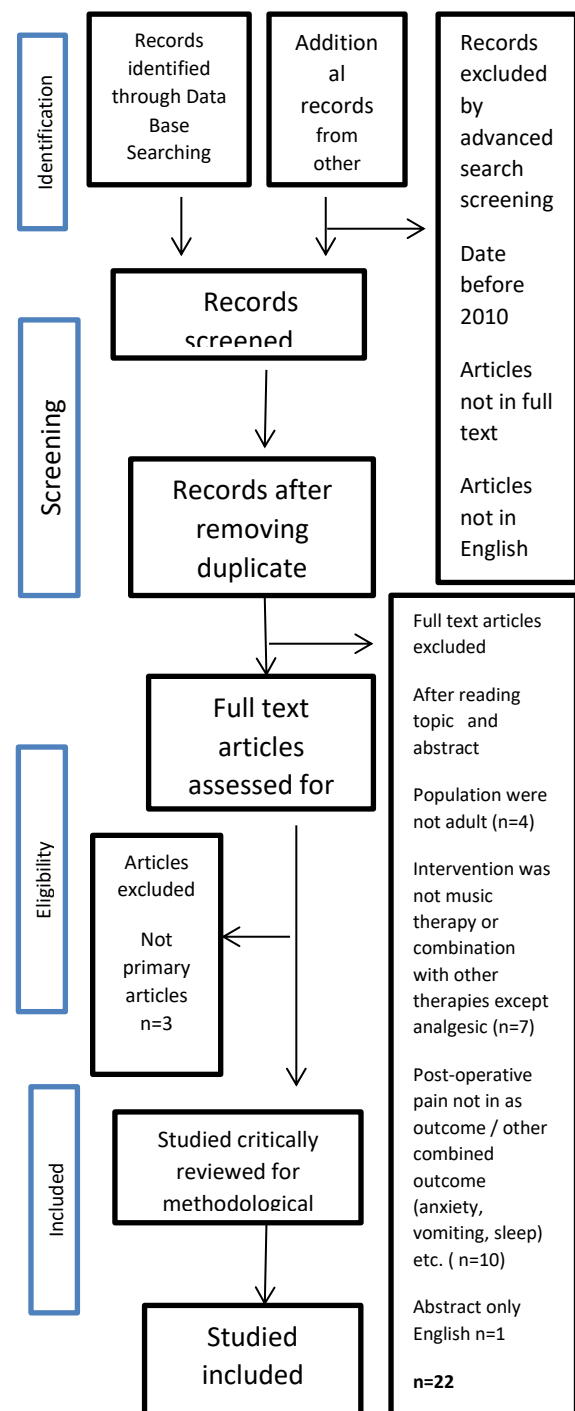
### Searching for studies

Information relevant to the topic of interest is searched through variety of databases using the key words Music therapy OR therapeutic Music AND Post-Operative Pain OR Post-Surgical Pain AND Effect OR Effectiveness OR Impact. Many databases such as Cumulative Index to Nursing and Allied Health Literature (CINAHL), PubMed, and University of Liverpool John mores DISCOVER, Medline and Google Scholar were searched to gather articles. A total number of 1177 were identified.

### Study selection

Advanced search of databases and other sources were applied to select full text journal articles published from 2010 to 2021 in English language only. All articles ordered according to relevance of key words. Records were screened and article number reduced to 43 when the exclusion criteria is used. There were 34 articles

after removing duplicates. Out of the thirty four articles some were removed as the adult population is not included and the intervention was not music therapy. After eligible full text records were reduced to number of seven all articles were thoroughly reviewed. Most of the articles were published within last five years but few articles of before last five years were also included considering the methodological quality and contents. Finally according to PRISMA Flow chart 7 articles were selected and included for this **Figure 2. Selection of Article-PRISMA Flow chart** Adapted from Moher et al. (2009)



systematic review. Most of the articles were published within last five years but few articles of before last five years were also included considering the methodological quality and contents. Finally according to PRISMA Flow chart (Figure 2) seven articles were selected and included for this systematic review.

### **Critical appraisal**

Purpose of the critical appraisal is excluding the studies with low quality and identify the strengths and limitations of the included studies (Porritt et al., 2014). Two different tools were used to continue the critical analysis. First tool is Critical Appraisal Skill Program (CASP) which has created a number of appraisal tools for different types of research Critical (Critical Appraisal Skills Programme, 2020). Eight critical appraisal tools are included in CASP and particular suit to use for randomized control trials which have been the majority of this current review. Moreover it helps to reduce being biased in evaluating the quality of the research by determining the strength of the findings (Clarke and Oxman, 2003).

The second tool was the checklist of Joanna Briggs Institute (JBI's) reviewers' manual which has been released for appraising both qualitative and quantitative studies (Joanna Briggs Institute, 2014). As quasi experimental studies were also included in the current review, JBI Critical Appraisal Checklist for quasi-experimental studies released by Joanna Briggs Institute (2017) is used to assess the methodological quality of included quasi experimental studies. Each article is reviewed twice by the authors of this study.

### **Data Extraction**

Accurate data extraction is essential as a part of good and quality systematic review (Tufanaru et al., 2020). In this review data was extracted from the selected articles

via generating and concluding the needful data (Godfrery and Harrison, 2010). Since data extraction should be unbiased and reliable (Higgins and Deeks, 2009) standard data extraction forms were used for each article identifying the author, country, sample, research design, type of surgery, intervention group, control group, measurement and results.

## **RESULTS AND DISCUSSION**

Seven studies were included in this systematic review. Four out of seven studies are from Asian countries such as India (Jose et al., 2012), Malaysia (Santhana et al., 2015), China (Li et al., 2011) and Indonesia (Tan and Koerniawan, 2021). Three out of seven studies are from Europe countries such as Greece (Sfakianakis et al., 2017), North West Indiana (Poulsen and Coto, 2018), West Virginia (Kenny, 2018). Two articles were randomized control trials (Li et al., 2011; Sfakianakis et al., 2017), two were quasi experimental (Santhana et al., 2015; Tan and Koerniawan, 2021) another one article was in experimental pre-test post-test design (Jose et al., 2012). All articles indicated that music therapy is a complementary therapy with standard analgesic therapy. All articles found music therapy as an effective intervention to reduce post-operative pain in adult patients. Further two articles found that music therapy reduces analgesic consumption (Poulsen, 2017; Santhana et al., 2015) and the other three indicated reduction of blood pressure and pulse rate post operatively with music therapy (Jose et al., 2012; Kenny, 2018; Sfakianakis et al., 2017).

Finding elaborated above lead to emerge two main key themes in this systematic review. One is "Music Therapy is an effective intervention to reduce Post-Operative Pain (POP) and the other one is

“Music therapy as a complementary therapy” which are described below.

### **Theme One - Music Therapy is an effective intervention to reduce POP**

All of the articles referred in this systematic review have found music therapy as an effective intervention to reduce post-operative pain in adults (Jose et al., 2012 ;Kenny, 2018;Li et al., 2011;Poulsen, 2017;Sfakianakis et al., 2017;Santhana et al., 2015;Tan and Koerniawan , 2021). Similarly, positive effects of music therapy on post-operative pain control were also found in other researches (Masuda et al., 2005; Laurion and Fetzer, 2003; Sendelbach et al., 2006). It is further revealed that music therapy reduced the post-operative pain entailing different types of surgeries such as cardiac surgery (Jose et al., 2012) knee and hip placement surgery (Kenny, 2018;Santhana et al., 2015) spinal surgery (Lin et al., 2011; Poulsen, 2017) abdominal surgery (Sfakianakis et al., 2017) gynecological and orthopedic surgery (Tan and Koerniawan, 2021). Moreover proving these findings, Dale (2021) observed significant positive impact of music therapy on post-operative pain reduction in abdominal surgeries among adults, while similar effect were detected in spine surgery (Mondanaro et al., 2017), in total knee arthroplasty (Allred et al., 2010) and also in mastectomy (Tola et al., 2021). This ability of music therapy is used to alleviate post-operative pain as described in through gate controlled theory which explains the descending act of music therapy upon the messages of pain impulses from the site of injury to brain and blocking the neural gates, (Melzak and Katz, 2004) through which perception of the pain may be reduced (Sarafino, 2005). In the contrary, statistical findings presented that there was a post-operative pain reduction over time but not a significant difference on

pain score between music therapy group and control group post operatively (Allred et al., 2010). Furthermore there was no reported significant effect of music therapy to reduce POP by comparing pain and anxiety in selected orthopedic patients who have received a kit of non-pharmacologic strategies for pain in addition to analgesics to those who received usual pharmacologic management alone (Pellino et al., 2005).

According to some of the articles used for this systematic review, another positive effect of music therapy is decreasing the amount of analgesic consumption while reducing post-operative pain. Some other studies have reported that music therapy could reduce usage of analgesics postoperatively (Ebnesahidi and Mohseni, 2008; McCaffrey and Locsin, 2009; Tse et al., 2005; Tse et al., 2005). In spite of this, many studies presented almost same amount of postoperative analgesic usage and no significant reduction of amount between music therapy group and control group (Sendelbach et al. 2006; Voss et al. 2004). Even under General Anesthesia, music therapy had an increased mitigating effect on pain when patients were conscious compared to the control group who was only under general anesthesia (Hole et al., 2015). Intraoperative Music therapy also reduced use of analgesics under general anesthesia (Hole et al., 2015).

Therefore, music therapy can be reckoned as a non-pharmacological intervention having a positive impact on postoperative pain reduction, along with analgesics without additional side effects (Cepda et al., 2006; Good et al., 2005;Nilsson et al., 2003).

## **Theme Two – Music as a complementary therapy**

Complementary therapy can be used alongside with standard medical treatment (Zollman and Vickers, 1999). Proving this statement all studies included in this systematic review have been carried out music therapy not alone but with standard analgesic therapies for enhancing the effectiveness of post-operative pain management. Also literature provides evidence that effect of music therapy on post-operative analgesic consumption is uncertain. Use of analgesic was measured in two studies in the current review and found reduction of analgesic amount of postoperatively in intervention group compared to control group (Poulsen, 2017; Santhana et al., 2015). But there were no zero consumption of analgesic in music therapy group and both two group have some amount of analgesic usage with or without music therapy in these two studies (Poulsen, 2017; Santhana et al., 2015). Another study included in the current review done by Poulsen (2017) reported decreased pain scores and milligrams of morphine with therapeutic music. But Good et al. (2001) indicated, there were no significant differences of morphine consumption for post-operative pain between the groups. According to Good et al. (2002) the intervention group reported 9% to 29% less pain than controls among patients who received analgesic via PCA (Patient Controlled Analgesia). Another two of studies by Nilson et al. (2003) ;Nilsson et al. (2005) presented less morphine consumption in music therapy group, but requirement of paracetamol, ibuprofen were not significantly differ between control group and intervention group post operatively. Study of Sfakianakis et al. (2017) has explained that there were no significant differences using analgesic such as pracetamol, celoxocib or tramadol between experimental and

control groups at milligram but experimental group used less analgesic than control group.

When considering all above findings, music therapy is not a total replacement therapy instead of standard analgesic therapy, but as a complementary therapy that can be used to enhance effectiveness of post-operative pain management.

## **CONCLUSIONS**

Many adult patients suffer from poorly controlled postoperative pain, despite modern knowledge regarding pain and how to alleviate it. Therefore, modern health care system is considering non pharmacological, adjunctive therapies such as music therapy which can be effective to reduce post-operative pain. Results of this systematic review revealed music therapy has a positive effect to reduce post-operative pain in adult patients. Also it has some significant positive effect to reduce post-operative analgesic consumptions, and postoperative blood pressure. Therefore music therapy is convenient, affordable and free of side effects with the intervention of great physical and psychological effects for post-operative pain management. However each and every study in this systematic review noted that generally music therapy is not a standard procedure for reducing post-operative pain but as a complementary therapy that can be combined with standard pharmacological management. Therefore this current systematic review emerged with two main key themes, first one is that music therapy is effective to reduce post-operative pain. Second one is, music therapy is a complementary therapy. Moreover this systematic review provides health care professionals, specially nurses with an evidence based practice that utilizes music therapy as a non-pharmacological interventions and a complimentary therapy for postoperative

pain management in adults. This systematic review was limited with only English language articles due to the fact that the search process and screening, hence not including literature in other language may cause build the gap in the literature. As it may negatively impact to get the most accurate overall conclusion, authors strongly recommend to include more and primary studies from different regions of the world.

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## Obstacles and Challenges for People with Visual Impairment and Blindness in Seeking Financial Services from the Banking Sector

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### ABSTRACT

In Sri Lanka, it is observed that the persons with visual impairment and blindness are experiencing several difficulties and challenges when it comes to using banking services. This paper explores the obstacles and challenges encountered by this group of customers based on qualitative approach using semi-structured questionnaire. Ten customers representing the visually impaired and blind community and seven officials representing a range of commercial banks were the interview respondents. Thematic analysis was used to obtain corresponding results. The key findings of this study shows that this community experiences various obstacles when accessing the banking services due to the banks' reluctance and inadequate training in providing the service with accurate information. Through this outcome, it manifests a clear insight on the key factors which affect the level of financial inclusion of persons with visual impairment and blindness. This research is an eye-opener for policymakers within and outside the banking sector to make improvements in financial inclusion concerning this vulnerable community that would help enhance their social and economic empowerment.

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## INTRODUCTION

Globally around 2.2 billion people have different visual incapacities, nearly half of them are severely impaired or blind (WHO, 2021). These individuals experience limited opportunities and extreme challenges in their day-to-day life. Their impairment along with society's discrimination have created difficult circumstances for these individuals. (Okonji & Ogwezzy, 2018). In developing countries society's acceptance for persons with visual impairment and blindness has substantially diminished where equitable opportunities are sparse for them. Within such a conundrum, ensuring these persons with visual impairment and blindness persons with beneficial mechanisms of financial inclusion is not viable. In the wider context a range of financial services including banking services, insurance facilitation, foreign exchange transactions, investments, stock business can be found. Nevertheless, the focus of this study is limited to banking services. The main reason behind this choice is that this is one of the financial services mostly sought after by the persons with visual impairment and blindness.

United Nations (2016) defines the term 'financial services' as open access provision for all the people at a fair cost. However, according to Raja (2016), the persons with visual impairment and blindness are marginalized when it comes to access to financial services. Globally, many studies have been conducted to identify financial inclusion of this community and observed that persons with different visual incapacities face severe challenges in accessing financial services. Further, from the bank's perspective, regardless of the ability to engage in income-generating activities,

this category of customers is considered risky and not seen as potential customer to provide certain services, such as loan and credit facilities in particular. (Sarker, 2020). Thus, these customers are practically debarred from seeking loan facilities from banks. Majority of the persons with visual incapacities is excluded from receiving financial services due to constant denial, negative perceptions, and a lack of social capital (Hermes & Lensink, 2007).

While such complications are seen locally, it can be observed that international organizations give priority to the inclusion of persons with disabilities. For example, Convention of the Rights and Disabilities and Millennium Development Goals can be cited. Even the national governments adhering to such understandings have progressively developed a range of legal frameworks aimed at ensuring the living standards of persons with visual incapacities. For example, the Central bank of Sri Lanka has developed the banking charter aimed at providing them a fair and sensible facilitation (CBSL, 2009). However, it is observed that in most cases, these vulnerable groups are yet to be absorbed into the banking systems to provide reasonable accommodation to include them into financial services. Therefore, it is vital to identify how far the persons with visual impairment and blindness are marginalized in the context of financial services and what factors has led to this discrimination. A study based on Sri Lanka is of special significance in this respect, since this is one developing country that provides a broad range of advanced banking services in the digital era.

Taking the above discernible knowledge gap into consideration, this study is aimed at exploring the problems and challenges

encountered by the persons with visual impairment and blindness in dealing with commercial banks. This study also examines the issues that the banks themselves encounter, while providing such services. This is a preliminary investigation conducted as a part of a broader study.

Findings of this study will be an eye-opener for policymakers at national level as well as within the banking sector to make improvements in financial inclusion of this vulnerable community. This paper is organized under five sections, where research approach is presented next. Results and discussion are detailed in the section three and the conclusions are given last. It is worth noting that the due ethical clearance from the academic authorities of SLIIT university has been obtained to conduct this study.

### **Research Approach**

This exploratory study adopted a qualitative approach using in-depth interviews with the purpose of understanding the services provided by the banks and how far they are accessible to persons with visual impairments and blindness within their abilities to interact with the banks. Ten purposively selected customers representing the community of persons with visual impairment and blindness, and seven officials representing commercial banks were the interview respondents. A semi-structured questionnaire was utilized as the guide for the interview process. The respondents were selected representing a range of age, profession, and income levels. The respondents' consent to participate was obtained to conduct and the interviews were audio recorded. It was then transcribed in Sinhala and translated to English. Using thematic analysis, the themes were generated under the category of discussing the services

available to this community and their challenges. The issues encountered by the banks in this respect were also examined. As of the final stage, to ensure the validity of data and findings, the findings were reviewed with three eminent persons who are well conversant in financial discipline as well as the population of interest.

### **RESULTS AND DISCUSSION**

The thematic analysis brought about a number of factors influencing financial inclusion. These themes explicate the obstacles and challenges faced when accessing different platforms of the bank. In terms of the financial products, the information, infrastructural facilitations, security concerns and the social attitude of the society specifically from the bank's perspective for this community is debated. Details of the analysis with supporting evidence are discussed in the next section.

#### **Access to Banking Services**

Banks provide a range of services to their customers with the purpose of ensuring their satisfaction and sustainability. Yet the current situation with respect to service provision for people with visual impairment and blindness is not as favorable as for the sighted customers in general. This problem is viewed by a lottery seller who is totally impaired; *"You know I'm a blind person, but I have a good income from this business. Still these banks do not allow me to get a loan. This may be because I'm blind. They may think I can't pay back. So they always ask me to come with another person as a guarantor"* To fulfill the financial needs and other services, persons with visual impairment and blindness, have to depend on their family members, which hinders their personal freedom and self-respect (Silver, 2015). Another government school teacher who is partially visually impaired stated that;

*"I'm not fully blind, I can see a little bit. Even though I'm a government teacher they rejected my request to open a bank account. All other teachers have bank accounts. It's very bad to treat us like this. I think the government has given instructions to the banks about these procedures. But still..."*

These instances provide evidence about the difficulties in opening accounts with banks and thus difficulties to fulfill their financial needs. Accordingly, it can be seen that persons with visual impairment experience problems when accessing banking services.

### **Access to information**

The level of understanding on the information provided to the persons with visual impairment and blindness is very poor. The main mode of providing information to customers is through printed documents in small fonts. For the people with visual impairment this mode is not accessible. In addition, there are TV and radio programs mostly aimed at marketing and awareness. The general feeling among the interviewees was that the banks do not provide information of the services and product portfolios in the manner comfortably accessible and understandable to them. A teacher who was blind said that;

*"I get all the information about banking products from my friends and from YouTube. The bank has never informed me properly."*

An employee of a private company who is visually impaired expressed his views on ATM service;

*"I'm not comfortable using an ATM to take money. I can't read that small screen. I heard that in some ATM's there are voice messages for us to follow. If such things are there, it is good."*

A lottery seller who was blind said;

*"I don't know much about other banking facilities. I know only ATM services and SMS alert services."*

Inadequate dissemination of information can be identified as one of the major reasons for banking products to be less available and accessible to persons with visual impairment and blindness. This finding is in conformity with Morgan and Pontines (2014) who claim that poor provision of information has become a challenging problem for them. Persons with visual impairment and blindness seem to be using only a limited number of services due to the lack of awareness about available banking products. Thus, it is clear that there is a need to adequately disseminate information about banking products through accepted and accessible modes to persons with visual impairment and blindness.

### **Infrastructure facilities**

The interviewees shared their experiences with the banks regarding the level of infrastructure facilities provided by the banks. As per their experiences, a teacher said;

*"It is bit difficult to walk alone inside the bank. Even when I could see a little ( this person is severely impaired), it was difficult as the area is not lighted properly. They have partitioned the area with glass, so we crash into"*

An assistant general manager from a private bank presented their views on the infrastructure available in banks for persons with visual impairment and blindness;

*"All banks in Sri Lanka have been duly informed through a circular from state central financial authorities on the 'disability friendly requirements'. We have provided ramps for wheelchair access. That's the only facility we have considered, as far as I am aware"*

Another branch manager from a state bank stated that;

*"We provide ramps with handrails to blind people."*

Most banks do have constructed ramps adhering to the policy recommendations

of the Central Bank of Sri Lanka (CBSL). However, the ramps can only help wheelchair users, not blind people. Yet due to the inadequacies of following these policies by the banks, these customers have to face difficulties when accessing the bank services experiencing demoralization. Cramm and Finkenflügel (2008) confirm this fact where not having proper infrastructure when accessing banks has led most of the people who are visually incapacitated to reach a higher level of dissatisfaction. Such facilities may need to be fortified with voice activation and other 'blind friendly' mechanisms.

### **Social attitude**

The society's general misconception towards people with visual impairment and blindness is that they are incapacitated due to visual weaknesses. This is seemingly the accepted norm and therefore the general public would tend to associate them with this misconception (Muricho, 2013). With such a perception, it could be possible for the bank officials also to have the same negative opinion when providing services for them. One of the junior executives of a private bank stated;

*"I think blind people should have a special reason for opening an account. In Sri Lankan context, blind people are usually beggars or the ones who live in charity homes."*

Bank officials' perception about this community confirms the above-mentioned problem. This situation has been further validated with the following observation by a government teacher who is blind;

*"I think every bank should give loans to blind people. It's unfair to our people that banks do not give these facilities even though we have necessary qualifications and income."*

Furthermore, banks are reluctant to even send the necessary information to them

due to their preconceived notions. A junior executive from a private bank stated; *"We never promote products like online banking, SMS alerts to them as they cannot use it."*

It is clearly visible that these misconceptions have led to severe negative connotations which could amount to discrimination of this community. Such attitude and behaviors make even the common banking services unavailable and inaccessible for persons with visual impairment and blindness. Clearly such actions would make them financially excluded.

### **Potential for security lapses and fraud**

A major challenge seen by the banks when engaging with the persons who are visual impaired and blind is the potential threat of fraud and misuse. One of the assistant general managers of a private bank stated; *"Once, we gave a joint account facility to a visually impaired person with the help of another party on behalf of him as a guarantee. After few years what happened was, the third party has withdrawn all the money. Then the visually impaired person accused the bank of fraud"*

One of the branch managers of a state bank highlighted;

*"Sometimes issuing an ATM card for blind people is difficult. This is because blind people seek the help of someone else when using an ATM card, which can jeopardize sensitive information and their privacy."*

With these evidences it is clear that banks are reluctant to facilitate persons with visual impairment and blindness due to the potential of threats and risks caused by third party involvement which at the end exclude persons with visual impairment and blindness from accessing banking products.

It is evident that there is a potential for security lapses and fraudulent practices along with providing banking service facilities to persons with visual impairment and blindness. However, this

problem might have arisen because banks have not appropriately tailored their services for catering to this specific customer group. The fact that the banking services have been designed by the sighted people for the sighted customers, might be the reason behind most of these issues.

## CONCLUSIONS

The study shows that persons with visual impairment and blindness encounter many obstacles and challenges when accessing financial products offered by banks. Besides, they are not duly informed of the available services. Appropriate systems should be introduced and the customers should be adequately informed of the banking services and their use. On the other hand, bank officials are also not adequately trained to handle this specific customer group with different abilities and capacities. This situation has led to create barriers towards accommodating persons with visual impairment and blindness for financial inclusion. It can also be seen that persons with partial visual impairments tend to experience a better banking service in comparison to persons with severe impairment and blindness. With the results it can be concluded that the bank personnel too have misconceptions toward this community. Therefore, it is important to introduce appropriate training programs and activities to raise awareness regarding these customers. The physical infrastructure facilities do not adequately support comfortable access to bank buildings and ATM locations. While improving them, new avenues need to be explored to use the facilities of information and communication technology. Persons with blindness, in particular the younger generation, are observed to be conversant with using smart phones and computers with the screen reading facilities. It is worth pursuing ways to make use of such technologies as a means of improved

financial inclusion. The findings of this study would be helpful for the policy makers, banking authorities to strengthen the service provision to this vulnerable community. Though this paper reports only preliminary findings, this study would pave the way to further detailed research in this vital area of social sciences.

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## Perceived Self-medication Practices and Associated Factors among Undergraduates of the Faculty of Humanities and Sciences (FHS), SLIIT.

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### ABSTRACT

This study is aimed to determine the perceived self-medication practices, associated factors, and awareness on contraindications related to self-medication among undergraduates. A random sample of 138 undergraduates of FoHS, SLIIT was selected and data were acquired from a pretested questionnaire. It was found that only 87% of the respondents had practiced self-medication in the past 3 month's period. The presence of chronic illnesses was significantly associated with self-medication practices ( $p < 0.05$ ). There was a significant association between the level of self-medication practices and both the variety of medicines ( $p = 0.006$ ) and prior experience with the self-medication related side effects ( $p = 0.05$ ). Headache (82.9%) and common cold (44.1%) were the major health conditions for self-medication, while painkillers (83.2%) and vitamins and minerals (47.8%) were the mostly used types of medicines. Covid-19 restrictions (48.4%) and unnecessary consultation for mild illnesses (44.0%) were recognized as the major reasons for self-medication. Based on results raising awareness on self-medication by conducting educational programs in pharmaceutical aspects is recommended to improve healthy medicinal compliance among the undergraduate population.

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## INTRODUCTION

Self-medication (SM) is a traditional practice of using medications, herbs, or other therapies on one's initiative or on another person's recommendation to treat a self-diagnosed physical ailment without consulting a physician (Bennadi, 2014). Self-medication may include consuming drugs without a prescription, using leftover drugs from treatment courses prescribed earlier, sharing medication with relatives or friends, or reusing old prescriptions to purchase drugs (Ocan et al., 2015; Zafar et al., 2008).

Self-medication is the first step in treating minor illnesses by most people, and it is considered non-threatening, if it is continued only for a short period (Alano et al., 2009). Self-medication would be beneficial in conditions where access to health care facilities is limited and would relieve the workload on medical health care delivery systems and reduce the costs for treatment at health care settings only if SM is practiced within the approved medicinal limits (Alano, 2009; Ruiz, 2010; Food and Drug Administration, Jordan, 2014). Self-medication will allow the patients to self-control their wellbeing and gain confidence in continuing the SM practice, encouraging self-empowerment towards their health issues management (Hughes, McElnay & Fleming 2014). However, the globally expanded higher availability of varieties of pharmaceuticals have caused easy access for medications among people resulting in increased rates of medicinal misuse (Ali, Ibrahim & Palaian, 2010).

Inappropriate medicinal usage related to self-medication practices (SMP) could lead to significant adverse effects such as antibiotic resistance, treatment failures, drug toxicity, adverse drug reactions and life long-suffering (Al Rasheed et al., 2017; Selvaraj, Kumar & Ramalingam, 2014;

Parulekar et al., 2016). Self-medication induced delays in receiving appropriate medical referrals could potentially lead to increase drug dependency and to further worsen the health status (Hughes, Whittlesea & Luscombe, 2002; Alhomoud et al., 2017).

Self-medication practice is identified as a public health problem in developing countries with the raised tendency of using medications arbitrarily (Kasulkar & Gupta, 2015). The worldwide prevalence of SM has been estimated to be between 10.3% and 87.0%, and a higher prevalence rate was reported in the European region while developing countries tend to report further increased prevalence of SM (Goossens, 2005; Ali, Ibrahim & Palaian, 2010).

Several local and international studies have been conducted on SMP among university students and have identified a rise in the prevalence of SM among undergraduates (Subashini & Udayanga, 2020; Gunawardhana, Sakeena & Sivayoganthan, 2015; Alshawi, 2018; Gelayee, 2017). The raised prevalence of SM among university students was related to students' misleading perceptions of SM (Mehta & Sharma, 2015).

Research is available on the prevalence of SMP among the general public and state university students in Sri Lanka (Rathnayake et al., 2016; Subhashini & Udayanga, 2020). However, studies on SMP among the undergraduate population of the Sri Lankan Private University sector are scarce. Therefore, this study aims to identify the perceived self-medication practices among the undergraduate students of the Faculty of Humanities and Sciences (FOHS) of Sri Lanka Institute of Information Technology (SLIIT) and associated factors that impact their self-medication practices, and awareness on

contraindications in self-medication practices.

## **MATERIALS AND METHODS**

### **Study design and population**

A descriptive cross-sectional study was conducted among undergraduates of the FOHS, SLIIT, Malabe. The participants included in the study were from seven study programs namely Biotechnology, Psychology, Law, Biological Science, English and Nursing and students were in different academic levels (1<sup>st</sup> year, 2<sup>nd</sup> year and 3<sup>rd</sup> year).

Stratified random sampling method was applied as the sampling criteria. The sample size (n) was calculated by using the equation for the margin of error [ $n = (Z\alpha\%/2 \cdot S/E)^2$ ] assuming that  $Z=1.96$  for 95% of confidence level, Standard deviation (S) and required margin of error =  $S/6$ . Based on the above equation, the calculated sample size was 138. The sample size was allocated to each study program proportionally to its size and, that sample size was further divided based on the available female and male proportion in each study program. Approximately, the sample size was 138 students. The sample of this study consisted Biotechnology-74, Psychology-21, Law-23, Biological Science-7, Physical Science-6, English-4, and Nursing-3 students. Students who were able to read and write in Sinhala language or Tamil language or English language were included in the study. Students who were following top-up programs in the FOHS were excluded from the study. Ethical clearance for this study was obtained from the Ethics Review Committee of SLIIT.

### **Data collection**

The researchers developed a self-administered questionnaire specific to the current research objective based on previous literature on SM (Subashini &

Udayanga, 2020; Fernando et al., 2017). The questionnaire was developed in English language and was translated to both Sinhala and Tamil languages. The face validity of the questionnaire was tested by conducting a pilot study using 30 students to make necessary amendments. The pre-tested questionnaire was distributed as an online survey for data collection.

The questionnaire consisted four major sections, with questions which addressed socio-demographic characteristics of the participants (Section A), questions to assess prevalence of SMP (Section B), questions to assess types of perceived SM behavior within three months prior to data collection (Section C) and questions to assess attitudes and awareness towards SMP (Section D).

Under the section B of the questionnaire, participants were questioned on whether they have purchased medicine with advice from pharmacists, consumed leftover medicines which were available at home, borrowed medicines from a friend, relative without visiting a doctor, shared medicines with their family members, bought medicines that they have frequently used before, purchased medicines with an old prescription given by a doctor or have consumed herbal medicines to cure mild illnesses within 3 months prior to data collection. Participants were considered to follow SMP, if they have reported at least one of above mentioned practices and SM prevalence was calculated based on the reported practices.

The levels of overall self-medication practices of the study sample were further categorized into two levels as high levels of SMP and low levels of SMP based on having four or more of above self-medication practices and having three or less than three of the above self-medication practices, respectively.

## Data analysis

Data were analyzed by IBM SPSS (22.0 version). The socio-demographic data, percentages of knowledge and practices and attitudes were analyzed, and results were produced using descriptive statistics. The Fisher's exact test was applied to compare variables of those who practiced SM and those who did not practice SM in order to find the statistical significance relationship. To determine the factors associated with the highest and lowest levels of SMP, independent samples nonparametric test (Kruskal-Wallis test) was performed. The results with p-value < 0.05 was considered to be statistically significant.

## RESULTS

Among the entire study sample, 87% (n=120) of the respondents had followed SMP within 3 months prior to data collection. The socio-demographic characteristics of the study participants, the reported practices of SM, factors associated with SMP and participants' awareness on SM related risks are as follows.

### Socio-demographic characteristics

Among 138 study participants, 82.6% of the sample comprised female participants. Continuing education in the 2nd year of academic studies, following the biotechnology stream, residing in Western province and living with their own families were the commonest sub-characteristics of respective demographic characteristics of all the participants (Table 01).

The age of the respondents was categorized into three groups ranging from 18-20 years, 21-23 years and above 24 years. Majority among the overall participants and majority among the participants who had SMP were in 21-23 years of age category.

Among those who have had practiced SM, the majority were females (81.7%). A higher percentage of self-medication users had not followed any medicine related or health-related courses (87.5%). Among all the study participants, only 16.7% reported to have a chronic illness while only 19.2% participants among those who practiced SM were having a chronic illness (Table 1).

**Table 1.** Socio-demographic characteristics of the participants and association of socio-demographic characteristics with self-medication

Socio-demographic characteristics		Study Participants		
		All	With SMP	
		%	%	p Value <sup>#</sup>
Gender	Female	82.6	81.7	0.74
	Male	17.4	18.3	
Age category	18 – 20	15.2	16.7	0.2
	21 – 23	73.2	73.3	
	>24	11.6	12	
Province	Western	57.2	55.5	0.45
	Other	42.8	44.2	
Living with whom	With own family	93.5	93.3	1.0
	Without own family	6.5	6.7	
Nationality	Sinhalese	94.9	95.8	0.23
	Tamil	4.3	3.3	
	Muslim	0.7	0.8	
Field of study	Biotechnology	53.6	55.5	0.35
	Law	15.9	14.2	
	Psychology	15.2	15.8	
	Other	15.2	15.1	
Study year	1 <sup>st</sup> Year	22.5	24.2	0.36
	2 <sup>nd</sup> Year	58.0	55.8	
	3 <sup>rd</sup> Year	19.6	20.0	
Monthly income	>100,000	47.1	49.2	0.31
	50,000-100,000	37.0	37.5	
	<50,000	15.9	13.3	
Having a chronic illness	Yes	16.7	19.2	0.04*
	No	83.3	80.8	

\*P<0.05 is considered significant, <sup>#</sup> Significance of Association of demographic characteristics with SMP – p values from Fisher's exact test

## Practices of Self Medication

The results on patterns of SMP, types of medicines utilized under SMP, sources of information and factors leading to SMP are presented under practices of SM.

The reported frequency of the evaluated SM patterns are mentioned in the Table 02:

**Table 02;** Frequency distribution of patterns of self-medication practices (n=120)

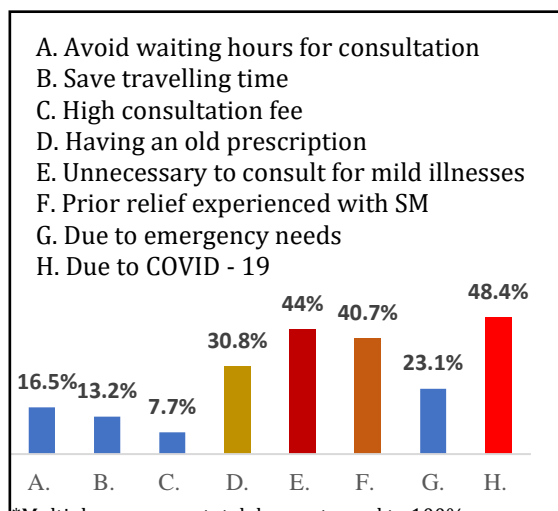
Pattern of Self-medication	%
1.Purchasing medicine with advice from pharmacists	57.5
2.Consuming leftover medicines available at home	52.5
3.Borrowing medicines from a friend, relative, etc. without visiting a doctor	12.5
4.Sharing medicines with your family members	43.3
5.Buying medicines that you have frequently used before	70.8
6.Purchasing medicines with an old prescription given by a doctor	34.2
7.Consuming herbal medicines to cure mild illnesses	77.5

\*Multiple responses, total does not equal to 100%.

COVID - 19 pandemic related restrictions were reported as the major concern for the following SMP. The additional concerns are presented in detail in Figure 01.

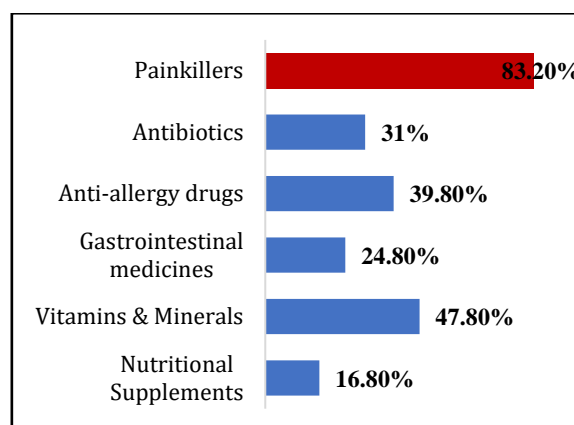
Western medicines have been consumed by 59.2% of the participants who reported SMP and painkillers, vitamins and minerals and anti-allergic drugs were the most consumed medication types among the chosen self-medications (Figure 02).

**Figure 01.** Reported Causes which have led participants to select self-medication practices (n=91)



\*Multiple responses, total does not equal to 100%.

**Figure 02.** Frequency of consuming different type of medicines under self-medication (n=113)

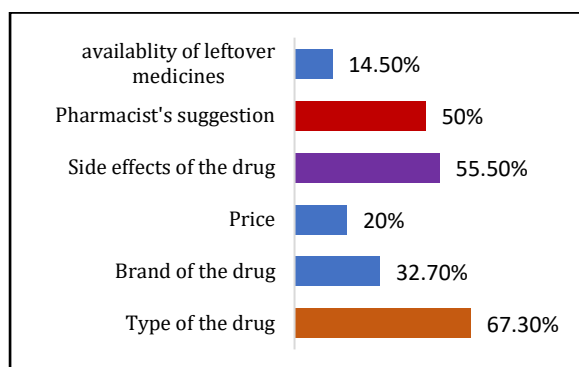


\*Multiple responses, total does not equal to 100%.

The reported frequency of SM usage was daily (4.2%), once a week/ fortnight (1%), once a month (3.1%) and whenever SM was needed (96.9%).

Among the participants who practiced SM, type of the drug, medicinal side effects and pharmacists' suggestion were the mostly considered concerns prior to purchasing medicines for SM (Figure 03).

**Figure 03.** Participants' considerations prior to purchase medicines under self-medication practices (n= 110)

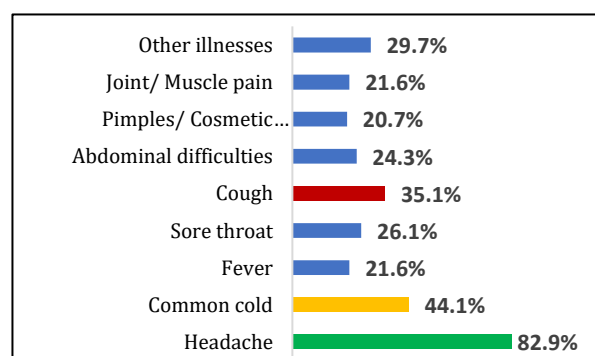


\*Multiple responses, total does not equal to 100%.

At the earlier stage of self-diagnosing, the health status prior to SMP, asking from family members/ a friend or a relative (58.5%) and deciding with their own knowledge and self-search (56.4%) were the most preferred among their multiple methods of self-diagnosing their illness to purchase medicine without consulting a doctor.

The perceived health conditions which led the participants to practice SM are detailed in figure 04.

**Figure 04.** Perceived health conditions for self-medication (n=111)



\*Multiple responses, total does not equal to 100%.

Most of the participants have had gained further information on drug type, frequency, and dosage of their self-desired medicine from the pharmacists and with

their own awareness from repetitive usage of the drug (Table 03).

**Table 03.** Frequency distribution of followed source of information for self-medication (n=110)

Source of information for SMP *	%
Pharmacists	59.3
Nurses, other health personnel	30.6
Experience with repetitive use	33.3
Drug label	30.6
Family, friend	29.6
old prescriptions	29.6
internet, books	20.4
advertisements	1.9
own guess	1.9

\*Multiple responses, total does not equal to 100%.

When the participants were questioned on the ways that they have pre checked the medicine prior to consumption and about their medicinal compliance, most of the participants have always read the medicine labels (62.5%) before consuming SM while some participants sometimes have read the medicine labels (35.0%). More than 70% of the participants have always checked the expired date prior purchasing medicine for SM. The most commonly reported rationale to withhold or alter the medicinal dosage was the improvement of the disease condition (70.7%).

### Knowledge on Self Medication

Among the students who have engaged in SMP (n = 120), the majority of participants (89.2%) were aware that using self-bought medicines has some risks while 10.8% were not aware of such risks. The reported mostly known risks related to the SM practices were 'side effects/ allergies' (85.1%), 'consuming wrong dose' (65.3%), 'consuming wrong drug' (49.5%), and 'interactions among drugs/ foods consumed' (40.6%). When the association of being aware of risk of developing antimicrobial resistance and reported self-usage of antibiotics were assessed based on Chi-square test results,

there was no significant association ( $p=0.935$ ) between the number of participants who used 'antibiotics' for SM ( $n = 113$ ; 31.0%) and their awareness of the SM related risk of developing antimicrobial resistance with overuse of antibiotics.

The majority (85.8%) of the participants who used SM believed that having a drug label was very useful. None of the students have believed that having a drug label is not at all useful. Among the participants, the majority had either 'partially understood' (55.0%) or 'fully understood' (40.8%) the contents in the drug labels. Almost half amount of the participants who have practiced SM (50.8%) have had a "neutral" idea about the attitude evaluation statement on "SM is effective similarly to medicines prescribed by a doctor".

### **Factors associated with Self Medication Practices**

Having a chronic illness ( $p=0.04$ ) was the only socio-demographic variable that had a significant association with having SMP according to the applied Fisher's exact test. There was a marginal significance ( $P=0.05$ ) between the levels of SMP and the 'participants who have experienced side effects related to SM'. The level of SMP was significantly high ( $p = 0.006$ ) among those who have utilized both "Western medicine" and "Herbal/ Ayurveda medicine" types together in comparison to those who have utilized only "Western" medicines and only "Herbal/ Ayurveda" medicines. However, there was no significant relationship between the levels of SMP and the 'awareness of the participants regarding the risks related to SMP' ( $p = 0.42$ ) and the attitude of the participants towards the statement "SMP are effective similarly to medicines prescribed by a doctor" ( $p = 0.06$ ).

## **DISCUSSION**

The reported SM prevalence among current study participants was high (87.0%) in comparison to a previously conducted Sri Lankan study (98.4%) and several international studies in Iran (89.6%), Nigeria (91.4%) and Pakistan (95.5%) (Subashini & Udayanga, 2020 ; Alireza et al., 2018 ; Osemene & Lamikanra, 2012 ; Ullah et al., 2013) On the contrary, a Turkish study has shown a lower prevalence of (45%) of SM use (Buke et al., 2005).

A Sri Lankan study conducted by Wijesinghe, Jayakody & Senevirathne (2012) have indicated a higher usage of allopathic medicines in the Sri Lankan community and similarly, 77.5% of current study participants with SMP had reported utilization of herbal medicine as the commonest self-medication practice while Western medicine was utilized by 59.2% of participants. In contrast, an Indonesian study has reported higher usage of western medicines for SM rather than other varieties of medicines (Annisa & Kristina, 2020).

In contrast to this finding, a significant correlation was not evident between the presence of chronic diseases and SM used in the study by Malak & AbuKamel (2019). The types of self- consumed western medicines in the current study were anti-allergy drugs (39.8%), antibiotics (31.0%), Vitamins and minerals (47.8%), and painkillers (83.2%). The comparatively higher utility of painkillers reported in current study is similar to a study conducted by Al-Flati et al. (2014) in Oman (96.6%). However, a previous Sri Lankan study has reported a contrasting finding in which antipyretics (73.6%) and cough and cold medicines (76.3%) have been commonly utilized under SMP (Subhashini & Udayanga 2020).

The causative health conditions among current participants which have led to choose SMP were, headache, common cold, cough and sore throat. Additionally, fever has been reported as the major illness for SM in a previous Sri Lankan and Omani study (Subhashini & Udayanga 2020; Al-Flati et al. 2014). Similarly, an Indonesian study also has indicated cough/ common cold (23.8%) , fever (18.9%) and headache (17.9%) as the commonest health conditions (Annisa & Kristina 2020) although the reported frequency was comparatively low in the latter studies and the current study.

Covid-19 restrictions, considerations on not to consult a doctor for mild illnesses and relief experienced with prior SMP, availability of old prescriptions were the main rationales presented by current study participants towards their SMP for above disease conditions. Though Covid 19 pandemic related issues are new and related literature is not available, other SMP directed rationales have been similarly reported in previous literature ((Helal & Abou-ElWafa, 2017; Malak & AbuKamel, 2019; Shah, Halder & Haider, 2021).

As a physician's consultation on required medicine is overridden in SMP, the participants had relied on alternative sources to gain information on medicines to be consumed for the disease conditions being presented (Table 02). Asking from a pharmacist, utilizing old prescriptions and gathering information from family members were commonly reported sources towards SMP in the current study and international literature (Alireza et al. 2018; Annisa & Kristina, 2020; Shah, Shimul & Haider, 2021).

However, the majority of the participants of the current study (89.2%) were aware of the risks of engaging in SMP yet, chose to use SMP. The most known SM related

risks reported by them were the risks for having side effects/ allergies (74.8%), risk of consuming a wrong dosage (57.4%) or wrong drug (43.5%).

Risk of misdiagnosing the illness and misuse of medications were additionally reported risks of SM reported in a similar study done in Sri Lanka (Subhashini & Udayanga, 2020).

In the current study, no significant association was observed between 'having SMP' and assessed socio-demographic characteristics ( $p > 0.05$ ) except the emerged significant association between the presence of chronic illness and having SMP ( $p < 0.05$ ). The reported insignificance between having SMP and socio-demographic data in the current study are consistent with the studies done by Alireza et al. (2018), Mustafa & Rohra (2017) and Regina, Jose & Elisardo (2020), which have proved the insignificant association between socio-demographic data such as age, gender and healthcare and non-healthcare student groups with SM use.

In contrast, another Sri Lankan Study (Subhashini & Udayanga 2020) has reported that all the basic socio-demographic factors have had a significant association with the practice of SM among their studied population except gender. In contrast to these findings, studies done in Jordan, Nigeria, Egypt, Eritrea have indicated that the scientific area of study, sex, the field of study, year of study, and monthly income were associated with SMP (Malak & AbuKamel, 2019; Esan et al., 2018; Helal & Abou-ElWafa, 2017; Araia, Gebregziabher & Mesfun, 2019).

The insignificant association between being a medical versus non-medical student, and having a high monthly expenditure and SM were also described in the studies done in Uganda and Ethiopia (Niwandinda et al., 2020; Abey & Amelo,

2010). Even though the current study presents findings as there were no significant associations between years of study and SM use, a previous study done in Sri Lanka has emphasized that the tendency for practicing SM could significantly increase ( $p < 0.001$ ) with the additions of academic years of the study period (Subhashini & Udayanga, 2020).

## CONCLUSIONS

The reported SMP among the undergraduates of FOHS, SLIIT was high irrespective of their variations of socio-demographic characteristics, yet corresponding to the presence of chronic illnesses. The intensity of these undergraduates engaged in SMP was significant with the variety of medicines used for SM and their previous experience of side effects related to SM. Covid-19 restrictions, belief that it is unnecessary to consult a doctor for mild illnesses, prior relief experienced with SM were the major contributing factors for SMP. The major sources of drug information were pharmacists' suggestions and their own knowledge of repetitive use of the drug. The awareness among the undergraduates regarding the risks related to SMP was high which was a satisfactory finding. Increasing awareness on SM by conducting educational programs in pharmaceutical aspects is recommended to promote healthy medicinal compliance among the undergraduate population. Moreover, the current study finding confirms that the Covid-19 restrictions have become a contributing factor for SMP among the studied population. Therefore, Sri Lankan health authorities should pay more attention to the medicinal compliance-related health impacts of the Covid-19 crisis. Future research is needed to determine the impact of the Covid-19 situation on SMP among the general population in Sri Lanka.

## LIMITATIONS

Being a newly established faculty, FOHS, SLIIT comprises the limited number of students who follow 3<sup>rd</sup> year and 4<sup>th</sup> year studies. Further, the majority of the undergraduates were females and had followed secondary education in the science stream which could have affected the results on associations with SMP concerning gender, academic year, and secondary education.

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## Prevalence of Computer Vision Syndrome among the Academic Staff of SLIIT, Malabe Campus amidst COVID-19 Pandemic

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### ABSTRACT

Computer Vision Syndrome (CVS) is considered as an occupational hazard in the 21st century resulting from high utilization of computers, laptops and mobile phones in the workplace. Current study aimed to determine the prevalence of computer vision syndrome and its associated factors among the academic staff of SLIIT, Malabe campus amidst the COVID-19 pandemic. A descriptive cross-sectional institution-based study was conducted among 145 academic staff members. Data were collected through a self-administered questionnaire that consisted demographic questions and a standard questionnaire validated to measure CVS. Data were analyzed using SPSS version 22. The participants of the study comprised 50.3% of female respondents and 49.7% of male respondents while majority of the participants were in 20-30 years age category. The prevalence of CVS among the participants was 59.3%. Dryness in the eyes (52.4%), itching (54.4%), eye pain (65.5%) and headache (76.5%) were the most common symptoms reported by the staff members, while coloured halos around objects (20.7%) and double vision (21.4%) were experienced by a limited number of participants. Laptops and mobile phones are used by the majority of the academic staff employees (91.5%) while 6-8 working hours in front of a digital screen was reported by 42.1% of academics. Awareness of CVS was identified among 136 employees. Taking breaks in-between the working time (26.2%), adjusting the screen (21.5%) and adjusting the chair and posture (20.7%) were the most common methods used by the participants to minimize CVS. A significant association was observed between age categories and the prevalence of CVS ( $p=0.006$ ). A high prevalence of Computer Vision Syndrome was observed among the academic staff of SLIIT. Further, institutional activities to raise awareness on CVS and ergonomic practices are recommended to reduce the prevalence of CVS among the academic staff.

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## INTRODUCTION

With the advancement of technology, computers and mobile phones have become an essential part of human life. The continuous use of computers for an extended time leads to several visual and ophthalmic problems known as Computer Vision Syndrome (CVS) (Barthakur, 2013; Sen and Richardson, 2007). CVS is also referred as digital eye strain by Rosenfeild (2011).

The American Optometric Association (2007), define CVS as “a complex of eye and vision problems related to activities, which stress the near vision, and which are experienced in relation or during the use of a computer.” Symptoms of CVS mainly include dry and irritated eyes, eye strain, blurred vision, red eyes, double vision, burning eyes, excessive tearing, headache, light/glare sensitivity, slowness in changing focus and changes in colour perception (Gangamma, Poonam and Rajagopala, 2010).

The risk factors for CVS are prolonged computer use, inadequate lighting, screen brightness, the strain on the eye muscles to read the content on the computer screen, vision difficulties, bad posture, inappropriate workstation setup, or a combination of any of above factors (Kozeis, 2009; Assefa, 2015). Modern e-device screens have built-in protective systems to protect the user from harmful lights emitted from the device, but the duration of use mostly contribute to CVS (Munsamy and Chetty, 2020).

According to a study by Thomson (1998), up to 90% of computer users may experience CVS after prolonged computer use. The term ‘prolonged computer usage’ refers to using a digital screen for 3 hours or more without a break in between (Sen and Richardson, 2007).

Studies show that the prevalence of CVS among the working community, who work with e-devices has increased as a result of COVID-19 pandemic (Bhattacharya, 2020). Alabdulkader (2020) has analyzed the total hours per day spent on e-devices by computer users during and before imposing the curfew in Saudi Arabia due to COVID-19 pandemic and discovered that those who used digital devices during the curfew had a higher prevalence of digital eye strain.

As reported by World Health Organization (2020), COVID-19, also known as 2019-nCoV, is an infectious disease caused by a newly discovered coronavirus named SARS-CoV-2. At the beginning of 2020, COVID-19 was the biggest concern of health professionals as it spreads rapidly throughout the community and the symptoms and complications were unknown to the health sector (Velavan and Meyer, 2020).

As a result of the community-imposed restrictions aimed at preventing the transmission of COVID-19, many occupations were conducted at home using computers and other electronic equipment (Baker, 2020). However, as a consequence, computer users have become habituated to excessive computer use, which results in several health problems.

Healthcare providers are concerned about these health problems related to CVS. Studies provide evidence that CVS can be prevented by altering the habits of the consumer while working with computers (Munsamy and Chetty, 2020). Adjusting the posture and the position of the screen, taking breaks in-between working time, use blue light blocking glasses, use of artificial lubricants on the eyes and taking Omega-3 supplements were recommended by previous studies to prevent and control CVS (Rosenfield,

2011; AOA, 2006; Coles et al, 2018; Munsamy and Chetty, 2020).

The CVS-Q is a questionnaire which has been developed to identify the frequency and intensity of the CVS symptoms present in the participants and the prevalence of CVS (Segui et al., 2015). The CVS-Q has been developed and validated to administer among English speaking population and has been used in previous research studies in different South Asian countries (Mohan et al., 2020; Arshad et al., 2019).

With the onset of the Covid-19 pandemic, mandatory e-learning has emerged as a medium for teaching and learning in universities and schools. Without any health considerations, it has been a common practice for students and academic staff to spend the majority of their time in front of a digital screen (Olaganwantte, 2020).

The aim of this study is to identify the prevalence of CVS and its associated factors among the academic staff of SLIIT during the COVID-19 pandemic.

## **MATERIALS AND METHODS**

A descriptive cross-sectional institution-based study was conducted among the permanent academic staff members of Sri Lanka Institute of Information Technologies (SLIIT), Malabe. Visiting academics, staff members who do not use a digital screen during working hours and members who have been diagnosed with glaucoma, cataracts or any infection in the eyes were excluded from the sample.

The sample size was determined using two-stage stratified sampling technique. A minimum sample size of 138 was calculated out of total number of permanent staff members (318) using the primary sampling. Secondary sampling

was based on the academic staff of the faculties. The questionnaire was sent as an online survey to all academics who fulfilled inclusion criteria, and responses were collected until required sample size is saturated in each faculty strata. The response rates for each faculty was 100% and 152 staff members participated in the study. However, 7 responses were excluded from the analysis as they were incompletely filled. Overall sample was 145.

Data were collected through a self-administered questionnaire that comprised demographic questions and a standard questionnaire (CVS-Q). The prior approval to administer the CVS-Q English version to Sri Lankan community was obtained from a Committee of Sri Lankan experts representing statistics, health and language fields (Tamil, Sinhala & English language). A scoring system has been developed in the questionnaire in which a standard expression was used to obtain the overall score for prevalence. If the overall score is  $\geq 6$ , the academic staff member was identified as a person with CVS (Segui, et al., 2015).

The study was ethically approved by the ethics working committee of SLIIT. Statistical Package of Social Sciences-version 22 was used in data analysis. Chi-squared test was applied to test the significance of associations ( $p < 0.05$ ).

## **RESULTS**

### **Demographic variables**

Table 1 shows that the total number of responses ( $n=145$ ) were almost equally received from female (50.3%) and male (49.7%) participants. Most of the responses were from the participants between 20-30 years of age category. The majority of the participants (91.5%) used laptops and mobile phones to perform their tasks while at work. Most of the

academic staff employees (42.1%) used to work for 6-8 hours in front of a digital screen. Almost half of the individuals (49%) who participated in the study did not have a preferred time to use the computer. The impacts of prolonged computer usage were known by 93.8% of the employees.

### Symptoms of Computer Vision Syndrome

Table 2 shows the distribution of CVS symptoms among the academic staff of SLIIT. Dryness in the eyes, Itching, Eye pain and Headache were the common symptoms experienced by the staff members. The majority of the participants (54.5%) have suffered from headaches in occasional intervals due to prolonged computer usage, while only a few responses have observed coloured halos around objects during working hours. A considerable number of participants have experienced burning in the eyes, tearing, excessive blinking and blurred vision while utilizing the digital device.

### Preventive measures of CVS

Taking breaks in between the working time (26.2%), adjusting the screen (21.5%) and adjusting the chair & posture (20.7%) were the common methods used by the participants to prevent and control CVS. Using blue light blocking glasses was practiced by 16.2% while use of eye lubricants and performing eye exercises were practiced by a limited number of staff members.

### Association of demographic variables and prevalence of CVS

The prevalence of CVS among the academic staff members was identified as 59.3%. There was no significant association between the prevalence of CVS and gender, faculty, types of devices used during working hours, screen time, preferred time to utilize the digital device, awareness of CVS and actions to minimize CVS ( $p > 0.05$ ). However, according to the

Chi-squared test results, a significant association was found between the prevalence of CVS and age in years ( $p = 0.006$ ).

**Table 1;** The distribution of demographic variables (n=145)

Demographic variables		n (%)
Gender	Male	72 (49.7)
	Female	73 (50.3)
Age (years)	20-30	68 (46.9)
	31-40	43 (29.7)
	41-50	16 (11.7)
	51-60	10 (6.2)
	>61	8 (5.5)
Attached faculties	Computing	62 (42.8)
	Engineering	44 (30.3)
	SLIIT Business school	15 (10.3)
	Humanities & Sciences	23 (15.9)
Type of device used	Desktop computers	2 (1.3)
	Desktop computers & laptops	6 (3.9)
	Desktop computers, laptops & mobile phones	35 (22.7)
	Desktop computers, laptops, mobile phones & tablets	14 (9.1)
	Desktop computers & mobile phones	2 (1.3)
	Laptops	25 (16.2)
	Laptops & mobile phones	48 (31.2)
	Laptops, mobile phones & tablets	13 (8.4)
Time spend	0-2hrs	0
	2.1-4hrs	3 (2.10)
	4.1-6hrs	23 (15.9)
	6.1-8hrs	61 (42.1)
	>8.1hrs	58 (40.9)
Preferred time	Daytime	49 (33.8)
	Night time	25 (17.2)
	No preference	71 (49.0)
Awareness of CVS	Yes	136 (93.8)
	No	3 (2.1)
	Maybe	6 (1.1)

**Table 2.** Occurrence of computer vision syndrome (n=145)

CVS symptoms	Never (%)	Occasionally (%)	Often & always (%)
Burning	54.6	37.5	7.9

Itching	45.5	49.0	5.5
Feeling of a foreign body	77.2	20.7	2.1
Tearing	51.0	44.1	4.8
Excessive blinking	60.7	36.6	2.8
Eye redness	66.2	30.3	3.4
Eye pain	34.5	51.7	13.8
Heavy eyelids	64.1	28.3	7.6
Dryness	47.6	41.4	11.0
Blurred vision	56.5	34.5	9.0
Double vision	78.6	15.2	6.2
Difficulty focusing near vision	62.8	29.7	7.6
Increased sensitivity to light	60.0	28.3	21.7
Colored halos around objects	79.3	20.7	-
Feeling the sight is worsening	61.4	31.0	7.6
Headache	23.4	54.5	22.1

**Table 3.** Associated factors for CVS

Associated factor	x <sup>2</sup> value	p value
Gender	0.0835	0.361
Age in years	12.485	0.006
Faculty	1.915	0.59

Types of devices used	7.301	0.398
Screentime (hours)	4.888	0.087
Preferred time	4.619	0.099
Awareness	0.879	0.349
Actions to minimize CVS	29.822	0.921

## DISCUSSION

The findings of the current study in relation to participants' gender and age categories were congruent with previous research studies in which the majority of participants were female and had similar age categories (Zainuddin & Isa, 2014; Hough & Nel, 2017).

A higher percentage of participants (42.1%) have spent 6-8 hours whereas 40% have spent >8 hours in front of the digital devices. Further, 15.9% of participants have experienced 4-6 hours of screen time. Similar results were observed in a study conducted among computer users in Debre Tabor Town, Northwest Ethiopia (Dessie et al., 2018). The study stated that workers who used computers for more than 4.6 hours per day were more likely to develop CVS as compared to those who used computers for less than 4.6 hours (Dessie et al., 2018). Other similar studies have also reported that an increase in the number of hours spent on the computer raises the risk of CVS significantly (Ranasinghe et al., 2016; Sharma et al., 2006; Logaraj et al., 2014). Most of the participants of the current study have used electronic devices without a preference on the time of the day. Though there was no significant association between the preference and prevalence of CVS, Blehm (2005) stated that the lighting within the workstation area affects the vision of the employees who work with computers.

Awareness of CVS was identified among 136 employees. According to Dessie et al

(2018) computer users with a high understanding of computer safety measures and awareness of CVS were found to be less affected by CVS. The result conform to a study conducted at the University of Benin, Nigeria (Chiemeke et al., 2007). The awareness and knowledge about CVS among the participants highly contribute in adhering to CVS preventive methods that occurred during working hours.

The prevalence of computer vision syndrome among the academic staff of SLIIT was 59.31%. Alarmingly, other studies also have reported CVS prevalence with higher values among the working community who use computers: 63% among the administrative staff of a university in Malaysia, (Zainuddin & Isa, 2014), 73.9% in University of Gondar, Ethiopia, among secretaries and secretaries and data processors (Alemayehu et al., 2014), 67.4% in Sri Lanka among office workers (Ranasinghe et al., 2016) and 72% in Ajman, United Arab Emirates (Shantakumari et al., 2014). The highest percentage of responses came from the Faculty of Computing, where a majority of participants work as computer experts who work with digital devices more frequently than other employees. Since they are spending more time with computers, the participants were aware of the causes of prolonged computer use. The possible reason for a lesser prevalence compared to other studies may be due to the awareness of CVS and the ergonomic practices among the academic staff members of SLIIT.

In this study dryness in the eyes (52.4%), itching (54.4%), eye pain (65.5%) and headache (76.5%) were the most common symptoms experienced by the staff members. Headache has been identified as one of the symptoms experienced by many computer users in prior studies. According to Bali et al (2007), 82.1 % of their study

population have complained of headaches, whereas 43.3% and 45 % were among medical and engineering students, respectively (Logaraj et al., 2014).

It has been proven that if a person sits at a computer screen for an extended amount of time, their blinking rate can be lowered by 60% (Akinbinu and Mashalla, 2013). As a result, tear production will be reduced, leading to dry eyes (Anshel, 2004). Dry eyes were more common in women, the elderly, and contact lens wearers, and less common in younger age groups and non-contact lens wearers (Schaumberg et al., 2003). However, the findings of the present study show that the prevalence of dryness in the eyes is high among the 20-40 age category. The possible reason could be due to, a sample containing a high percentage of 20-40 years old participants. Although itching and eye pain were complained by most of our participants, prior studies show that redness in the eye, eyestrain, double vision, & watery eyes were also frequently observed among the employees who use computers (Akinbinu & Mashalla, 2013; Anshel, 2004; Talwar, 2009; Chiemeke, 2007; Ranasinghe et al., 2016).

Upon assessing the preventive measures of CVS taken by the academic staff, adjusting the chair & posture, adjusting the screen and taking breaks in-between the working time were the most common methods used by the participants. Taking a work break during long periods of computer work can help to relieve eye strain by allowing the eye muscles to rest by shifting their attention away from the computer screen (Alexis & Gregory, 1997). In a study conducted in Malaysia by Rahman & Sanip (2011), taking breaks (at least 10 minutes during continuous one-hour computer work) was found to be significantly associated with CVS. Previous studies show that improper workstations, unsuitable viewing angle

and distance, incorrect positioning of the keyboard, inadequate room illumination and improper screen brightness were factors associated with CVS symptoms (Parihar et al., 2016; Ranasinghe et al., 2016). In this study, improper ergonomic practices were prevalent among the participants who were identified as having CVS. According to Ranasinghe et al (2016), individuals at workstations that were noncompliant with standard ergonomic recommendations had a greater prevalence of CVS.

## CONCLUSION

The present study showed a high prevalence of Computer Vision Syndrome among academic staff of SLIIT. Since the majority of the participants were aware of CVS, they were practising CVS prevention measures in the workplace. Increasing the knowledge and awareness on CVS and recommending workplace ergonomics will contribute to reduce the number of CVS reported incidences.

## RECOMMENDATIONS

This study benefited the participants to perceive their vision status and to receive an appropriate referral with regard to the improvement of their vision status. Regular screening and testing should be done for the academics who have CVS symptoms more often. Webinars are recommended to be conducted on preventive measures of CVS and workplace ergonomics. Receiving consultations from a physiotherapist is recommended to get further information regarding workplace ergonomics and eye muscle strengthening. Furthermore, those who experienced multiple CVS symptoms were recommended to refer an ophthalmologist for further treatment.

## LIMITATIONS

The main limitation of the study was that the CVS-Q has not been adapted and validated for Sri Lankan population although it is validated to be used in English language. Another limitation was that an ocular examination was not performed to measure CVS. Therefore, all the discussed data on symptoms related to CVS depended on self-reported measures by the study participants. The study setting was limited only to SLIIT due to COVID 19 restrictions in the country. Hence, the overall results cannot be generalized to academic staff who utilize computers in other universities in Sri Lanka.

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# **Mathematics & Statistics**



## The Impact of Environmental Risk Factors on Road Traffic Accidents (RTAs) in Sri Lanka

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### ABSTRACT

The environmental factors have a remarkable importance due to their effects on traffic accidents' severity and their injuries. This study therefore intended to determine the significant environmental factors associated with RTAs in Sri Lanka (2005 - 2019) and the impact of those factors using data obtained from the Department of Police, Sri Lanka. Chi-square statistics and binary logistic regression analysis were applied to derive the required inferences. When the variables were considered separately, all the attributes of environmental characteristics have significant association with the severity of accident. The fitted binary logistic model revealed that rural area, wet road surface, road flooded with water, night with no street lighting, night with improper street lighting, light condition is dusk, or dawn, junction and roundabout have significantly contributed to occurrences of fatal accidents. The odds of happening fatal accidents in wet road surface 1.141 times higher than that it occurs in dry road surface. The odds of happening fatal accidents during night with no street lighting and night with improper street lighting are 1.789 times and 1.759 times higher than that it occurs during daylight respectively. The inferences derived from this study would be very useful for policy makers in order to minimize RTAs in Sri Lanka.

## INTRODUCTION

Road Traffic Accidents (RTA) are rising steadily resulting in the loss of lives of approximately 1.35 million people each year. It has been estimated that everyone minute, 2 people die and 95 people are either harshly injured or incurably disabled due to traffic accidents, globally.

Furthermore, an estimated number of 20 to 50 million people experience minor injuries while many are left disabled. WHO (2004) mentioned that lower middle and upper middle income earning nations account for about 85% of the deaths and 90% of the annual Disability-Adjusted Life Years (DALYs) lost because of RTAs.

The death rate due to RTAs was 2.6 times greater in the lower middle and upper middle income countries than in higher income countries, despite lower rates of vehicle ownership in lower middle and upper middle income nations in comparison to higher income earning nations. When stated relative to the population, lower middle and upper middle income countries experience 24.1 deaths per 100,000 population while higher income countries experience 9.2 deaths per 100,000 population (WHO, 2000).

The current trend of RTAs suggest that it will take the third place in terms of contributing to the universal burden of injury and disease by the year 2021 (IHME, 2018). Based on the WHO (2013), most of the countries, especially the developing countries do not pay sufficient attention to RTAs, road safety measures, and the challenges that come with the increased occurrences of road traffic accidents.

Sri Lanka which belongs to the upper middle income strata shows a prominent burden of damages and fatalities related to RTAs (WHO, 2015). The deaths caused by RTAs are made up 2.8% of total deaths in Sri Lanka or 3,554 lost lives as per the WHO data published in 2017. The age-adjusted death rate was found to be 16.33 per 100,000 of the population. Amarasinghe and Dharmaratne (2019) mentioned that Sri Lanka is facing the burden of RTAs and associated injuries and deaths, due to an exponential growth in motorization on a static road system.

Statistics of the Sri Lanka Police (n.d.) also displayed that an enormous increase has taken place in mobility and motorization in Sri Lanka during the last decade. A study done by Kopits and Cropper (2003) claimed that there would be a 150% increase in RTAs within the period of 2000 to 2021 in Sri Lanka.

Based on the above facts and figures, RTAs remain an ever-increasing trend and the alarming numbers of fatality recorded globally as well as in Sri Lanka, suggest that this trend will continue to be the case throughout the foreseeable future (WHO, 2018).

In comparison to the other leading causes of death in Sri Lanka, RTA is a controllable public health, economic and social problem. Yet, without sufficient knowledge of the seriousness of the problem, the risk of death and injury involved, the ability to carry out context-specific and appropriate interferences are severely limited.

Prominent scholars (Pierce & Maunder, 1998; Baruah & Chaliha, 2015; Singh et al., 2013) conducted studies exploring the risk elements that influence RTAs globally.

The effect of environment on several health issues has been an interesting topic for researchers for a long time. In the field of RTAs, a growing body of studies has reviewed the relationship between environmental factors and RTAs. The study was carried out based on traffic data of England and Wales, and it demonstrated the importance of a geographical approach rather than a more conventional road section study.

Nevertheless, studies done by different scholars (Conesa et al., 2013; Liu, 2013) in different situations have identified poor lighting, inadequate visibility, improper designs, inefficient traffic administration, bad weather conditions, poorly lit roads, lack of street lighting, absence of warning systems, mobility of the population, traffic density, and the proportion of paved roads, motorways, and express roads as additional risk factors of road fatalities.

Furthermore, Harith et al., (2019) claimed that poor weather conditions have significantly reduced drivers' visibility and subsequently increased accident risk. As per above research results, it can be claimed that environmental factors have a remarkable importance due to their effects on traffic accidents' severity and their injuries. More importantly, some of these factors are controllable.

This study therefore focused on stimulating actions to establish road safety within the country through the identification of environmental related risk factors that are associated with RTAs in Sri Lanka.

## **MATERIALS AND METHODS**

This study is carried out with panel data (2005 - 2019) of RTAs in Sri Lanka, obtained from the Sri Lanka Police. Analysis of frequency tables with Chi-square statistics and binary logistic regression analysis were applied to derive the required inferences.

The dependent variable (y) is binary with 1 for fatal accidents and 0 for non-fatal accidents. The explanatory variables considered are road surface, light condition, location type, sector and weather as key factors of RTAs which describe the environmental characteristics of RTAs.

## **RESULTS AND DISCUSSION**

### **Association between environmental variables and RTAs**

In order to find the association of each variable on RTAs, separate Chi-square tests were carried out initially. Results found that all categorical variables related to environmental characteristics have significant influence ( $p < 0.05$ ) on the severity of RTAs (Table 1).

**Table 1.** Association between Severity of Accident and Independent variables

Main Variable	Category	% fatal accident	Test statistic and p value
Road surface	Dry	5.6	$\chi^2_3 = 256.840$ p = .000
	Wet	7.8	
	Flooded with water	7.8	
	Slippery surface (mud, oil, etc)	6.7	
Light condition	Day light	.7	$\chi^2_4 = 2947.479$ p = .000
	Night, no street lighting	9.4	
	Dusk, dawn	6.5	
	Night, improper street lighting	8.0	
	Night, good street lighting	5.8	
Location type	Road no junction within 10 meters	6.2	$\chi^2_3 = 798.352$ p = .000
	Junction	4.6	
	Roundabout	1.6	
	Other	6.3	
Sector	Urban	3.9	$\chi^2_1 = 3853.123$ p = .000
	Rural	7.8	
	Clear	5.6	
Weather	Cloudy	7.6	$\chi^2_3 = 323.559$ p = .000
	Rain	7.9	
	Fog/Mist	7.8	

### Analysis of environmental variables simultaneously

To find the combined impact from the best fitted model, binary logistic regression was carried out under forward stepwise method. The results of the final model are shown in Table 2. The significance of the

Hosmer and Lemeshow test statistic concludes that the fitted model is significant at 5% level. The overall predictive power of the model is very high as 76.8%. The fitted model is shown in equation (1).

**Table 2.** Properties of the estimators for best fitted binary logistic model

Variables	B	S.E.	Wald	df	Sig.	Exp (B)
Sector (S)	.659	.013	2717.447	1	.000	1.933
Road Surface (RS)			35.743	3	.000	
RS. Wet	.132	.024	30.361	1	.000	1.141
RS. Flooded with water	.152	.065	5.431	1	.020	1.164
RS. Slippery surface	-.048	.075	.414	1	.520	.953
Light Condition (LC)			2015.993	4	.000	
LC. Night, no street lighting	.582	.015	1481.389	1	.000	1.789
LC. Dusk, dawn	.300	.024	153.224	1	.000	1.350
LC. Night, improper street lighting	.565	.020	763.552	1	.000	1.759
LC. Night, good street lighting	.430	.023	344.356	1	.000	1.537
Location Type (LT)			319.559	3	.000	
LT. Junction	-.200	.016	164.486	1	.000	.819
LT. Roundabout	-1.025	.079	167.738	1	.000	.359
LT. Other	-.009	.021	.173	1	.677	.991
Constant	-3.320	.012	77678.403	1	.000	.036

Hosmer and Lemeshow Test Statistic:  $\chi^2_3 = 225.349$  (p =.000)

### Impact of levels within variables on fatal accidents

The results in table 2 indicate that the variables: sector, road surface, light condition and location type to predict the outcome variables which are significantly associated with the severity of accidents

when all the variables are taken into consideration simultaneously. Based on the results in the 7th column of Table 2 model for odds ratio for the occurrence of fatal accident is given in equation (1).

$$\left(\frac{p}{1-p}\right) = 0.036 + 1.933 * S + 1.141 * \text{RS. Wet} + 1.164 * \text{RS. Flooded with water} + 1.789 * \text{LC. Night, no street lighting} + 1.350 * \text{LC. Dusk, dawn} + 1.759 * \text{LC. Night improper street lighting} + 1.537 * \text{LC. Night good street lighting} + 0.819 * \text{LT. Junction} + 0.359 * \text{LT. Roundabout} \dots\dots\dots (1)$$

The odds of fatal accidents happening on wet road surfaces is 1.1 times higher than that the odds of the occurrence of fatal accidents on dry road surfaces when all other variables in the model are fixed. The odds of fatal accidents happening during night with no street lighting is 1.8 times higher than that it occurs during daylight. The odds of fatal accidents taking place are 1.93 times higher in rural area compared to odds of fatal accidents taking place in urban area.

## CONCLUSIONS

When the variables were considered separately, all attributes to environmental characteristics have significant association with accident severity. The fitted binary logistic model revealed that sector, wet road surface, road surface of flooded with water, poor light condition junction and roundabout have significantly contributed to occurrences of fatal accidents. The inferences derived from this study can be easily used for proper planning and consequently to reduce the RTAs in Sri Lanka.

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## An Empirical Study on the Factors Affecting Entrepreneurial Intention of Management and Arts Undergraduates: with Reference to USJ

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### ABSTRACT

As a developing country, Sri Lanka is currently facing several economic challenges, and it is necessary to decode how this positioning can be improved. Out of the various efforts that are available, enriching the number of entrepreneurs has been one such strategy that is proven to boost the economy. Sri Lanka still records low entrepreneurship rates in comparison to developing countries. This paves the way for the need to understand the entrepreneurship intention of youth. Therefore, this study was conducted with students of two faculties to identify the latent factors that affect entrepreneurship intention among undergraduates and to recognize if there are any significant statistical differences on the perceptions of students between the two faculties. The sampling method was stratified random sampling and the sample size was 106. Data collection was conducted through a self-administered questionnaire. Using factor analysis it was identified 8 factors that affect entrepreneurial intention of the undergraduates in Sri Lanka. Of them, five proved to be controllable factors (aspiration, entrepreneur characteristics, awareness, readiness financial knowledge) by the students suggesting that actions can be demonstrated in enriching students' motivation and consideration towards entrepreneurship. The remaining three factors (education received, financial ability, family influence) show that external factors such as parents, investors and educational institutions can influence students towards choosing a career path of entrepreneurship. The findings of this study can be used in structuring the youth mindset to enhance entrepreneurial intention among them.

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## INTRODUCTION

In a day and age with increasing technology and information on hands for youth, entrepreneurship is becoming less daunting. The Global Entrepreneurship Index rankings for 2018 show the United States at top of the list with Switzerland recording the second highest. Sri Lanka is ranked 90 out of 137 countries (Global Entrepreneurship Index, 2018).

Along with generating businesses, entrepreneurs can accelerate economic growth, add value to national income, develop and improve existing systems as well as bring about social development. With the gamut of such benefits it offers, entrepreneurship is still shunned due to a number of causes such as inevitable risk, limited resources, lack of exposure, personal choices or mindset. Hence, there remains considerable space for its unpopularity.

Looking at the situation specifically in Sri Lanka, Bandara (2019) states that comparing to Bangladesh (11.6%), Vietnam (19.6%) and Thailand (27.5%); only 2.8% of the total working population is recognized as a business owner or hold authority as an employer. A subset of this number would include youth who are willing to be identified as entrepreneurs explicitly generating a difference between the desired and existing number of entrepreneurs. By comprehending the values that can be brought into the country and its economy through the improvement of entrepreneur businesses, it is evident these low numbers should be improved. In understanding the context of Sri Lanka, Sirisena (2015) identified that three components: cultural influences, youth attitudes and education determine the lower numbers of youth engaging in entrepreneurship in the country.

Therefore, in order to investigate the perception of youth, this study was designed to explore undergraduates' intention on entrepreneurship.

With the intention of shedding light on developing this field in the country in future, the main objective of the study was to understand what main factors affect the Management and Arts undergraduates in University of Sri Jayewardenepura (USJ) in wanting to become an entrepreneur. By recognizing this, those in a position to influence students in enhancing their entrepreneurial intention can utilize resources to enrich the identified factors. In addition, focus was also brought upon any differences that may be demonstrated by the faculties that were used in this study. Based on the scope of this study, other literature available illustrated the need in advancing the entrepreneurial landscape in society.

## Literature Review

Several studies have been conducted in this discipline of entrepreneurship and university students around the globe. One study conducted in Ghana suggested that a student's personal attributes such as task taking and risk performance attitudes, positively contributed towards entrepreneurial intention while other demographic factors such as age, gender and academic background had no impact (Asamani and Mensah, 2013). However, contrary to this finding; Keat, Selvaraja & Meyer (2011) revealed that gender and working experience significantly affected the youth inclination towards entrepreneurship. They also identified that the university's stance in promoting entrepreneurship and the education provided on it also impacted the students

of the Malaysian university in which this study was conducted.

With regards to entrepreneurship education and intention, many studies worldwide confirmed that education within this field has a direct impact or enhances entrepreneurial intention (Patricia & Silangen, 2016; Moses et al., 2016,). These studies point out that education of this nature is an important factor in shaping the intention of growing into an entrepreneur.

While some studies have been conducted with students of multi-academic backgrounds, an Indonesian study by Mahendra et al., (2017) with students from the management discipline revealed that entrepreneurship education indirectly affects the intention, with entrepreneurial motivation and attitudes being mediators.

The studies conducted in Sri Lanka paint a picture as follows. Jayarathna et al., (2011) identified that intention of undergraduates for other employment opportunities was higher than their intention towards entrepreneurship. They employed a regression analysis to conclude that social, economic, psychological, political and legal factors contribute towards the intention of becoming an entrepreneur. Following a similar analysis structure, Wickramasinghe et al., (2017) and Kumara (2012) applied correlation analysis to understand entrepreneurial intention of undergraduates. While the former study which proceeded with a regression analysis concluded that fear of failing, availability of business network and support from family as significant determinants on entrepreneurial intention; the latter concluded that entrepreneurial belief and attitude towards self-employment had positive

associations with entrepreneurial intentions.

The study conducted by Madhavika (2019) also followed a correlation and regression analysis to reveal that proactive personality and perceived support significantly influence entrepreneurial intentions. Conversely, it was identified that risk taking ability and educational back up do not significantly influence the intent for entrepreneurship.

According the sourced literature, it can be identified that this area of interest shares various outcomes which are in some instances controversial based on various factors. Besides this, even though literature is available in this regard, adequate statistical analysis has not been applied in disseminating the reinforced data. Thus, as mentioned, this highlights the importance of and compels one into conducting an empirical study for understanding the true responses of the undergraduates in Sri Lanka. Thus, with an understanding of the available literature in this regard, the author orchestrated the study to identify what factors would impact the young persons in their intent to grow as entrepreneurs in future in Sri Lanka.

## **MATERIALS AND METHODS**

The study under consideration focused on understanding the undergraduates' intention of growing with entrepreneurship skills and attitudes. Undergraduates are in a position of readying themselves for the future while preparing with sufficient knowledge that would be needed for the employment sphere. This study was conducted with students from the USJ with students from both the Faculty of Management and Commerce and the Faculty of Humanities and Social Sciences.

These faculties were selected to understand the differences that resulted in entrepreneurship intention of undergraduates. Faculty of Management which enriches students with knowledge of management and handling business (as based on the available literature), is taken for the purpose of comparison against Faculty of Humanities and Social Sciences which supposedly continued to record high unemployment rates (National Audit Report, 2019) among its graduates.

Thus, from a total sample of 106 students who were selected using random sampling methodology, 52 were representatives of the Faculty of Humanities and Social Sciences while the remaining 54 students were from the Faculty of Management and Commerce. The study considered an approximately equal number of students who were employed for the purpose of comparison. However, it was ensured according to the research design that, students were from only within the 3<sup>rd</sup> and 4<sup>th</sup> academic years as they would be graduates in the nearest future.

The study took a quantitative approach by setting the core of the research on primary data and analysis whilst secondary data too was utilized in serving as a directive for the approach. Primary data collection resulted in a self-administered questionnaire that was collected by the researcher. Following the procedure of data collection, statistical analytical methods were employed so as to draw out conclusions. Prior to employing multivariate analysis techniques, a descriptive study analysis was also carried out for the purpose of understanding the make-up of the sample. Moreover, the t test was applied in assessing if there are any statistical differences between the students of each faculty.

A factor analysis centered on principal components analysis (PCA) was applied

on the collected data in order to compute any latent factors that affect entrepreneurship intention of undergraduate students. The model used for this analysis is as follows:

$$X_i = \mu_i + \alpha_{i1} F_1 + \alpha_{i2} F_2 + \dots + \alpha_{im} F_m + \varepsilon_i$$

where  $X$  is the random vector with mean  $\mu$  and covariance matrix. Further,  $F_1, F_2, \dots, F_m$  are the unobserved variables with  $\alpha_{i1}, \alpha_{i2}, \dots, \alpha_{im}$  being the factor loading coefficients.

The covariance matrix was selected as the variables were measured on a similar scale and varimax rotation was applied to maximize the sum of squared loading variances. Prior to multivariate analysis, reliability and validity of data were confirmed ensuring quality data used for analysis.

## RESULTS AND DISCUSSION

### Descriptive analysis

According to the results of the study under consideration, an approximately equal 49% and 51% made up the sample of students from the faculty of arts and the management faculty. Of them, majority were from a family income of Rs. 15,000 – Rs. 49,999 (33%) and Rs. 50,000 – Rs. 99,999 (35%), followed by 28% above Rs. 100,000. Of the sample, only 8% claimed to have been employed before entering university.

Only 79% mentioned of having awareness on entrepreneurship prior to entering university. The highest positive influence is received from the family (51%) followed by friends (24%) and the university (16%). Furthermore, of those who were disinterested in entrepreneurship opportunities, 44% followed by 42% feel they do not look towards entrepreneurship opportunities because of lack of financial support and the expectation of performing one job. The

remaining 14% feel they do not have sufficient awareness about it.

### Bi-variate analysis

Data collected using a Likert scale to measure the dimensions of the variables based on a structured questionnaire was employed in this section. The independent t test was performed on the variables after indexes were formed using the principal components analysis.

**Table 1.** Independent t test against faculties

	t value	p value
Entrepreneurship	-0.370	0.712
Family background	-0.506	0.614
Social media	-3.401	0.001
Personality traits	0.481	0.632
Entrepreneurship education	-2.257	0.027
Business environment	1.253	0.213
Financial strengths	-1.448	0.151
Future interest	-0.407	0.685

According to the data shown in Table 1, the usage of social media for entrepreneurship ( $p = 0.00$ ) and entrepreneurship education ( $p = 0.03$ ) alone show a significant statistical difference between the two faculties at a 5% level of significance. Both variables had higher scores from the management faculty. This reveals that, apart from the mentioned two variables, there is no significant statistical differences between the two faculties.

### Multivariate analysis

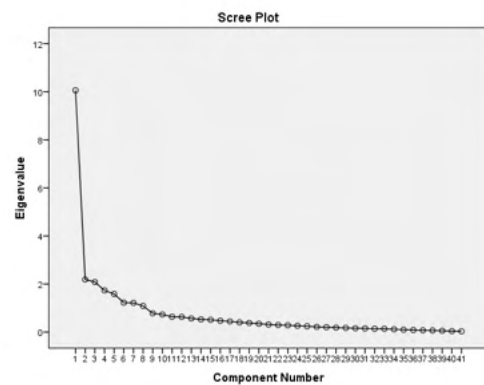
In order to employ the dataset for further analysis, the Cronbach's Alpha value was determined as 0.947 ensuring the questionnaire to be reliable for conducting further analysis. Additionally, the calculated Kaiser-Meyer-Olkin Measure of Sampling Adequacy appeared to be  $KMO = 0.792$  while the Bartlett's Test of Sphericity ( $\chi^2 = 2822$ ,  $p = 0.000$ ) proved to be significant thereby concluding with

95% confidence that the observed correlation matrix is significantly different from the identity matrix assuring the validity of the data for further analysis.

The initial eigen values claim to have 8 components with values higher than one explaining 70% of the variance. Determinant value of 3.31 shows there is very low multicollinearity within the data assuring that the data can be used for further analysis. The correlation matrix output provided the correlation between variables with high coefficients within variables related to future expectations and goals on becoming an entrepreneur. This was followed by variables relating to personality traits.

As the data suggested, 8 factors were identified that impact the intention of students. This was confirmed by the scree plot shown in Figure 1.

**Figure 1.** Scree plot for identified factors



Based on the rotated component matrix, similar variables were clubbed together to create factors which were identified by the author. A total of 41 variables were reduced to 8 factors through the analysis. Accordingly, the latent factors were identified as follows. Since varimax rotation was applied it can be confirmed that the factors are orthogonal and unrelated to each other.

1. Aspiration
2. Entrepreneur characteristics
3. Awareness
4. Education received
5. Readiness
6. Financial ability
7. Financial knowledge
8. Family influence

## CONCLUSIONS AND RECOMMENDATIONS

### Conclusions

The analysis applied through the collected data provided an understanding of the entrepreneurial intention of undergraduates of the afore mentioned faculties. Moreover, it is clear that lack of financial support remains a vital reason for students to navigate away from startups, while lack of awareness is relatively low. Only two variables proved to have a distinct difference between the faculties – where usage of social media and entrepreneurship education were observed stronger in the Management Faculty.

Multivariate analysis proved to be valuable in decoding the underlying factors that affect entrepreneurial intention of students. According to the factor analysis, the factors that affect entrepreneurial intention are as follows: how the student aspires to have a career path as an entrepreneur, the entrepreneurial characteristics such as risk taking, finding new things, high self-confidence etc., the level of awareness in knowing what entrepreneurship is all about, the learning on entrepreneurship received by the student, how ready the student is to take on a new business, the availability of finance as an investment for the startup, the understanding of financial opportunities and threats and finally, the support and influence given by family. Thus, it can be confirmed that undergraduate students' intentions are

affected by these latent factors with regards to the Sri Lankan context.

### Recommendations

As the analysis suggested, the factors that affect the intention should be sought after so that it may be improvised for future students which will enrich the entrepreneurial scope in Sri Lanka. It was identified through this study that, there are many personal, family and university related factors impacting the intention. Therefore, it is concluded that collective effort needs to be made by the society in lifting the entrepreneurial space open for new ventures to bloom. However, emphasis is given to the findings of this study that indicated that most factors affecting intention are controllable factors of the students. Of the 8 factors that have been identified, a simple classification of the factors into controllable and uncontrollable factors shows that five of the factors are controllable by the students themselves. These five factors are: aspiration, entrepreneurial characteristics, awareness, readiness and financial knowledge.

Hence, special focus delivering these factors to instill them in students will enable students to be motivated and consider the option of growing to be entrepreneurs. It is strongly suggested that further analysis be conducted in dissecting the identified factors further, so that actionable procedures can be implemented for the improvement of entrepreneurship intention among undergraduate students for a flourishing economy in the country.

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## Comparing Trends in Data (with Applications to COVID and Image Data)

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### ABSTRACT

Many applications involve looking at and comparing trends in data. We will discuss some statistics that can be used to assess the similarity or dissimilarity between pairs of cumulative trends. These statistics can then be used to study sets of trends – for example, to cluster them or to compare them across different groups. We will describe one possible approach and illustrate its use in two case studies. In the first case study, we studied the trend over time of COVID-19 in New Jersey in the USA– it was found that areas close to New York City had significantly different (more rapidly increasing) cumulative trends compared to areas further from New York City during the early days of the pandemic, but this difference dissipated as the pandemic progressed and spread within New Jersey itself. In the second case study, we compared two sets of CT scan images of lungs – a significant difference could be detected between COPD-diseased lungs and normal lungs. Overall, the method performed well and detected insightful differences.

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## INTRODUCTION

Almost all of data analysis is concerned with looking for and studying patterns in data. One such pattern that is often of interest is a trend. A trend can be thought of as follows: Given a set of univariate observations,  $\{a_i\}$ , a trend looks at how smoothly and systematically  $a_i$  shifts with increasing values of  $i$ . With time course data,  $i$  would be time and it would be interesting in following how the  $\{a_i\}$  pattern evolves over time. With imaging data,  $i$  would be pixel intensity, and it would be interesting to see how the pixel count  $a_i$  varies with the increasing intensity. In pharmaceutical research,  $i$  would be dose and we would like to see how increasing a dose elicits a change in response to  $a_i$ . These are only a few contexts in which this type of data arises. As can be seen, there are many situations in many disciplines in which this type of data is of interest.

In this paper we will discuss a method to study sets of trends. We will focus on data where the  $\{a_i\}$  are counts and it is interesting to compare and/or classify cumulative trends. A cumulative trend  $\{x_i\}$  is defined as follows: If  $a_{it}$  is the count at  $t$  for sample  $i$ , then,  $x_{it}$  is the sum of all counts up to  $t$ :

$$x_{it} = \sum_{k=1}^t a_{ik}$$

We will describe some different statistics that could be used in the method to assess the dissimilarity between two such monotonic trends and study their performance in a simulation.

Note that, while  $\{a_i\}$  is essentially a time series, there are issues that make it problematic to use conventional time series formulations here to determine clusters or to classify them. In each of the applications of interest here, there are

multiple series; all of them involve a fairly short time period and the data exhibits no seasonal or cyclical component. Also, even though the series of  $\{a_i\}$  counts may be autoregressive, it is the dissimilarity in the evolution of counts that matters for our purpose rather than the autocorrelation structure. Thus, conventional time series methodology will not be applied here.

To motivate our approach, we will give two case studies in which the procedure we describe has been successfully applied.

## MATERIALS AND METHODS

Given two cumulative trends,  $x=\{x_i\}$  and  $y=\{y_i\}$ , suppose that we are interested in seeing how similar or dissimilar they are. There are a number of different statistics that could be used for this purpose.

(1) Euclidean distance:

$$d(x, y) = \sum (x_i - y_i)^2$$

(2) Manhattan distance:

$$d(x, y) = \sum |x_i - y_i|$$

(3) Maximum distance:

$$d(x, y) = \max_i |x_i - y_i|$$

(4) Chi-squared distance:

$$d(x, y) = \sum (x_i - y_i)^2 / (x_i + y_i)$$

(5) Kullback-Leibler divergence:

$$d(x, y) = \sum (x_i - y_i) \log(x_i, y_i)$$

Once dissimilarities between pairs of trends are calculated using one of these statistics, they can be analyzed in various ways as appropriate to the study objective.

For instance, it is often helpful when comparing multiple trends, to have a visualization that displays the similarity-dissimilarity patterns among the samples. This can be done using multidimensional

scaling (MDS). Given  $n$  trends  $\{x_i: i = 1, \dots, n\}$ , MDS finds a set of  $n$  2-dimensional points  $\{z_j\}$  that are such that the Euclidean distance between  $z_i$  and  $z_j$  approximates  $d(x_i, x_j)$ .

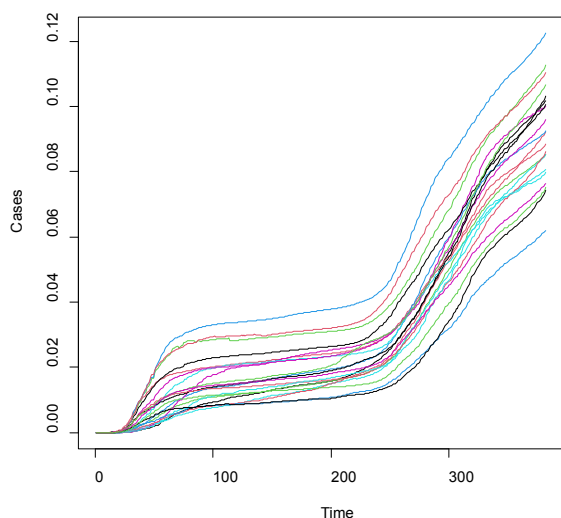
Further analyses can be done using either the  $\{z_i\}$  or the  $\{d_{ij}\}$ . We shall give some examples in the next two sections.

### Case Study 1: COVID-19 Data

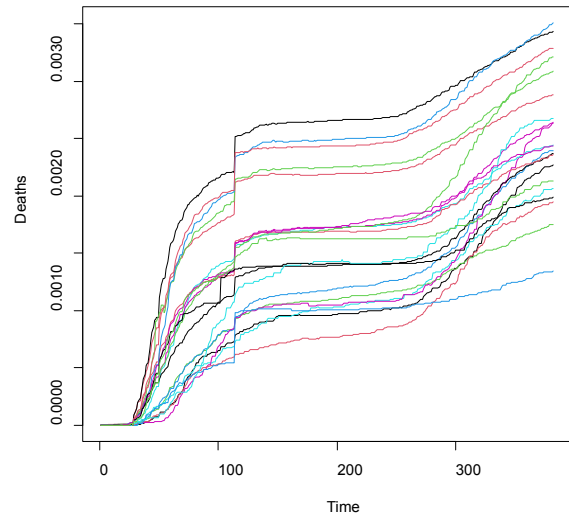
The spread of COVID-19 across different geographic regions of New Jersey (NJ) was studied. NJ is a state located just next to New York City (NYC) in the USA and there is a lot of commuter and commercial traffic between NJ and NYC.

In particular, we studied the cumulative time trends,  $\{x_i\}$ , of the counts of confirmed COVID-19 cases and COVID-19-related deaths for each of the 21 counties in NJ from 4 March 2020 to 20 March 2021 (Figures 1 and 2).

**Figure 1.** Cumulative time trends,  $\{x_i\}$ , of the counts of confirmed cases; each line corresponds to a separate county



**Figure 2.** Cumulative time trends,  $\{x_i\}$ , of the counts of COVID-19-related deaths; each line corresponds to a separate county



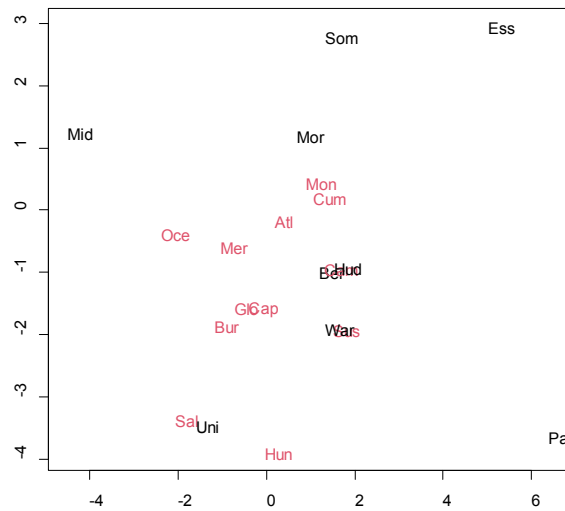
We calculated the dissimilarities,  $D_{ij}$ , between all pairs of counties  $i$  and  $j$ .

$$D_{ij} = d(x_i/P_i, y_i/P_i),$$

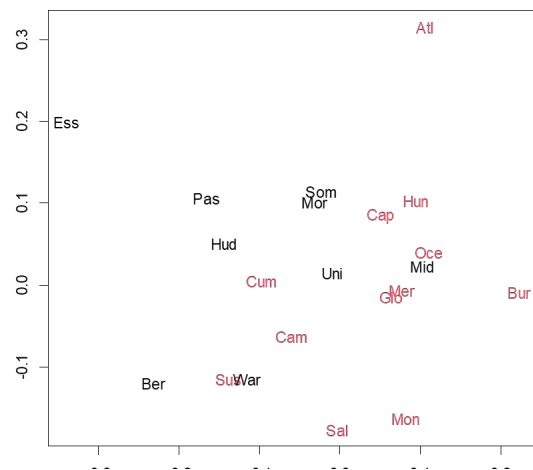
where  $P_i$  is the population of county  $i$ . This population adjustment was done to take into account the differences in county populations. We then used Manhattan distance (because the simulation reported in Section 5 indicated it provided a good estimate of the separation between time profiles) to estimate the dissimilarities between county time trends.

Multidimensional scaling was done using these dissimilarities. Figures 3 and 4 show MDS plots of the data (Figure 3 is for cases and Figure 4 is for deaths). We compared the counties relatively close in commuting distance to NYC (shown in black) to the counties relatively distant from NYC (shown in red).

**Figure 3.** MDS plot for the confirmed COVID-19 cases. Each point has the first 3 letters of the county it represents; counties close to NYC are in black and counties relatively distant from NYC are in red

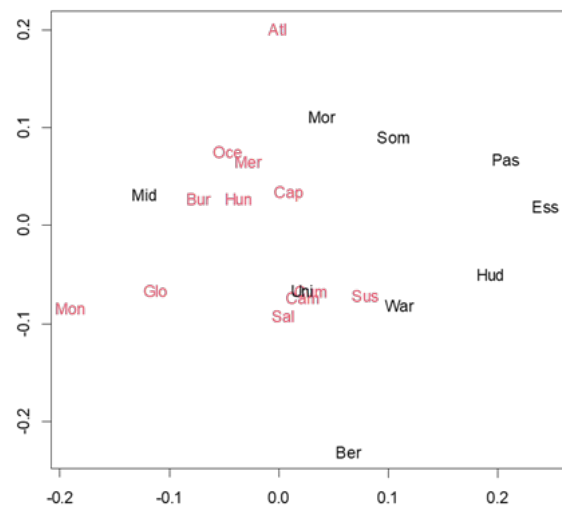


**Figure 4.** MDS plot for the COVID-19-related deaths. Each point has the first 3 letters of the county it represents; counties close to NYC are in black and counties relatively distant from NYC are in red

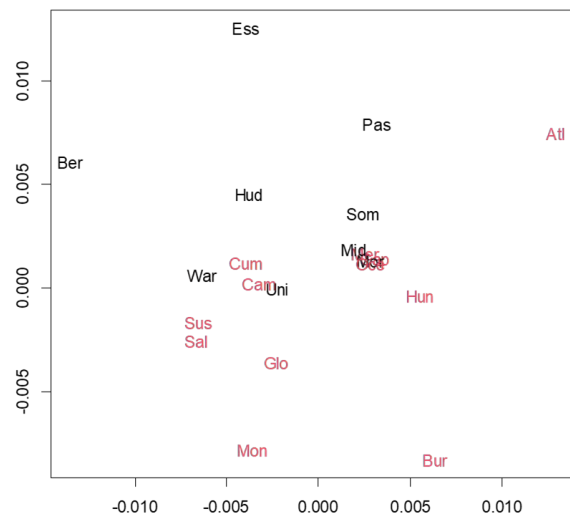


Hotelling's  $T^2$  test comparing the two sets of 2-dimensional points showed no difference for cases ( $p=0.2080$ ), but a significant difference in deaths ( $p=0.0220$ ). On the other hand, we also looked at the time trends up to Day 60 (3 May 2020) of the pandemic in NJ. Figures 5 and 6 show the corresponding MDS plots.

**Figure 5.** MDS plot for the confirmed COVID-19 cases for the first 60 days



**Figure 6.** MDS plot for the COVID-19-related deaths for the first 60 days



In this case, a clearer separation between the counties close to NYC and those far from NYC can be seen for both cases and deaths. Hotelling's  $T^2$  test comparing the two sets of trends showed a significant difference for both cases ( $p=0.0243$ ) and deaths ( $p=0.0184$ ).

Such significant differences can be seen at the early time points but not at the later time points. See Table 1. This demonstrates the geographic evolution of the pandemic over time, with many early cases and deaths in NJ arising from its

proximity to NYC, but with this effect being dampened later as infections spread within NJ itself.

**Table 1.** P-values comparing the cumulative trends in cases and deaths between counties close to and far from New York City for various time periods from the start of the epidemic

No. of days	Cases p-value	Deaths p-value
60	0.0243	0.0184
120	0.0575	0.0074
180	0.1402	0.0085
240	0.1405	0.0102
300	0.1553	0.0128
360	0.2069	0.0189

In related work, Amaratunga et al (2021) also investigated whether various socio-economic factors could have influenced the spread of COVID-19 within NJ. They looked at factors such as percentage of elders in the population, percentage of low-income households, the numbers of food and health facilities (including fast-food and non-fast-food restaurants, groceries, nursing homes, fitness centers, and pharmacies – these were obtained by querying the Yelp Fusion API). Since a large proportion of the dissimilarities between counties could be accounted for by the first eigenvector of MDS (it was larger than 0.90 for both cases and deaths), it was reasonable to regard the values along this eigenvector as carrying the most information regarding differences between counties. These values were then used as a response variable and modeled against the above socio-economic factors. The model indicated that the most important factors were population, distance to NYC, and percent of low-income households.

### Case Study 2: COPD Data

Images of lungs were obtained from a study of chronic obstructive pulmonary disease (COPD), a disease that affects airflow from the lungs (Lubomirski, et al, 2021). The lungs of 6 mice experimentally

induced with COPD were compared to the lungs of 6 healthy mice. Lung images were obtained using high resolution computerized tomography (CT) imaging of lung structure; CT scans provide detailed maps of lung airways and soft tissue and have been shown to provide critical insights to changes in lung function. Here the objective was to determine whether it was possible to detect a difference between the two sets of images.

Figure 7 shows the empirical distribution functions of the pixel intensities for the 12 lung images. A shift to lower values can be seen in the images corresponding to the mice with COPD (red lines) compared to the healthy mice (shown in black), indicating impaired lung function.

**Figure 7.** Empirical distribution functions of the pixel intensities for the 12 lung images, with the healthy mice shown in black and the COPD-affected mice shown in red

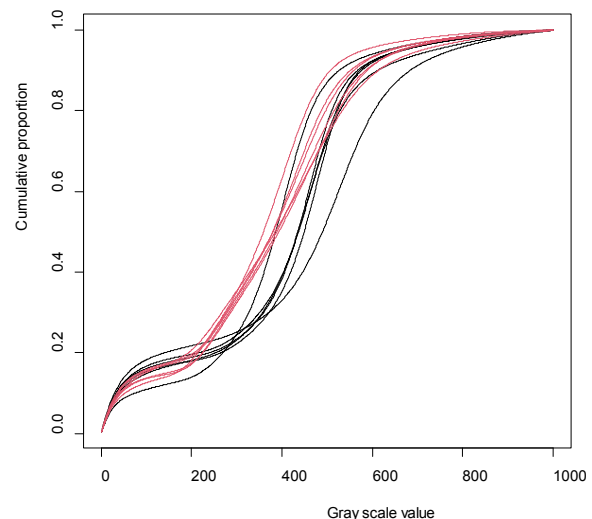
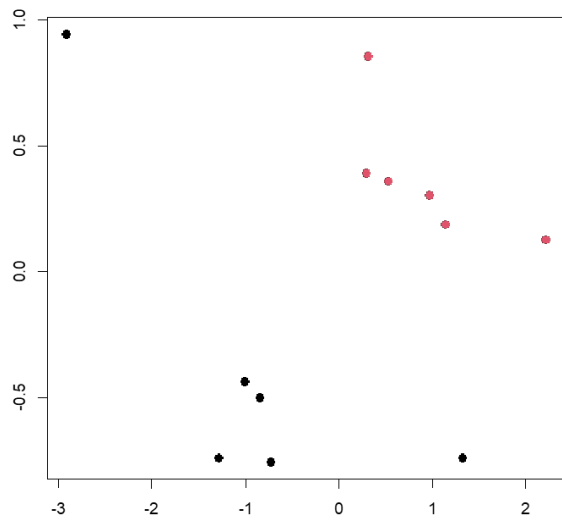


Figure 8 shows a multidimensional scaling plot of the data. Hotelling's test, when done to compare the two sets of mice, showed a statistically significant difference between the two groups ( $p=0.0159$ ).

**Figure 8.** MDS plot of the pixel intensities for the 12 lung images, with the healthy mice shown in black and the COPD-affected mice shown in red



## Simulation

We carried out a simulation to compare the various dissimilarity measures outlined in Section 2.

A set of 1000 observations were generated from a Normal distribution with mean 7 and standard deviation 1. In addition, a set of 1000 observations were generated from a Contaminated Normal distribution, in which 90% of the observations came from the same distribution as above and 10% of the observations came from a Normal distribution with mean 10 and standard deviation 2. We then computed their empirical cumulative distribution functions and, based on these, calculated the dissimilarity  $d(\mu)$  between these two sets of observations using each of the different measures described in Section 2. This was repeated 500 times and the mean,  $\overline{d(\mu)}$  was computed. This was then repeated for several different values of  $\mu$ .

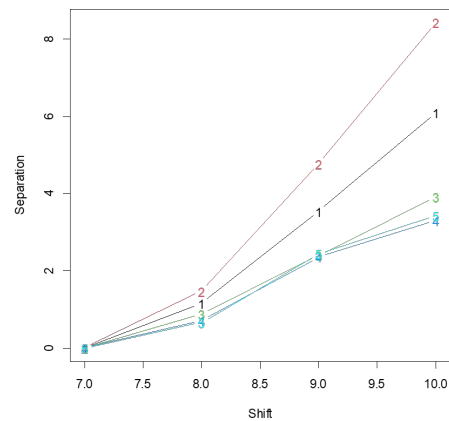
Dissimilarity measures that are better able to discern the difference of the Contaminated Normal from the Normal will tend to have larger values of  $d$ . This can be used to compare the different measures. Since the dissimilarity

measures are on different scales, the performance of a dissimilarity measure was evaluated using a standardized measure:

$$P(\mu) = \frac{\overline{d(\mu)} - \overline{d(0)}}{SD}$$

where  $SD$  is the standard deviation of the dissimilarities when  $\mu = 0$ . Figure 9 shows a plot of  $P(\mu)$  vs  $\mu$  for the five dissimilarity measures.

**Figure 9.** Performance measure  $P(m)$  vs  $m$  for the five dissimilarity measures. The lines are coded as follows: 1 = Euclidean distance, 2 = Manhattan distance, 3 = Maximum distance, 4 = Chi-squared distance, 5 = Kullback-Leibler divergence



It can be seen that Manhattan distance displays most clearly the differences in cumulative trends as  $\mu$  increases.

## CONCLUSIONS

We studied a method for comparing cumulative trends. A key aspect of the method is a dissimilarity measure. We compared the performance of five measures in a simulation and found that Manhattan distance displays the best performance in the setting in which the simulation was done.

Case studies were also done and showed the value of the method. In the first case study, we studied the trend over time of

COVID-19 in New Jersey in the USA– it was found that areas close to New York City had significantly different (more rapidly increasing) cumulative trends in both confirmed cases and deaths compared to areas further from New York City during the early days of the pandemic, but this difference dissipated as the pandemic progressed and spread within New Jersey itself. In the second case study, we compared two sets of CT scan images of lungs and detected a significant difference between COPD-diseased lungs and normal lungs.

Since this type of trend data arises in a variety of settings, this methodology is an overall useful tool to have.

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## Relationship between Refractive Index and Compositions of Building Windows Non Float Processed Glasses

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### ABSTRACT

Refractive index is one of the physiochemical properties of substances which is mostly used in optical sciences and provides very important information about the behavior of ray of light in various materials. This study was conducted to identify highly associated compositions of building windows non float processed glasses with refractive index and to develop a linear model to represent such relationships. Results of this study will provide a clear indication on how rays of light behave when passing through building windows non float processed glasses according to its composition. For compositions of glass, it was considered elements contained in corresponding oxide other than oxide type. A multiple linear regression model fitted for the data found that only sodium (*Na*), aluminum (*Al*), silicon (*Si*) and calcium (*Ca*) are highly associated with refractive index of building windows non float processed glasses. There was a strong positive linear relationship between refractive index and calcium (*Ca*) while a moderately strong negative linear relationship between refractive index and silicon (*Si*) for building windows' non float processed glasses. Both sodium (*Si*) and aluminum (*Al*) had weak negative linear relationships with refractive index.

## INTRODUCTION

Refractive index is also known as index of refraction. It is one of the physiochemical properties of substances (optical medium) and is mostly used in optical science. It indicates a material's ability to refract the light. Light travels at a constant speed only in a vacuum and its speed slows down when it passes through an object. So, refractive index is used to measure the bending of a ray of light when passing from one medium into another medium. The refractive index of a material is defined as follows:

$$n = \frac{c}{v}$$

Where,

$n$  = Refractive index of a medium

$c$  = Speed of light when in vacuum

$v$  = Speed of light when in medium

In most cases, refractive index has a positive value and mostly it is in between 1 and 2 which makes use of visible light. But in 1968, Veselago showed that there are substrates with a negative refractive index (Koohyar, 2013). In case of infrared waves and high temperature, refractive index values may be significantly higher. When the refractive index of a material increases, then the extent to which light beam deflects when entering or leaving the material will also be increased.

### Literature review

From the past literature, it was found that the refractive index of a glass depends on many different factors such as temperature, wavelength of light passing through the medium, composition of glass, density, interaction between molecules of components in glass etc. This study focuses on finding an association between the refractive index and compositions of building windows' non float processed glasses while keeping other factors constant.

## Refractive index

It was found that density and the refractive index for various compositions of heavy metal fluoride (HMF) glasses, used to make low loss optical wave guides where, density is calculated as a function of composition considering the effective volume of the ions contained in the glass to be invariant and the refractive index is calculated as a function of composition based on the Lorenz-Lorentz equation by computing the electronic polarizability of HMF glasses (Shaukat, Dong, Farooq, & Hobson, 2001).

For a given region of composition and structure of silicate glasses, defined by the ratio of silicon to the total number of oxygen, or  $N_{Si}$ , the excess refractive index ( $n-1$ ) is found to be linearly additive of composition (Sun, 1947).

### Significance of the study

The refractive index provides important information about behavior of light in different kinds of materials. It has many number of applications. According to Fardad Koohyar (2013), refractive index is generally used to measure the concentration of a solute in an aqueous solution. He stated that mostly it is applied for identifying a substance, to confirm its purity or to measure its concentration. Also, he mentioned that it can be used to calculate focusing power of lenses, dispersive power of prisms and to estimate thermophysical properties of hydrocarbons and petroleum mixtures etc. Thus, the refractive index of a material is very useful in both fields of academia and industry (Koohyar, 2013).

There were many studies conducted to identify the association between the refractive index of a glass and various factors such as temperature, density, composition of glass based on different

glass types. In most of the studies, different oxides contained in the glass other than single elements for compositions of glass were considered. Mostly mathematical equations and models based on theories in physical science to conduct the research were used. So this study was conducted to identify association between the refractive index and compositions of building windows' non float processed glasses through a proper comprehensive statistical analysis. It was considered elements contained in corresponding oxide other than the oxide types used for the compositions of glass.

Results of this study can be used to get an idea about how rays of light behave when passing through building windows non float processed glasses according to its composition. It will be very useful to understand many theories in optical science.

### **Objectives of the study**

The objectives of this study are:

- To determine highly associated compositions of building windows' non float processed glasses with refractive index.
- To develop a linear model to represent the association between the refractive index and compositions of building windows' non float processed glasses.

### **MATERIALS AND METHODS**

This study was conducted based on a secondary data set which obtained from one of the popular websites for open data sets, UCI Machine Learning Repository. Data collected on building windows non float processed glasses were used for this study and sample size was 76. It had 10 variables including a sample identification number. Prior to the analysis, the data set was validated to eliminate missing values. An average value for the variable was used to estimate the missing values under that

variable. Data analysis was carried out under two stages, descriptive analysis and fitting a linear regression model. R statistical software was used to analyze the data in this study.

A descriptive analysis was conducted to get an idea about the behavior of each variable in data set. Descriptive statistics, box plots and Pearson's correlation coefficients were used under descriptive analysis. Pearson's correlation coefficient is used to measure the direction and strength of linear relationship in between two continuous variables.

Then, a multiple linear regression analysis was carried out with a validation of the model adequacy. Residual diagnostics were used with some statistical tests to ensure the model adequacy and validity.

### **RESULTS AND DISCUSSION**

The analysis was carried out using a secondary data set. Dependent variable was refractive index ( $Y$ ). Predictor variables were sodium ( $X1$ ), magnesium ( $X2$ ), aluminum ( $X3$ ), silicon ( $X4$ ), potassium ( $X5$ ), calcium ( $X6$ ), barium ( $X7$ ) and iron ( $X8$ ). Unit of measurement for each glass composition was weight percent in the corresponding oxide.

Prior to the analysis, data set was validated by estimating missing values. Average value for the variable was used to estimate the missing values under that variable.

#### **Descriptive analysis**

In Table 1, it has given minimum, maximum, mean, variance, standard deviation and coefficient of variance for each variable. Mean refractive index for a glass is 1.5186. It can be seen that highest mean glass composition is from silicon while lowest mean glass composition is from iron. Potassium and barium mean

glass compositions are approximately same. Further, according to the box plot of refractive index, it was found that refractive index has a positively skewed distribution.

**Table 1.** Descriptive Statistics for Variables

Variables	Minimum	Maximum	Mean	Variance	Standard Deviation	Coefficient of Variation
Y	1.5141	1.5339	1.5186	1.4456e-05	0.0038	0.0025
X1	10.73	14.86	13.11171	0.4411	0.6642	0.0507
X2	1.01	3.98	3.4059	0.2510	0.5010	0.1471
X3	0.56	2.12	1.4082	0.1013	0.3183	0.2261
X4	69.81	74.45	72.5980	0.5250	0.7246	0.00998
X5	0.06	1.1	0.5424	0.0344	0.1854	0.3418
X6	7.08	16.19	9.0737	3.6927	1.9216	0.2118
X7	0.06	3.15	0.6397	0.1014	0.3185	0.4978
X8	0.08	0.35	0.1897	0.00245	0.0497	0.2619

According to Table 2, it can be seen that sodium, aluminum, silicon, potassium, calcium and barium have significant correlations with refractive index at 5% level of significance as their p values are less than 0.05. Out of those variables, only calcium and barium have significant positive correlations with refractive index at 5% level of significance. Calcium has strong positive linear relationship with refractive index as its correlation value is very close to one. Correlations among most glass compositions are not significant at 5% level of significance as their p values are greater than 0.05. But correlations among some glass compositions are significant at 5% level of significance as their p values are less than 0.05. Those correlations will be captured under testing of multicollinearity.

**Table 2.** Matrix of Pearson's Correlation Coefficients among Variables (P values given inside parenthesis)

	Y	X1	X2	X3	X4	X5	X6	X7	X8
Y	1	-0.3889 (0.0005)	-0.1802 (0.1192)	-0.3978 (0.0004)	-0.6598 (0.0000)	-0.4965 (0.0000)	0.9327 (0.0000)	0.3690 (0.0010)	0.1439 (0.2149)
X1	-0.3889 (0.0005)	1	-0.0882 (0.4486)	0.0234 (0.8407)	-0.0712 (0.5410)	-0.2415 (0.0356)	-0.4518 (0.0000)	-0.3637 (0.0012)	-0.3771 (0.0008)
X2	-0.1802 (0.1192)	-0.0882 (0.4486)	1	-0.0626 (0.5913)	0.0967 (0.4058)	0.1892 (0.1017)	-0.2672 (0.0196)	0.0694 (0.5511)	0.0114 (0.9220)
X3	-0.3978 (0.0004)	0.0234 (0.8407)	-0.0626 (0.5913)	1	-0.0848 (0.4663)	0.4762 (0.0000)	-0.4443 (0.0000)	0.2340 (0.0419)	0.0269 (0.8179)
X4	-0.6598 (0.0000)	-0.0712 (0.5410)	0.0967 (0.4058)	-0.0848 (0.4663)	1	0.3616 (0.0013)	-0.4480 (0.0000)	-0.4465 (0.0000)	-0.1147 (0.3240)
X5	-0.4965 (0.0000)	-0.2415 (0.0356)	0.1892 (0.1017)	0.4762 (0.0000)	0.3616 (0.0013)	1	-0.4696 (0.0000)	-0.0089 (0.9391)	0.1998 (0.0836)
X6	0.9327 (0.0000)	-0.4518 (0.0000)	-0.2672 (0.0196)	-0.4443 (0.0000)	-0.4480 (0.0000)	-0.4696 (0.0000)	1	0.2521 (0.0280)	0.1320 (0.2558)
X7	0.3690 (0.0010)	-0.3637 (0.0012)	0.0694 (0.5511)	0.2340 (0.0419)	-0.4465 (0.0000)	-0.0089 (0.9391)	0.2521 (0.0280)	1	0.1631 (0.1592)
X8	0.1439 (0.2149)	-0.3771 (0.0008)	0.0114 (0.9220)	0.0269 (0.8179)	-0.1147 (0.3240)	0.1998 (0.0836)	0.1320 (0.2558)	0.1631 (0.1592)	1

## Multiple linear regression model

### Model fitting

Under this section, it was expected to build up a suitable regression model to identify the highly associated compositions of building windows non float processed glasses with refractive index. In this analysis, refractive index is the dependent variable and compositions of building windows non float processed glasses are independent variables.

A multiple linear regression model was fitted by using the stepwise method to identify the association between refractive index and compositions of building windows non float processed glasses. Equation of the fitted model is as follows:

$$\widehat{\text{Refractive Index}} = 1.673 - 0.00076 * \text{Sodium} - 0.0018 * \text{Aluminum} - 0.00211 * \text{Silicon} + 0.00124 * \text{Calcium}$$

Table 3 indicates that all coefficients in the model are significant at 5% level of significance as their p values are less than 0.05. Based on the results of ANOVA given in Table 4, it can be concluded that the fitted regression model is significant at 5% level of significance (F statistic = 429.365, p value = 0.000). In Table 3, it has given that adjusted R-squared value for the fitted model is 0.9581. This implies that 95.81% of the variation in refractive index

through building windows non float processed glasses has explained by the variables selected in the model.

**Table 3.** Model Summary for Multiple Linear Regression Model

```
Call:
lm(formula = Y ~ X1 + X3 + X4 + X6)

Residuals:
    Min       1Q   Median       3Q      Max
-0.0015165 -0.0004000 -0.0000692  0.0004223  0.0037606

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  1.673e+00  1.417e-02  118.018 < 2e-16 ***
X1          -7.553e-04  1.755e-04  -4.304 5.28e-05 ***
X3          -1.797e-03  3.663e-04  -4.905 5.72e-06 ***
X4          -2.106e-03  1.674e-04 -12.580 < 2e-16 ***
X6           1.239e-03  8.048e-05  15.402 < 2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.0007786 on 71 degrees of freedom
Multiple R-squared:  0.9603,    Adjusted R-squared:  0.9581
F-statistic: 429.4 on 4 and 71 DF,  p-value: < 2.2e-16
```

**Table 4.** ANOVA for the Fitted Multiple Linear Regression Model

ANOVA <sup>a</sup>						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.001	4	.000	429.365	.000 <sup>b</sup>
	Residual	.000	71	.000		
	Total	.001	75			

a. Dependent Variable: RRefractiveindex  
b. Predictors: (Constant), CaCalcium, AlAluminum, NaSodium, SiSilicon

### Model adequacy checking

The multiple linear regression model was fitted based on several assumptions defined for the model. So, it is essential to check whether those assumptions are being violated in the model.

The first assumption was a linear relationship in between the dependent variable and each of the independent variables. It was checked by using scatter plots. According to Figure 1, it can be seen that sodium, aluminum and silicon have negative linear relationships with the refractive index while for calcium, there is a positive linear relationship with the refractive index.

The assumption of normality of the residuals was assessed by using normal quantile-quantile plot for standardized residuals and by applying Shapiro-Wilk

normality test. As in Figure 2, it can be seen that all the observations lie approximately on the line in Normal Q-Q plot other than one point marked as 55 implying that residuals are normally distributed. But in Shapiro-Wilk normality test, it was found that the p value is 0.00002 which is less than 0.05. Thus, the null hypothesis of normality of residuals rejected at 5% level of significance concluding that residuals are not normally distributed.

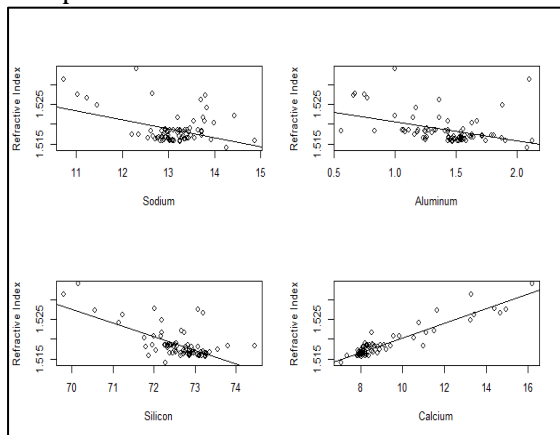
Since, this can be due to the point (marked as 55) which lies very far away from other data points in Normal Q-Q plot the regression model was refitted after removing that point and found that the same variables become significant even without that point. Then, Shapiro-Wilk normality test was conducted to check the normality of residuals and found that p value for the test is 0.7199 which is greater than 0.05. Thus, the null hypothesis of normality of residuals, did not reject at 5% level of significance and this concludes that residuals are approximately normally distributed at 5% level of significance. These results conclude that observation which marked as 55 is influenced for the normality of the residuals and results of the analysis. But there was insufficient information at present to consider it as an outlier. Therefore, a regression analysis was conducted without removing that data point.

Assumption of homoscedasticity of residuals was checked using the scatter plots for residuals versus fitted values and plot of scale location in Figure 2. Since there is no specific pattern in those plots, it indicates that residuals have constant variance without any serious assumption violation. But they show one outlier point in the data set which lie svery far away from other observations and marked as 55.

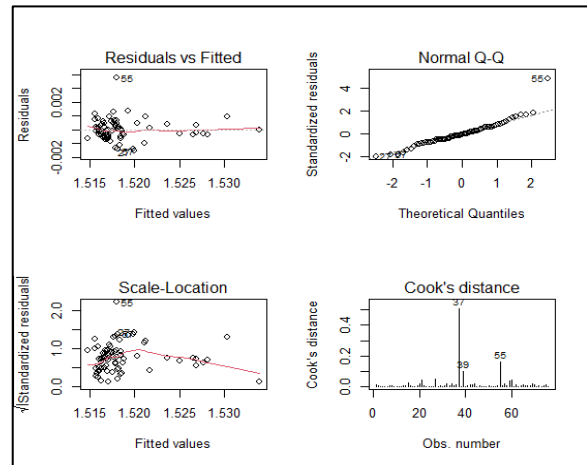
Then, independence of residuals was checked by using Durbin-Watson statistic. It was found that Durbin-Watson statistic for the fitted model is 1.8439 which is very close to 2. Also, the p value for test was 0.386 which is greater than 0.05. Thus, the null hypothesis of independence of residuals did not reject at 5% level of significance. This implies that residuals are independent.

To check the multicollinearity of predictors, Pearson's correlation coefficients among predictors, variance inflation factor (VIF) and tolerance values for predictor variables were calculated. According to Table 2, it can be seen that all correlation values among predictor variables are less than absolute value of 0.5. According to Table 5, it can be seen that all VIF values are less than 10 and tolerance scores are greater than 0.2. These results indicate that there is no multicollinearity among predictor variables in the model.

**Figure 1.** Scatter Plots for Refractive Index Vs Compositions of Glass in Fitted Model



**Figure 2.** Residual Diagnostics for Multiple Linear Regression Model



**Table 5.** Tolerance and VIF Scores

Tolerance and Variance Inflation Factor			
variables	Tolerance	VIF	
1 X1	0.5949690	1.680760	
2 X3	0.5945479	1.681950	
3 X4	0.5495133	1.819792	
4 X6	0.3379904	2.958664	

In order to detect outliers and highly influential points in the data set, standardized residuals, leverage values and Cook's distances were used. According to Figure 2, it is found that all the standardized residuals are within the absolute value of 2 except the observation marked as 55. Leverage values were then compared with  $2p/n = 0.1316$ . It is found that only few points in data set lies beyond this value and they were very close to this threshold value other than one point. This indicates that there is only one significant outlier in the data set. In the plot of Cook's distance in Figure 2 shows that there are three Cook's distances which are greater than  $4/(n-p) = 0.0563$ . It implies that there are three influential points in the data set.

Since there were few outliers and influential points in the data set, a regression analysis was conducted again after removing those outliers. It was found that the same variables become significant even without the outliers. Thus, the model

was developed without removing those data points.

From all the results above, it is clear that there is no serious assumption violation in the model and so the fitted model is appropriate to predict refractive index of building windows non float processed glasses.

## CONCLUSIONS

This study was done to achieve two main objectives. They were to determine highly associated compositions of building windows non float processed glasses with refractive index and to develop a linear model to represent such association. Following conclusions were made based on the results of the analysis.

Out of eight compositions considered, only four compositions of building windows non float processed glasses identified as highly associated with refractive indices of those glasses. They are sodium, aluminum, silicon and calcium. A multiple linear regression model can be used to predict refractive index of building windows non float processed glasses by using the above mentioned compositions of glass.

According to the fitted model, if one unit of sodium (*Na*) increases while keeping other compositions constant, refractive index of building windows non float processed glasses will decrease by 0.00076 units. Similarly, if one unit of aluminum (*Al*) increases while keeping other compositions constant, refractive index of those glasses will decrease by 0.0018 units. If one unit of silicon (*Si*) increases while keeping other compositions constant, refractive index of those glasses will decrease by 0.00211

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units. But if one unit of calcium (*Ca*) increases while keeping other compositions constant, refractive index of building windows non float processed glasses will increase by 0.00124 units.

For building windows non float processed glasses, there is a strong positive linear relationship in between refractive index and calcium (*Ca*) while a moderately strong negative linear relationship in between refractive index and silicon (*Si*). Both sodium (*Na*) and aluminum (*Al*) have weak negative linear relationships with refractive index.

These results can be used to get an idea about how rays of light behave when passing through building windows non float processed glasses according to its composition. The fitted model can be used to predict refractive index of any building windows non float processed glass. It will be very useful to understand many theories in optical science.

There are many other factors such as temperature, density, interaction between molecules of components in glass that would affect on refractive index of glasses. Thus, future studies can be conducted by incorporating those variables into this study.

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## Review on Maximum Degree Diameter Bounded Subgraph Problem

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### ABSTRACT

The maximum degree diameter bounded subgraph problem is a quest to find the largest subgraph embedded in a host graph in terms of vertices. The problem is closely related to the decades-old famous Degree Diameter Problem. The problem has been solved for many host graphs in recent years. This article provides a review of all the results obtained in the maximum degree diameter bounded subgraph problem. Furthermore, unsolved problems on these aspects are highlighted for the benefit of new researchers.

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## INTRODUCTION

Maximum Degree Diameter Bounded Subgraph Problem (MaxDDBS) is a problem to find the largest subgraph in terms of vertices embedded in a given host graph. The problem was initially posed by Dekker, et al (2012). and thereafter the problem was solved for selected networks. This problem is NP-hard (Garey & Johnson, 1979) since it contains other well-known NP-hard problems as sub problems. The problem can be mentioned as follows:

**MaxDDBS:** - Given a connected undirected host graph  $G$ , an upper bound  $\Delta$  for the maximum degree, and upper bound  $D$  for the diameter, find the largest connected subgraph of  $G$  with maximum degree  $\leq \Delta$  and diameter  $\leq D$ .

In the initial paper by Dekkar et al (2012), (Dekker, Perez-Rosés, Pineda-Villavicencio, & Watters, 2012) the authors define two problems. That are MaxDDBS (Maximum Degree Diameter Subgraph Problem) and MaxWDDBS (Maximum Weighted Degree Diameter Subgraph Problem). In this paper we consider only the unweighted case. This problem becomes maximum clique problem when the diameter( $D$ ) is one according to Karp (1972). When the host graph is a complete graph the problem becomes the decades old degree diameter problem (Miller & Siran, 2013).

The degree diameter problem is to find the largest graph in terms of vertices for a given maximum degree and diameter. The order of a graph with given degree and diameter never exceeds the upper bound called Moore bound (Hoffman & Singleton, 1960). The graphs whose order is equal to Moore bound are called Moore graphs. Clearly, the Moore bound acts as an upper bound also for

Maximum Degree Diameter Bounded Subgraph Problem.

### Honeycomb Network

The MaxDDBS for honeycomb network was studied by Holub, Miller, Roses and Ryan (Holub, Miller, Perez-Roses, & Ryan, 2014). In this work they present the upper bounds and lower bounds for the order of the graphs embedded in  $k$ -dimensional honeycomb network. Further they thoroughly examine the cases of dimensions 2 and 3.

Honeycomb network is a tight structure like the shape of the honeycomb made by bees. This consists of a hexagonal tessellation where three hexagons meet at each vertex. Corners of the hexagons are the vertices of the graph while they are connected by edges. Honeycomb networks can be found in real world applications like cellular networks (Gao, Wang, & Jafar, 2015), image processing (Brimkov & Barneva, 2005) and in benzenoid hydrocarbons (Gutman & Cyvin, 1989).

In this work, the authors determine the order of the largest subgraphs embedded in the planer honeycomb grid. Mainly, two cases are considered in determining the largest subgraph of a planer honeycomb grid.

#### Case 1: The diameter ( $D$ ) of the optimal subgraph is even.

When the diameter ( $D$ ) is even the largest subgraph corresponds to a closed ball with radius  $\frac{D}{2}$  with a fixed vertex as the center of the ball

#### Case 2: The diameter ( $D$ ) of the optimal subgraph is odd.

When diameter ( $D$ ) is odd the largest subgraph corresponds to a closed ball with radius  $\lfloor D/2 \rfloor$  with a fixed edge as the center of the ball. Considering all the

possible cases following proposition is obtained (Holub, et al, 2014). (Holub, Miller, Perez-Roses, & Ryan, 2014).

**Proposition 2.1:** Let  $H$  be the infinite honeycomb grid. Let  $H_D^2$  denotes the largest subgraph of  $H$  of diameter  $D$  where  $D = 4k + r$ ,  $k \in \mathbb{N}$ ,  $r \in \{0,1,2,3\}$ . Then,

$$|V(H_D^2)| = \begin{cases} 6k^2 + 3k + 1, & r = 0 \\ 6k^2 + 6k + 2, & r = 1 \\ 6k^2 + 9k + 4, & r = 2 \\ 6k^2 + 12k + 6, & r = 3 \end{cases}$$

When  $N_H(\Delta, D)$  clearly denotes the number of vertices of the largest subgraph of diameter  $D$  and maximum degree  $\Delta$ ,

$$N_H(\Delta, D) \leq |V(H_D^2)|$$

Further, the following proposition is obtained.

$$N_H(2, D) = \begin{cases} D + 1, & \text{if } D \leq 4 \\ 2D, & \text{Otherwise} \end{cases}$$

### D Honeycomb grid

The 3D honeycomb grid  $H^3$  is given by  $H^3 = H \times P_\infty$ , where  $P_\infty$  is the infinite path. For the graph  $H^3$  the largest degree of any vertex  $\Delta(H^3)$  is 5. The largest subgraph of maximum degree  $\Delta(H^3)$  and even diameter  $D$  corresponds to a closed ball with radius  $\frac{D}{2}$  with a fixed vertex as the center of the ball. When  $D$  is odd largest subgraph corresponds to closed ball of radius  $\lfloor D/2 \rfloor$  with a fixed edge as the center of the ball. Thus, the upper bounds for  $N_{H^3}(\Delta, D)$  can be established as follows (Holub, Miller, Perez-Roses, & Ryan, 2014).

**Theorem 2.1.** Let  $H^3 = H \times P_\infty$ , Let  $D, \Delta$  be positive integers such that  $D = 4k + r$  ( $k, r \in \mathbb{N}, r \in \{0,1,2,3\}$ ) and  $\Delta \leq 5$ . Then

$$N_{H^3}(\Delta, D) \leq \begin{cases} 8k^3 + 6k^2 + 5k + 1 & \text{if } r = 0 \\ 8k^3 + 12k^2 + 8k + 2 & \text{if } r = 1 \\ 8k^3 + 18k^2 + 17k + 6 & \text{if } r = 2 \\ 8k^3 + 24k^2 + 26k + 10 & \text{if } r = 3 \end{cases}$$

Further, they have investigated lower bounds for  $N_{H^3}(4, D)$ . It can be summarized as follows,

**Theorem 2.2.** Let  $H^3 = H \times P_\infty$ . Let  $D \geq 2$  be a positive integer such that  $D = 4k + r$ ,  $k \in \mathbb{N}$ ,  $r \in \{0,1,2,3\}$ . Then

$$N_{H^3}(4, D) \geq \begin{cases} 2 & \text{if } D = 1 \\ 5 & \text{if } D = 2 \\ 8 & \text{if } D = 3 \\ 16 & \text{if } D = 4 \\ 8k^3 + 6k^2 + 3k - 2 & \text{if } r = 0, k \geq 2 \\ 8k^3 + 12k^2 + 6k - 2 & \text{if } r = 1, k \geq 1 \\ 8k^3 + 18k^2 + 15k + 2 & \text{if } r = 2, k \geq 1 \\ 8k^3 + 24k^2 + 24k + 6 & \text{if } r = 3, k \geq 1 \end{cases}$$

Thus,  $N_{H^3}(5, D)$  is equal to the upper bound found in their work. In this work the authors have not presented exact values for the order of the optimum subgraphs with maximum degree  $\Delta$  and diameter  $D$  when  $\Delta = 4$ .

### r- Dimensional honeycomb grid

The r- dimensional honeycomb grid  $H^r$  is defined as  $H^r = H^{r-1} \times P_\infty$ . If  $H_D^r$  denotes the largest subgraph of  $H^r$  with even diameter  $D$  then it corresponds to a closed ball of radius  $\frac{D}{2}$  with a fixed vertex as the center of the ball. When  $D$  is odd it corresponds to a closed ball with radius  $\frac{D-1}{2}$  with a fixed edge as the center of the ball. Here the maximum degree of the r- dimensional honeycomb grid  $\Delta(H^r) = r - 1$ . Further lower bounds for  $N_{H^r}(\Delta, D)$  are provided. Some values for  $|V(H_D^r)|$  and lower bounds for  $N_{H^4}(\Delta, D)$  were determined.

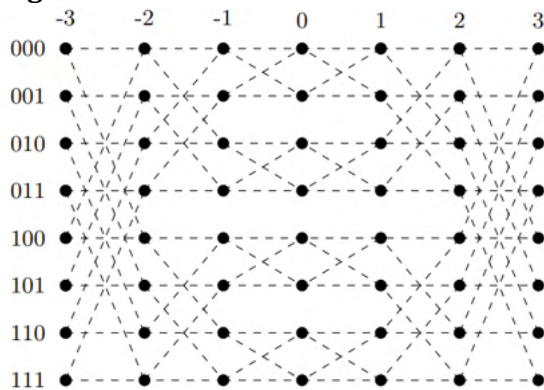
The exact values and upper bound for the order of the largest subgraphs for higher

dimensional ( $r > 3$ ) honeycomb grids are yet to be determined. Hence there is a future research scope in this problem for higher dimensional honeycomb grids.

### Benes Network

The MaxDDBS for Benes network was studied by Novi, et al (2017). Benes network contains back to back butterfly networks. Both Butterfly network and Benes network have maximum degree 4. But the structure of their maximum subgraphs is different. Figure 1 depicts the Benes network of dimension 3. They have provided lower bounds for the order of the optimal subgraphs of the Benes network for maximum degrees 4, 3, 2 and 1. Let  $B(r)$  be the  $r$  dimensional Benes network and  $N_{B(r)}(\Delta, D)$  denote the order of the largest subgraph of  $B(r)$  with maximum degree  $\Delta$  and diameter  $D$ . Subgraph for maximum degree  $\Delta = 1$  is trivial that is  $k_2$ ,

**Figure 1.** Benes Network



### Subgraph of maximum degree $\Delta = 4$

In this work when finding the lower bounds for the optimal graph for  $\Delta = 4$  the authors have considered two cases. Those are when the diameter of the subgraph is even ( $D = 2t$ ) and when the diameter is odd ( $D = 2t - 1$ ). Theorem

3.1 provides the lower bounds for the number of vertices in an optimal subgraph with even diameter ( $D = 2t$ ) and maximum degree 4.

**Theorem 3.1.** Let  $D = 2t$ . For any  $r \geq t$ ,  $N_{B(r)}(4, D) \geq (2t + 1) \times 2^t$ .

By the Theorem 3.2 the authors have provided lower bounds for the number of vertices in the optimal subgraphs when the maximum degree is 4 and diameter is odd ( $D = 2t - 1$ ).

**Theorem 3.2.** Let  $D = 2t - 1$ . For any  $r \geq t$ ,  $N_{B(r)}(4, D) \geq t \times 2^t$ .

### Subgraph of maximum degree $\Delta = 3$ .

Theorem 3.3 provides lower bounds for the order of the optimal subgraphs of  $B(r)$  for the maximum degree 3 and even diameters ( $D = 2t$ ).

**Theorem 3.3.** Let  $D = 2t$ . For any  $r \geq t$ ,  $t > 1$ ,  $N_{B(r)}(3, 2t) \geq 5 \times 2^t - 6$ .

In this paper the authors have provided the lower bounds for the order of the optimal subgraphs of the Benes network. Hence there is a future research scope to find the upper bounds and exact values for the order of the optimal subgraphs.

### Triangular Network

The MaxDDBS for triangular network is solved by Holub & Ryan (2015) The triangular network consists of triangular tessellation, such that the corners of the triangles are the vertices of the graph while they are connected by edges. Six triangles meet at each vertex. In this work the authors find some exact values and some lower and upper bounds for the optimal graphs inside the triangular network. When the infinite triangular

network is represented by  $T$  the maximum degree of a triangular network is denoted by  $\Delta(T)$ . ( $\Delta(T) = 6$ ).  $T_D$  represents the optimal subgraph of triangular network grid with diameter  $D$ .  $N_T(\Delta, D)$  represents the number of vertices of the optimal graph with degree  $\Delta$  and diameter  $D$ . Then the following proposition is obtained.

**Proposition 4.1.** Let  $D$  be positive integer and  $T$  be infinite triangular grid then,

$$N_T(6, D) = \begin{cases} \frac{3}{4}D^2 + \frac{3}{2}D + \frac{3}{4} & \text{for odd } D \\ \frac{3}{4}D^2 + \frac{3}{2}D - 1 & \text{for even } D \end{cases}$$

Here  $N_T(6, D) = |V(T_D)|$  where  $|V(T_D)|$  is the number of vertices of  $T_D$ . When  $D$  is even the subgraph  $T_D$  corresponds to a regular hexagon having an arbitrary vertex as the center. When  $D$  is odd  $T_D$  corresponds to a nonregular hexagon having an arbitrary unit triangle as the center.

Further,  $N_T(1, D) = 2$  and  $N(2, D) = D + 1$  since the network contains a cycle for each  $D > 0$ . Further the following results are obtained.

When  $\Delta = 5$

$N_T(5, D) = |V(T_D)| - 1$ ; when  $D$  is an even positive integer.

$N_T(5, D) = |V(T_D)|$ ; when  $D$  is an odd positive integer.

When  $\Delta = 4$

$N_T(4, D) = |V(T_D)| - 2$ ; when  $D$  is an even positive integer.

$N_T(4, D) \geq 9$ ; when  $D = 3$ .

$N_T(4, D) = |V(T_D)|$ ; when  $D$  is an odd positive integer and  $D \neq 3$ .

When  $\Delta = 3$ .

When  $D$  is even,

$$N_T(3, D) \geq \begin{cases} 5 & \text{when } D = 2 \\ 11 & \text{when } D = 4 \\ 22 & \text{when } D = 6 \\ 46 & \text{when } D = 8 \\ |V(T_D)| - 6 & \text{otherwise} \end{cases}$$

When  $D$  is odd,

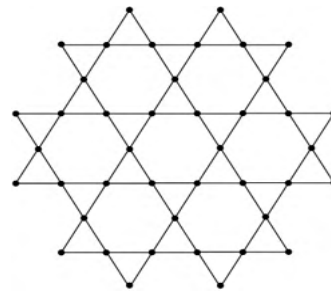
$$N_T(3, D) \geq \begin{cases} 7 & \text{when } D = 3 \\ 14 & \text{when } D = 5 \\ 24 & \text{when } D = 7 \\ 48 & \text{when } D = 9 \\ 96 & \text{when } D = 11 \\ |V(T_D)| - 6 & \text{otherwise} \end{cases}$$

In this work the authors have determined the optimal graphs for all the cases except when  $\Delta = 3$ . Lower bounds for the graphs with degree 3 have been determined. Exact values for  $N_T(3, D)$  are yet to be determined for all the diameters.

### Oxide Network

The MaxDDBS for oxide network was studied by Akhtar MS (Akhtar, 2018). Oxide network is formed after deleting silicon nodes from silicate network. Figure 2 depicts the structure of the oxide network.

**Figure 2.** Structure of the Oxide Network



If  $X$  denotes the infinite oxide network, then the maximum degree of  $X$  is represented by  $\Delta(X)$ . Obviously  $\Delta(X) = 4$ .

**Proposition 5.1.** For even  $D \geq 4$  if  $O_D$  is a closed ball of radius  $\frac{D}{2}$  with center as a common vertex  $m$  of two triangles with vertices set  $\{x \in V(X) : d_X(X, m) \leq \frac{D}{2}\}$  then

$$|V(O_D)| = \begin{cases} 9k^2 + 5k & \text{for } D = 4k \\ 9k^2 + 13k + 5 & \text{for } D = 4k + 2 \end{cases}$$

Where  $k \in \mathbb{N}$ .

Here  $|V(O_D)|$  is the number of vertices of the subgraph  $O_D$ .

**Proposition 5.2.** For odd  $D > 4$ , Let the induced subgraph of  $X$  denoted by  $O_D$  is a closed ball of radius  $\frac{D-1}{2}$  with center as a triangle with vertex set  $\{x \in V(X): d_X(x, m) \leq \frac{D-1}{2}\}$ , where  $m$  is the vertex of the central triangle which is closest to  $X$  then

$$|V(O_D)| = \begin{cases} 9k^2 + 9k + 3 & \text{for } D = 4k + 1 \\ 9k^2 + 18k + 9 & \text{for } D = 4k + 3 \end{cases}$$

In this work the authors determine the largest connected subgraph of oxide network ( $H_D$ ). If  $N_X(\Delta, D)$  represents the number of vertices of the largest subgraph with maximum degree  $\Delta$  and diameter  $D$ , the authors show that

$$N_X(4, D) = |V(H_D)| = |V(O_D)| + 1 \text{ for } D = 4k, k \in \mathbb{N}$$

$$N_X(4, D) = |V(O_D)| \text{ for } D = 4k + r, k \in \mathbb{N}, r \in \{1, 2, 3\}$$

The authors present the lower bounds and upper bounds for  $N_X(3, D)$ . They can be summarized as follows.

$$|V(H_D)| - (2k + 6) \leq N_X(3, D) \leq |V(H_D)|,$$

$$\text{for } D = 4k + 8, k \in \mathbb{N}$$

$$|V(O_D)| - (k + 5) \leq N_X(3, D) \leq |V(O_D)|,$$

$$\text{for } D = 4k + 6, k \in \mathbb{N}$$

$$|V(O_D)| - 9 \leq N_X(3, D) \leq |V(O_D)|,$$

$$\text{for } D = 4k + 1, k \in \mathbb{N}$$

$$|V(O_D)| - 9 \leq N_X(3, D) \leq |V(O_D)|,$$

$$\text{for } D = 4k + 7, k \in \mathbb{N}$$

In their work the authors have not determined the exact values for the order of the optimum subgraphs when  $\Delta \leq 3$ . Then there is a space found the exact values for  $N_X(3, D)$  between the provided lower bounds and upper bounds.

## **k- Dimensional mesh**

Maximum degree diameter subgraph bounded problem (MaxDDBS) was initiated by Dekker et al (2012). The authors first define the problem. Then the problem is considered for  $k$ - dimensional mesh or grid. When the host graph  $G$  is infinite  $k$ -dimensional with maximum degree  $\Delta = 2k$  the size of largest subgraph embedded in the  $k$ - dimensional mesh is calculated by counting the number of vertices inside a closed ball of radius  $\frac{D}{2}$ . When  $D$  is even the center of the ball is a vertex and when  $D$  is odd the center of the ball is the midpoint of an edge.

**Theorem 6.1.** Let  $D$  be a non-negative integer and let  $B_k(p)$  a maximal closed ball in  $k$  dimensional  $L^1$  metric space ( $k \geq 1$ ) with diameter  $D$ . Let  $B_k(p)$  denote the set of points with integer coordinates contained in the closed ball  $B_k(p)$ . The cardinality of this set is given by the following equation.

$$|B_k(p)| = \begin{cases} \sum_{i=0}^p \binom{k}{i} \binom{k+p-i}{p-i} = \sum_{i=0}^p \binom{k}{p-i} \binom{k+i}{i} & \text{if } p = 2p \\ \sum_{i=0}^p \binom{k}{p-i} \binom{k+i}{i} = \sum_{i=0}^p \binom{k}{p-i} \binom{k+i}{i} & \text{if } p = 2p + 1 \end{cases}$$

The value provided by theorem 6.1 can be taken as an upper bound for all the optimal subgraphs. Further, the authors present a heuristic strategy to solve the problem. Then the heuristic algorithm is applied to many real-world networks and show that it performs well in each case. However, this algorithm does not provide the exact size of the optimal graph. Therefore, the researchers have the opportunity to find the exact size of the optimal graphs.

## **Butterfly Network**

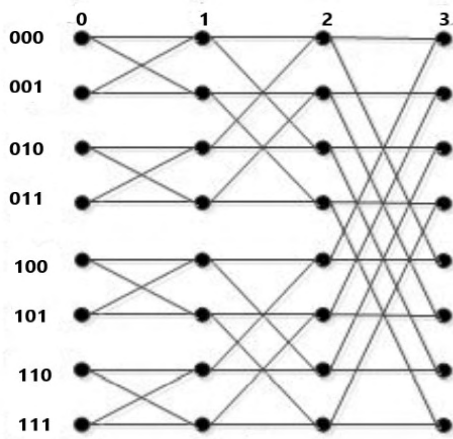
Miller, Ryan & Sugeng (2017) investigated the MaxDDBS for butterfly network. The authors give constructive lower bounds for subgraphs of maximum degree 4, 3 and 2. Butterfly networks are used in parallel computing systems.  $r$ - dimensional butterfly

network is represented by  $BF(r)$ . Each vertex of the butterfly network is represented by  $\langle w, i \rangle$ . Here  $w$  is an  $r$ -bit binary number written as  $w = w_r \dots w_1, w_j \in \{0,1\}$  and  $j = 1, \dots, r$ . Here  $i$  is the level of a vertex. ( $0 \leq i \leq r$ ). Two vertices  $\langle w, i \rangle$  and  $\langle w', i' \rangle$  are adjacent if they satisfy on of the following conditions.

- i.  $i' = i + 1$  and  $w$  and  $w'$  are identical
- ii.  $i' = i + 1$  and  $w$  and  $w'$  differ at precisely the  $i^{th}$  bit.

Figure 3 depicts the structure of the 3-dimensional butterfly network.

**Figure 3.** 3- dimensional butterfly network



Following theorems related to lower bounds of the optimal graphs are proved. Here  $N_{BF(r)}(\Delta, D)$  represents the number of vertices of the optimal subgraph of maximum diameter  $\Delta$  and degree  $D$ .

**Theorem 7.1.** Let  $D = 2t$ . For any  $r \geq t$ ,  $N_{BF(r)}(4, D) \geq (t + 1) \times 2t$ .

**Theorem 7.2.** Let  $D = 2t - 1$ . In an  $r$ -dimensional butterfly network,

1.  $N_{BF(r)}(4, D) \geq (t + 1) \times 2^{t-1}$ , if  $r = t$
2.  $N_{BF(r)}(4, D) \geq (t + 2) \times 2^{t-1}$ , if  $r > t$

**Theorem 7.3.** Let  $D = 2t$ . For any  $r \geq t, t \geq 1$

$N_{BF(r)}(3, 2t) \geq 7 \times 2^{t-1} - 4$  and When  $t = 1, N_{BF(r)}(3, 2) = 4$ .

**Theorem 7.4.** Let  $D = 2t - 1$ . In the  $r$ -dimensional butterfly network  $r \geq t$ , we have

- (i)  $N_{BF(r)}(3, D) \geq 7 \times 2^{t-2} - 2$ , if  $r = t$ .
- (ii)  $N_{BF(r)}(3, D) \geq 7 \times 2^{t-2} - 1$ , if  $t + 1 \leq r \leq 2t - 1$
- (iii)  $N_{BF(r)}(3, D) \geq 2^{t+1} - 2$ , if  $r \geq 2t - 1$ .

**Theorem 7.5.** Let  $BF(r)$  be a butterfly network of dimension  $r$ . The largest cycle contained in  $BF(r)$  is of size  $r2^r$ .

In this work the authors have found only lower bounds for  $N_{BF(r)}(\Delta, D)$  for  $\Delta = 2, 3, 4$ . The exact values or upper bounds for the size of the optimal graphs have not been determined. Constructing optimal graphs and finding their order remains as an open problem.

## CONCLUSIONS

MaxDDBS is a problem to find the optimal graph embedded in a given host graph for a given maximum degree and diameter. The problem has been active since 2011 and due to its' computational complexity, the maximum degree diameter bounded subgraph problem becomes NP-hard since it contains other NP hard problems as sub problems. Despite many results obtained related to this problem many outcomes are yet to be determined. In this paper we have summarized the results obtained related to this problem. Some findings are incomplete since some exact values have not been determined. Further, this problem can be extended and applied to many real-world networks in future.

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## Offline Signature Verification Using a Statistical Approach

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### ABSTRACT

There is a growing interest in signature verification with the increasing number of transactions, especially financial, that are being authorized via signatures. Hence methods of automatic signature verification are essential if authenticity is to be verified regularly. In this research, two statistical approaches are used to develop an offline signature verification system. Data collection was done from 100 individuals. Everyone was asked to provide 12 samples of his/her original signature for training and testing processes. 600 forgeries were collected from three forgers and 6 forgeries were generated for each of the original signature samples. In this study features were extracted from the signatures after the preprocessing stage. Altogether 10 features were collected and those were used to verify the signatures. It was found that when there is a multicollinearity, Generalized Linear model by estimating parameters using generalized estimating equations is not appropriate to solve the above problem. Multicollinearity problem can be minimized using factor analysis and then generalized linear model was found to be a more effective approach. However, further research needs to be carried out to solve this problem.

## INTRODUCTION

Research is very actively under way in the signature verification domain. Approaches to signature verification fall into two categories according to the acquisition of the data: On-line and Off-line. Online data records the motion of the stylus while the signature is produced; and includes location, and possibly velocity, acceleration and pen pressure which are functions of time. On the other hand, in offline signature verification, it is just required to scan the signature as an image, and then it can be used for extracting the features from it.

Static features such as signature height to width ratio, signature occupancy ratio, slope of the signature, etc. can be used for the verification process. Offline signature verification involves less electronic equipment and features used for the verification and thus are much simpler. In this offline method, all verification methods will be based on the analysis of the pixel image.

As compared to online signature verification systems, offline systems are difficult to design as many desirable characteristics such as the order of strokes, the velocity and other dynamic information are not available. Although difficult to design, offline signature verification is crucial for determining the writer identification.

Within a signature verification system, it must consider three types of forgeries. They are skilled forgeries, random forgeries, and simple forgeries. Generally, skilled forgery is defined as a signature that is made with close imitation of another person's signature by visually looking at genuine samples. Detecting random forgeries is an easier task. In this situation, forger just tries to make the valid signature of another

person. In simple forgeries, however, forger spells the name correctly but writes in his own style. Therefore, detecting simple forgeries is easier than detecting other two types (Kuzhinjedathu, n.d.)

## MATERIALS AND METHODS

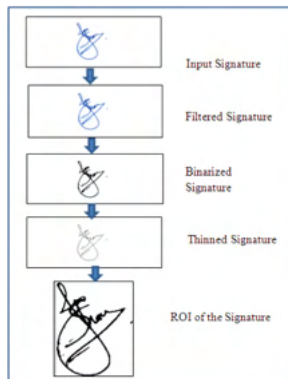
### Data collection

Since a standard signature database is not available in the public domain (due to the confidentiality of such information), a new signature database is built to test the effectiveness of the system. The signature database consists of 1800 signatures which composed of 1200 original signatures collected from 100 individuals and 600 forged signatures. Everyone was asked to provide 12 samples of his/her original signature for training and testing processes. 600 forgeries were collected from three forgers and 6 forgeries were generated for each of the original signature samples.

If the signatures are collected in a box, then the user must limit the signature to the size of the given box; which will affect the size of the original signature. Therefore, eventually it was decided not to use a box for collecting signatures and signatures were collected on dotted lines which were marked using a pencil.

When collecting signatures from individuals, everyone was advised not to make all the twelve signatures at once. If so, it might not be able to capture the variations among the signatures of that person because if the person makes twelve signatures at once then it will be a burden to him/her.

**Figure 1.** Preprocessing Stage



### Preprocessing

The main purpose of the preprocessing stage is to get all the signatures into a particular standard format and make them ready for feature extraction. There are several sub phases.

As the first sub phase filtering must be done to remove noise from the signature image. Noise can be added to the signature image during the scanning process. Salt and pepper or impulse noise can be added to the signature due to the roughness of the paper surface. Therefore, to remove the noise, as the filtering technique, Gaussian filtering was used.

As the second stage, image has been converted to black and white, which is the binarization stage. In this stage signature image is converted to binary with a threshold of 0.7. Then it contains only ones and zeros as the pixel values. The threshold is set to this value because after filtering, the intensity of the signature pixels also reduces (Bhuyan M., 2010).

As the third stage, signature must be thinned to reduce the width of the strokes of the signature from several pixels to a single pixel. Morphological thinning has been used for thinning the signature. Purpose of thinning is to eliminate the thickness differences of pen by making the image one pixel thick.

But when collecting some of the features, such as centroid of the signature, signature occupancy ratio etc., signature images that have not been thinned were used because some people might use thick lines purposely. Thus, using those features, that effect can be confined. Therefore, that can be captured without thinning the image.

Fourth step is to select the region of interest of the signature. That is, it must select the bounding box which envelopes the signature. Figure 2 illustrates the preprocessing of the signature.

### Feature extraction

Feature Extraction is done to map the signature image into feature space. In offline signature verification systems, three types of features are used.

#### a) Global features

Global features are extracted from every pixel that lies within a rectangle circumscribing the signature. These features do not reflect any local, geometrical, or topological properties of the signature, but include transformations, series expansions; image gradient analysis etc. although global features are easily extractable and insensitive to distortion and style variations (Ajith, 1997)

#### b) Statistical features

Statistical Features are derived from the distribution of pixels of a signature.

E.g., Statistics of high gray level pixels to identify pseudo dynamic characteristics of signatures.

#### c) Geometrical and topological features

Geometrical features describe the characteristic geometry and topology of a signature and thereby preserve the signatures' global and local properties.

E.g. Local correspondence of stroke segments to trace signature. Geometrical and topological features have a high tolerance to distortion and style variations, and they can also tolerate a certain degree of translation and rotation variations (Ajith, 1997).

## Features

### i. Height to width ratio

In this context, width and height are considered in terms of number of pixels and height is the maximum length of the rows obtained from the cropped signature and width is also calculated considering the columns of maximum length. Signature height and width of the same individual's signatures can change, which can also be justified using the Mann Whitney test. Therefore, height to width ratio is used instead of height and width.

### ii. Signature occupancy ratio

Signature occupancy ratio is a measure of signature density. The equation for signature occupancy ratio is given in the equation 1.

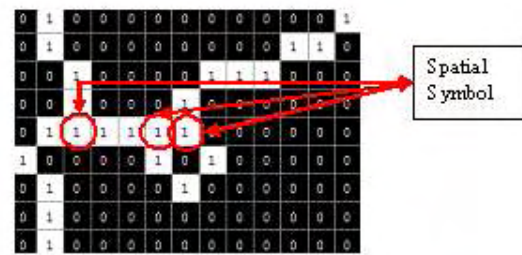
*Signature Occupancy Ratio*

$$= \frac{\text{Number of pixels in the signature}}{\text{Number of all the pixels (black and white)}} \dots (1)$$

### iii. Number of spatial symbols in the signature

Every person uses some spatial symbols in their signature, such as 'x' marks (cross marks), star marks or other symbols (Biswas S., 2010). The total number of spatial symbols of a person's signature is unique. After thinning the signature, if one pixel has more than two neighbors each of which gets the value 1, then those pixels will form a spatial symbol. Figure 2, illustrates the spatial symbols of a given signature.

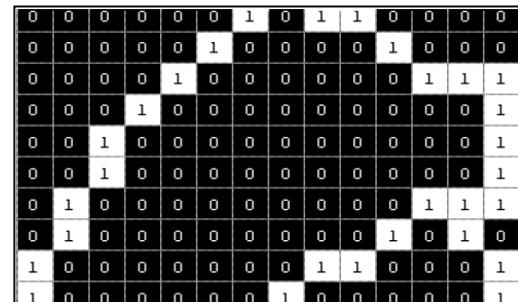
**Figure 2.** Spatial Symbols of a Signature



### iv. Length and the ratio of adjacency columns

A new feature extraction procedure is introduced here (Biswas S., 2010). In this stage, initially the length of the adjacency columns from top and from bottom of the sample signature image are computed and they are stored in one dimensional arrays LT and LB. Then sum of all elements of LT and LB is calculated. Overall procedure for the extraction of this feature is shown in the following figure. Initially, a portion of a signature is shown.

**Figure 3.** Length and Ratio of Adjacency Columns



**Table 1.** Adjacency Columns

Length From Top (LT)												
8	6	4	3	2	1	0	9	0	0	1	2	2
Length From Bottom (LB)												
0	2	4	6	7	8	9	0	1	1	2	3	0

Now the Adjacency Ratio can be calculated as follows using the equation 2.

$$\text{Adjacency Ratio} = \frac{\sum(L_T)}{\sum(L_B)} \times \text{Signature Occupancy Ratio} \dots (2)$$

#### v. Ratio of number of black pixels in each half

Initially the signature is divided into two halves and then number of black pixels in each half is calculated. Afterward, to capture effect of both values the ratio was taken. The equation is given as follows.

$$\text{NBPR} = \frac{\text{Number of Black Pixels in half1}}{\text{Number of Black Pixels in half2}} \dots (3)$$

#### vi. X Coordinate of the Centroid of the signature

The center of mass of a signature is a specific point at which, for many purposes, the system's mass behaves as if it were concentrated. The center of mass is a function only of the positions and masses of the particles that comprise the system. The center of mass of a signature does not always coincide with its intuitive geometric center. As a feature, X coordinate can be used to distinguish signatures.

#### vii. Y Coordinate of the centroid of the signature

Center of mass of the signature is obtained and then its y coordinate is also taken as a feature.

**Figure 4. Correlation Matrix**

		Correlations										
		HWR	SOR	SS	NBPR	EP	MVP	MHP	AR	CH	CV	
HWR	Pearson Correlation	1	-.048	.018	.193	-.322	.172	-.353	-.159	-.481	.398	
	Sig. (2-tailed)		.097	.537	.000	.000	.000	.000	.000	.000	.000	
	N	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	
SOR	Pearson Correlation	-.048	1	.385	-.128	-.284	-.020	.062	.366	-.462	-.535	
	Sig. (2-tailed)	.097		.000	.000	.000	.494	.032	.000	.000	.000	
	N	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	
SS	Pearson Correlation	.018	.385	1	-.059	-.009	.450	.413	.114	.105	.159	
	Sig. (2-tailed)	.537	.000		.042	.753	.000	.000	.000	.000	.000	
	N	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	
NBPR	Pearson Correlation	.193	-.128	-.059	1	-.138	.122	-.105	-.042	-.248	.117	
	Sig. (2-tailed)	.000	.000	.042		.000	.000	.000	.150	.000	.000	
	N	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	
EP	Pearson Correlation	-.322	-.284	-.009	-.138	1	-.005	.149	-.098	.443	.085	
	Sig. (2-tailed)	.000	.000	.753	.000		.874	.000	.001	.000	.003	
	N	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	
MVP	Pearson Correlation	.172	-.020	.450	.122	-.005	1	.301	-.028	.118	.381	
	Sig. (2-tailed)	.000	.494	.000	.000	.874		.000	.340	.000	.000	
	N	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	
MHP	Pearson Correlation	-.353	.062	.413	-.105	.149	.301	1	.213	.508	.154	
	Sig. (2-tailed)	.000	.032	.000	.000	.000	.000		.000	.000	.000	
	N	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	
AR	Pearson Correlation	-.159	.366	.114	-.042	-.098	-.028	.213	1	-.100	-.105	
	Sig. (2-tailed)	.000	.000	.000	.150	.001	.340	.000		.001	.000	
	N	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	
CH	Pearson Correlation	-.481	-.462	.105	-.248	.443	.118	.508	-.100	1	.353	
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.001		.000	
	N	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	
CV	Pearson Correlation	.398	-.535	.159	.117	.085	.381	.154	-.105	.353	1	
	Sig. (2-tailed)	.000	.000	.000	.003	.000	.000	.000	.000	.000	.000	
	N	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	
** Correlation is significant at the 0.01 level (2-tailed).												

\*\*. Correlation is significant at the 0.01 level (2-tailed).

#### viii. Maximum vertical projection

The vertical projection of the preprocessed signature image is calculated by summing all the black pixels along the rows.

#### ix. Maximum Horizontal Projection

The horizontal projection of the preprocessed signature image is calculated by summing all black pixels along the rows.

#### x. Number of Edge Points

An edge point is defined as a signature point that has only eight neighbors. It only considers black pixels in the signature image, and it checks its 8 neighborhood and if there is only one black pixel then it is an edge point.

## RESULTS AND DISCUSSION

### Testing with features

It must combine the effects of all the features for the classification process. Different approaches can be used for this purpose. The approach used for combining the effects of features was Generalized Estimating Equations model.

### a. Generalized Estimating Equations (GEE) model

In this scenario, just a Generalized Linear Model cannot be fitted on data due to the repeated measurements involved in data. For one individual, there are 8 signatures in the training data set. Thus, for each of those signatures feature values are calculated and hence there are repeated measures from a particular case. Due to that reason, it was decided to go for a GEE (Generalized Estimating Equations) model because it can handle repeated measures. There are 10 numerical variables or covariates that can be used for the model. Since there are signatures of 100 people, another additional variable was added to the data set to recognize the person. Data set contains both original and forged signatures, thus another nominal variable was used to indicate whether that signature is forged or an original one.

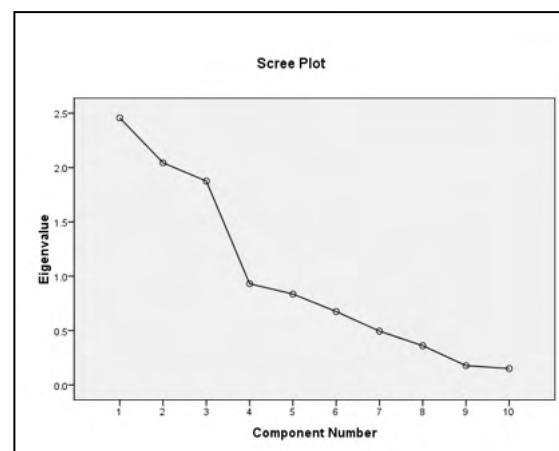
GEE binary logistic model can be applied if the features which are going to be used for the model are uncorrelated only. Therefore, initially the correlation between those feature values was found using a correlation matrix. Correlation matrix is shown in the above figure.

According to the above matrix, there are correlations among the variables. Therefore, multi collinearity was presented in the data set. Thus, it is not possible to apply a GEE model directly. Therefore, factor analysis was applied, which makes it possible to find some interpretable factors and those corresponding factor scores can be used to obtain the model.

According to the scree plot, 3 factors could be used. Scree plot is shown in the following Figure 5. According to the plot after 3 eigen values there is a significant reduction of the eigen values. Due to that reason, 3 factors were used. After

obtaining the component matrix, varimax rotated matrix was also obtained to check whether there are interpretable factors. Although some of the factors obtained are interpretable, it was not possible to fit a GEE model for those factor scores, because most of the factors became insignificant in the model. The reason for that could be the high multi collinearity involved in the data set.

**Figure 5.** Scree Plot



Following table shows the varimax rotated matrix, when all the features are used. According to the Table 2, it shows that, for the first factor height to width ratio (HWR), x coordinate of the centroid (CH), maximum horizontal projection (MHP) and the number of edge points (EP) have high loadings. Moreover, in the second factor Signature Occupancy Ratio (SOR), Adjacency Ratio (AR) and Y coordinate of the centroid (CV) have higher loadings. In the third factor higher loadings are displayed in the features Number of Spatial Symbols (SS), Maximum Vertical Projection (MVP) and Maximum Horizontal Projection (MHP). Factors can be interpreted in different ways. But the factors were always not interpretable.

**Table 2.** Varimax Rotated Matrix

	Component		
	1	2	3
HWR	-.830	.237	.130
SOR	-.139	-.910	.099
SS	.020	-.315	.782
NBPR	-.462	.185	.059
EP	.603	.333	-.014
MVP	-.163	.127	.778
MHP	.528	-.117	.639
AR	.109	-.553	.168
CH	.757	.441	.296
CV	-.153	.688	.523

Then the factor scores obtained from the interpretable factors were used to fit a Generalized Estimating Equations (GEE) model. But an acceptable goodness of fit of the model could not be achieved.

## CONCLUSIONS

When there is multicollinearity, Generalized Linear modeling approach by estimating parameters using generalized estimating equations is not suitable for offline signature verification. Through identification of orthogonal factors from factor analysis, this problem can be solved to some extent.

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## Heuristic Approach to Solve Interval Transportation Problem

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### ABSTRACT

The transportation problem is a special type of linear programming problem in which commodities are transported from a set of sources to a set of destinations subject to the supply and demand quantities of sources and destinations respectively such that the total transportation cost is minimized. This plays an important role in logistics and supply-chain management for improving services, reducing cost, and optimizing the use of resources. Researchers have given considerable attention to the transportation problem with fixed demand and supply. Many algorithms are available to solve transportation problems with the above conditions. However, in real-world applications, demand and supply quantities may vary within a specific interval due to variations in the global economy. Finding an upper minimal total cost of interval transportation problem (ITP) is an NP-hard problem. Thus, less attention has been given to this type of transportation problem. Heuristic approaches are preferred to solve this type of problem. Genetic algorithm is a powerful algorithm to solve NP-hard problems because of its special characteristics. In this paper, a solution procedure based on the concept of a genetic algorithm is proposed to solve ITP.

## INTRODUCTION

The Transportation Problem (TP) is one of the most important and highly considered problems in Operations Research and it is a subclass of linear programming. TP plays an important role in logistics and supply chain management. Also, it has a wide range of applications in various areas. TP is applied to the transportation of commodities from different sources to different destinations with the objective to minimize the transportation cost. TP was introduced (Hitchcock, 1941) and based on the linear programming problem and occasionally called the Hitchcock problem. Based on the above TP model formulation, researchers have developed various methods to solve TP. The simplex method was developed (Dantzig, 1965) to solve TP. Charnes and Copper (1954) have developed the stepping stone method. Then, the stepping stone method is modified as the modified distribution method to solve TPs. A new algorithm to solve TP was developed (Arsham, 1989). Another study on candidate locations for the more-for-less solution in the TP is conducted (Adlakha, 1998).

A large number of studies was conducted to solve TPs by assuming that demand and supply values are fixed. But in real situations, it is difficult to decide fixed demand and supply quantities due to the economic conditions. Hence, each of the demand and supply quantities may vary within a specific range in a period due to the economic conditions. Due to the above scenario, the minimum transportation cost also varies within a range. It is difficult to find an exact upper bound on the minimal transportation cost using traditional algorithms. A few numbers of studies were conducted to investigate the upper minimal transportation cost for better decision making and proper saving. Also, the demand and supply combinations may increase with the increment of the number

of demand or supply points and according to the ranges of particular demand or supply.

The TP with interval demand and supply can be converted into a linear programming problem (Liu, 2003). In this study, a pair of two-level TPs is transformed to one level mathematical programming problem to find the objective function value. Due to the structure of the TP, the upper minimal transportation cost may not occur at the highest total quantities shipped. Then, Juman and Hoque (Juman, 2015) developed a heuristic solution technique to obtain the upper minimal transportation cost of ITP. They proved that Liu's (Liu, 2003) approach always does not provide the exact upper minimal transportation cost on the ITP.

In this study, our purpose is to investigate a new algorithm to solve ITP. The rest of the paper is organized as follows. First, the transportation problem with varying demand and supply is introduced. Then the proposed genetic algorithm is introduced, and finally, results and conclusion are included in this paper.

## MATERIALS AND METHODS

### Mathematical model

TP can be expressed as a network consists of nodes and arcs. Suppose that there are  $m$  supply nodes and  $n$  demand nodes. The  $i^{th}$  supply node can provide  $\hat{s}_i$  units of a certain product and the  $j^{th}$  demand node has a demand for  $\hat{d}_j$  units. The unit transportation cost of products transported from the  $i^{th}$  supply node to the  $j^{th}$  demand node is represented by  $c_{ij}$ . The demand and supply vary, and they can be represented by  $\hat{d}_j$  and  $\hat{s}_i$  with the lower and upper bounds  $[\underline{D}_j, \bar{D}_j]$  and  $[\underline{S}_i, \bar{S}_i]$ ,

respectively. Let  $x_{ij}$  be the number of units transported from  $i^{th}$  supply point to the  $j^{th}$  demand node. The transportation problem with varying demand and supply has the following mathematical form:

$$\begin{aligned}
 & \text{Minimize } \sum_{i=1}^m \sum_{j=1}^n c_{ij} x_{ij} \\
 & \text{Subject to} \\
 & \sum_{j=1}^n x_{ij} \leq \hat{s}_i \quad (i = 1, 2, \dots, m) \\
 & \sum_{i=1}^m x_{ij} = \hat{d}_j \quad (j = 1, 2, \dots, n) \\
 & x_{ij} \geq 0 \quad \forall i, j \\
 & \hat{s}_i \in [\underline{S}_i, \bar{S}_i], \hat{d}_j \in [\underline{D}_j, \bar{D}_j] \quad \forall i, j \text{ and} \\
 & \sum_{i=1}^m \hat{s}_i \geq \sum_{j=1}^n \hat{d}_j
 \end{aligned}$$

### Methodology

Heuristic algorithms are used to find better local optimal or global optimum solutions for NP-hard optimization problems. Genetic algorithm is one of the widely used heuristic approach to solve NP-hard optimization problems. The genetic algorithm relies on Charles Darwin's (Darwin, 1987) theory of natural evolution. The basic concept of the genetic algorithm was developed (Goldberg, 1988). The genetic algorithm follows the steps corresponding to the genetic concept. It consists of selection, crossover, and mutation. These concepts are applied to a computational algorithm to find the solution to a problem called the objective function.

### Proposed genetic algorithm

The following steps are proposed for the genetic algorithm.

#### Step 01

Set number of generations ( $G$ ), population size ( $N_p$ ), crossover rate ( $\rho_c$ ), mutation rate ( $\rho_m$ ), number of supply points ( $m$ ), number of demand points ( $n$ ), and  $g = 1$  and go to step 02.

#### Step 02

Dimension of initial population is  $N_p$  by  $(m + n)$ . First consider the first row of initial population.

Generate  $(m + n)$  number of random numbers. If random numbers  $< 0.5$ , then set the solution value as the lower bound of particular supply or demand point. Otherwise, set the solution value as the upper bound of particular supply or demand point. Continue this process until values are assigned for the initial population matrix. Next, go to step 03.

#### Step 03

Solve the linear programming problems (using MATLAB) corresponding to the generated solutions. Set the fitness value of infeasible solution sets as zero and fitness of feasible solution sets as the objective function value. If  $g = 1$ , go to step 04 else go to step 07.

#### Step 04

Apply tournament selection to select parent chromosomes. Go to step 05.

#### Step 05

Generate  $N_p$  random numbers and select the random numbers ( $c_1$ ) that are less than to the crossover rate ( $\rho_c$ ). Then, select the parents corresponding to the index of selected random numbers ( $c_1$ ). Then, generate  $c_1$  number of random numbers between 1 to  $(m + n - 1)$  to determine the positions of the crossover in the chromosome. Next, consider first selected two parents, and interchange the solution values of first parent from the crossover position. Continue this process until you perform  $c_1$  number of crossover

operations (as a cycle) and obtain off\_springs\_crossover. Go to step 06.

#### Step 06

Calculate total genes  $((m + n) * N_p)$  and the number of mutations  $(m_1 = (\rho_m * total\ genes))$ . Generate  $m_1$  random numbers between 1 and *total genes* to determine the positions of the mutation. Then generate  $m_1$  random numbers between lower bound and upper bound of relevant supply point or demand point. Replace the values of the mutation positions using the generated random numbers and obtain off\_springs\_mutation. Go to step 03.

#### Step 07

Combine the initial population and off\_springs\_mutation and fitness values of initial population and off\_springs\_mutation. Select the highest  $N_p$  fitness values and corresponding chromosomes as the initial population of  $(g + 1)^{th}$  generation. Go to step 08.

#### Step 08

If  $G = g$  then, select the maximum fitness function value as the upper minimal total cost and corresponding chromosome as the optimal demand and supply values. Else go to step 04.

### Tournament selection (Miller, 1995)

#### Step 01

Set  $i = 1$  and go to step 02.

#### Step 02

If  $i = N_p$ , go to step 04. Else, select  $i^{th}$  and  $(i + 1)^{th}$  chromosomes from the initial population. If  $Fitness(i) \geq Fitness(i + 1)$ , then  $i^{th}parent = i^{th}chromosome$  else  $i^{th}parent = (i + 1)^{th}chromosome$  and go to step 03.

#### Step 03

Set  $i = i + 1$  and go to step 02.

#### Step 04

Select  $N_p^{th}$  and  $1^{st}$  chromosomes from the initial population. If  $Fitness(N_p) \geq Fitness(1)$  then  $c^{th}parent = N_p^{th}chromosome$  else  $N_p^{th}parent = 1^{st}chromosome$  and stop.

## RESULTS AND DISCUSSION

In this section, the proposed heuristic algorithm is used to solve benchmark problems of ITP and compared against Liu's (Liu, 2003) approach (UB(L)) and Juman and Hoque (2005)'s approach (UB(J)) to evaluate the performance of the proposed genetic algorithm (UB(G)). The proposed heuristic algorithm is coded with MATLAB and run on PC with Intel® Core™ i3-3227U CPU @ 1.90GHz and RAM 6.00GB.

In this example four cases (two suppliers & three buyers), (three suppliers & five buyers), (four suppliers & six buyers), and (five suppliers & ten buyers) are solved and the data was compared with the upper bound total cost. When compared to the other two methods, the proposed method provides better upper minimal total cost.

**Table 1.** The near optimal upper bound for 2X3 ITP

Problem Name	1	2	3	4	5	6	7	8	9	10
UB(L)	5250	7530	7710	7290	4350	4350	7410	10890	6960	9000
UB(J)	5370	7530	7710	8010	7725	4725	8430	11565	8730	10725
UB(G)	8085	8775	10065	8010	7800	4800	8430	11565	8730	10725

**Table 2.** The near optimal upper bound for 3X5 ITP

Problem Name	1	2	3	4	5	6	7	8	9	10
UB(L)	16410	14820	20550	12940	16650	16490	10195	12620	11010	12915
UB(J)	16305	14280	20650	12820	16650	16540	10120	12450	9765	12340
UB(G)	16410	14820	20650	12940	16650	16540	10195	13360	11010	12915

**Table 3.** The near optimal upper bound for 4X6 ITP

Problem Name	1	2	3	4	5	6	7	8	9	10
UB(L)	27125	19970	23615	22375	19500	9250	17245	24180	23610	22825
UB(J)	27110	20090	17845	20950	19500	8830	16580	22695	21660	19700
UB(G)	27125	20635	23615	22375	19500	11380	17245	24180	24060	22825

**Table 4.** The near optimal upper bound for 5X10 ITP

Problem Name	1	2	3	4	5	6	7	8	9	10
UB(L)	25700	24220	19585	30260	23470	23035	22375	30000	24675	39985
UB(J)	21190	23190	18080	27335	20770	19580	21970	27520	21805	37600
UB(G)	25760	24980	19635	30260	23590	23075	22375	30000	24675	39985

## CONCLUSIONS

The transportation model plays an important role in supply chain management for reducing cost and improving service. Previous studies have devised solution procedures for the transportation problem with varying demand and supply parameters. When compared to Liu (2003) and Juman and Hoque (2015) approaches, the proposed heuristic algorithm provides the highest upper minimal total cost. The proposed genetic algorithm is performing better than the existing approaches and there is a large increment in the upper minimal total cost when compared with the other existing methods. Thus, our proposed approach is more beneficial in decision making especially for proper investment.

The proposed method is performing better when compared to the upper minimal total cost of previous methods. It is recommended to develop this method

for large scale problems and to obtain better solution in terms of solution time and upper minimal total cost.

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# Psychology



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## Lesbian, Gay and Bisexual Adults' Recollections of Others' Reactions to Their Early Gender Non-conformity

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### ABSTRACT

Globally, gender non-conforming (GNC) behaviours are identified as one of the earliest precursors of same sex orientation. The role of reactions by key persons such as parents, teachers and peers to such behaviours is crucial to sexual identity development. In Sri Lanka, there are currently no scholarly data on LGB adults' recollections of their early experiences, particularly those involving how others reacted to their early GNC and gender atypical behaviours. Through narratives, this exploratory research paper addresses this gap by presenting how 26 LGB adults recalled the manner in which their parents, teachers, and peers responded to their gender-atypical and gender non-conforming behaviours during childhood and adolescence. A participant-focused thematic analysis highlighted the following findings: permissiveness of adults towards childhood gender non-conformity for both boys and girls; how adults' attitudes shifted during adolescence to be more regulatory; and how adolescent girls and boys recalled experientially different reactions to their GNC behaviours by their peers. These results suggest the nuances of recollections growing up as GNC children and adolescents, and the impact these experiences had on the acceptance of a sexual identity. Future research could begin by observing actual gender nonconformity and gender atypical behaviours in children and adolescence.

## INTRODUCTION

Anecdotal information increasingly suggests an unprecedented rise in visibility of lesbian, gay and bisexual (LGB) persons in physical and virtual spaces in Sri Lanka. Many contribute to social and community endeavours across both public and private settings. Yet, very little is currently known about their lived experience and identity development. Currently, information on the functioning of LGB persons is limited to policy and advocacy documents by non-governmental organizations (NGOs) that address aspects of liberty, equality, and health. While highlighting the negative experiences resulting from the ambiguous legal status of non-heterosexual persons in the country, such information tends to emphasize stereotypical attitudes on the part of the general public, invite negative attention and inadvertently victimize non-heterosexual persons further.

Scholarly literature on LGB persons' identity development in Sri Lanka is scarce. Apart from the exploration of lesbians' masculine identities from childhood tomboyism to adult lesbian identity (Kuru-Utumpala, 2013), no other scholarly inquiry on LGB identity development is currently available. Particularly absent from the literature is how members of LGB persons' support structures reacted to their early gender atypical and gender non-conforming (GNC) behaviours.

This paper hopes to fill this gap with an exploration into how LGB people recalled the reactions of their parents, teachers and peers to their GNC and gender atypical behaviours during the early stages of identity development.

Given that parents, teachers and peers are primary support structures for children and adolescents, the types of feedback

received from them are crucial to identity formation and personal development. Practically, such information will add to the overall understanding of the factors that influence identity development of LGB persons in Sri Lanka.

## LITERATURE REVIEW

Gender is considered a social construct involving feelings, behaviours and attitudes within a given culture that are conventionally associated with sex assigned at birth (male or female); behaviour that is compatible with cultural expectations for men or women is referred to as 'gender-normative'; behaviours that are viewed as incompatible with these expectations constitute 'gender non-conformity' (GNC) (American Psychological Association, 2015). Gender non-conformity is considered a marker of same sex orientation and is linked to anti-gay prejudice and discrimination (Gordon & Meyer, 2007). The construct is also associated with transgender/non-binary identities, although it is outside the scope of this article.

'Gender typed behaviours', the process through which children learn and behave in accordance with their sex assigned at birth, is one of the earliest predictors of sexual orientation (Li et al., 2017). However, contemporary research on sex and gender is divided on whether the constructs are fused or separated. While some theorists assert sex and gender are related though not connected constructs (Chivers & Bailey, 2000; Roselli, 2018), others suggest a strong conflation of the two (Francis and Kjaran, 2020).

In the West, childhood GNC has been linked to adolescent GNC that predicted adult same-sex or bisexual inclinations (Drummond et al., 2008). Similarly, early GNC has also been associated with adult same-sex inclinations in gay men (Zucker

et al., 2006). An association between adolescent gendered behaviour and adult sexual orientation has also been established (Udry & Chantala, 2016). Furthermore, Rieger et al (2008) concluded through the analysis of childhood home videos that non heterosexual adult men and women recalled more childhood GNC behaviours than heterosexual adults. Thus, childhood GNC behaviours are considered a robust developmental correlate of adult sexual orientation (Bailey et al., 2016).

However, it is important to note that children who behave according to conventional gender norms identify as experiencing same-sex desire, and some who do not conform to gender norms identify as heterosexual (Green, 2008). Furthermore, gender nonconformity in girls is not linked to a sexual identity or sexual orientation (Schope & Eliason, 2004) as many heterosexual women also embody a tomboy identity.

Scholarly literature in South Asia that explores the reactions of others to early GNC is scarce. In Sri Lanka, Kuru-Utumpala (2013) reported butch lesbians' childhood recollections of riding bicycles, climbing trees, playing cricket, being 'naughty', and of either wanting to be a boy, or having been like a boy, while simultaneously, hating playing with dolls and wearing dresses. However, initial parental permissiveness to these behaviours tightened after puberty. Similarly, Renade (2018) analysed the recollections of LGB adults' growing up in urban India. While parents had initially encouraged GNC in boys (wearing dresses, make-up, and cooking) and girls (wearing shirts, climbing trees, riding bikes) in childhood, such behaviours were condemned in adolescence. One of the key highlights of her study was how the reactions of adults and peers towards LGB persons' gender expressions in childhood signaled a sense of subjective difference.

In the West, parental reactions to children's GNC behaviours appear to be mediated by children's gender. Parents with conventional mindsets were more uncomfortable with their sons' GNC and appeared more tolerant of their daughters' gender atypical behaviours (Spivey-Rita et al., 2018). Furthermore, studies highlight especially the efforts of fathers to 'balance' young boys GNC by encouraging normative masculine activities (Kane, 2006) and also to change their sons' gender atypical behaviours to parallel conventionally masculine ideals (Spivey-Rita et al., 2018). However, while parents may be tolerant of gender atypical behaviours in girls in childhood, if such behaviours persist into adolescence, the girls are considered immature (Carr, 2007). Western scholars hypothesized that the stark negative reactions to early male GNC (compared with female GNC) are associated with the fear of that GNC being a predictor of adult same-sex inclinations (McCreary, 1994).

In the West, reactions to GNC of adolescents in schools is widely documented. GNC adolescents experience school as a particularly unforgiving climate. Typical developmental concerns are often aggravated by school-based peer victimization. In fact, homophobia, social prejudice, and sexual orientation and gender identity/expression (SOGIE) related verbal and physical harassment are common daily challenges for boys and girls (Kosciw et al, 2018). Peers, teachers, and school administrators are most responsible for such treatment (Baams, 2018; Timmins et al., 2020). Scholars note that identifying as LGB "is a moderate and consistent risk factor for victimization at school" (Myers et al., 2020, p. 15). Furthermore, gay adolescent boys experience more discrimination and violence than lesbian girls (Dunn & Szymanski, 2018).

Most research on childhood GNC is a product of broadly Western contexts. A cross gendered self-presentation does not always indicate a non-heterosexual identity, and many individuals who identify as heterosexuals present themselves in a variety of gender atypical ways. Furthermore, gender expressions and sexual preferences are fluid and can vary with time. Nevertheless, Western studies indicate that adults and peers tend to view early GNC as indicative of later homosexual orientation or same-sex preference. Although this was not my main purpose, the present study sheds some light on this question.

Hence, the research question was:

1. How do LGB adults in Colombo narrate the story of their recollections of how others reacted to their early gender expression?

The corresponding objective was to gather life-story accounts of LGB persons' recollections of parents, teachers and peers' reactions towards their gender non-conforming (GNC) and gender-atypical behaviours in childhood and adolescence.

## **MATERIALS AND METHODS**

### **Method**

This exploratory study used a narrative research design. My decision to use narratives hinged on their versatility; they enable researchers to explore a variety of topics that are impervious through quantitative research methods (Carpentieri et al., 2016). McAdams's (2008) Life Story Interview was adapted to a semi-structured in-depth interview protocol to collect the life stories of 26 participants.

### **Inclusion criteria**

Self-identifying LGB adults over 18 years, fluent in English and/or Sinhala, of any ethnicity, willing to voluntarily provide an

approximately 90-minute audio recorded interview.

### **Sampling strategy**

A snowball recruitment with maximal sampling variation across demographic indicators was used for recruitment. Each participant also acted as a 'referrer' for other potential participants in their existing social networks. Most of the participants were currently living in or near Colombo, although 2 had grown up in rural areas in the South.

### **Materials**

English and Sinhala versions of the interview protocol, a study introduction sheet, a preliminary screening script to evaluate eligibility for the study, consent and confidentiality forms, and demographic questionnaire.

### **Pilot study**

To assess the feasibility of the research design, to pre-test the interview protocol, and to provide a better understanding of the limitations anticipated was conducted.

### **Ethical clearance**

Granted by the Ethics Review Committee of the Faculty of Graduate Studies, University of Colombo. Written and verbal informed consent was obtained from every participant. All audio recordings and interview transcripts were made by myself and were stored on two separate password protected and encrypted drives. This data was accessible only by myself and the primary research supervisor.

A reflexive diary was maintained throughout the process of the research to continuously reflect on my own heteronormative standpoint as well as my own experiences conducting the research. Data analysis followed a participant-focused analysis to extract shared meaning or "repeating ideas" (Magnusson & Marecek, 2015, p.2) from the

transcripts. These repeated ideas were identified by succinct phrases resembling thematic codes.

## RESULTS AND DISCUSSION

Many of the participants, particularly the men, had lived in semi-urban or rural environments during childhood, and migrated to Colombo either with their families of origin or alone. Most of the women had lived continuously in Colombo since their childhood. For many of the men and women, Colombo represented an opportunity for freedom from restrictive home environments. All but two participants were based in Colombo at the point of data collection; two were studying abroad.

### Reactions of adults and peers to participants' GNC from childhood to adolescence –

Many participants recalled that in childhood, adults were far more lenient towards their gender non-conformity than peers generally were.

The men recalled that their parents had not openly encouraged nor explicitly discouraged their GNC behaviours. Particularly mothers, aunts and grandmothers had reportedly regarded GNC by boys as typical childhood play and valued what they regarded as creative talents. For instance, Randil, a self-identifying gay man in his mid-twenties recalled how wearing sarees and playing dress up were seen as childhood play. Fathers' reactions to young boys' GNC were spoken about less, likely because many fathers were employed either overseas or in Colombo.

The women recalled that parents, teachers and peers had responded either positively or fairly ambivalently to their early tomboyishness and gender atypical style of dress and behaviour in their childhood. Many of the women recalled they had

preferred shorts and t-shirts over dresses and skirts, preferred boys over girl playmates, enjoyed climbing trees, playing cricket and football and enjoyed competitive sports. For instance, Yuvani, a self-identifying lesbian in her mid-twenties recalled “... *In my childhood, I was like a tomboy...they [adults] actually wanted me to be like a boy and I was OK with it and really liked it... my grandfather had to cut some trees in the garden because I was all over the place like a monkey. My uncles taught me how to whistle...*”

Many participants recollected that by adolescence, adult permissiveness to childhood GNC tightened, which also coincided with the onset of puberty. The men recalled that they were often punished for appearing too “girly” or for behaviours that were considered gender transgressions. For instance, Roy, in his late twenties, identifying as gay, recalled how his teacher had dealt with incidents of bullying, “... *She said that my mother should teach her son how to live like man, because he is a boy, but his attitude and everything else are like a girl*”.

Interestingly, even though adolescent girls received some corrective feedback from adults towards their gender atypical behaviour, being sporty, and headstrong were viewed positively by parents and teachers. Often such self-presentations shielded them from punitive adult sanctions, such as what adolescent boys received. Moreover, participants said that their mothers had not appeared to relate their daughters' gender-atypical clothing and activities to sexual identity. For instance, Anisha, a self-identifying bisexual in her mid-twenties fondly recalled how her mother used to say, “... *'Oh, like a boy, noh? Even sitting like a boy'... [But] She never said anything. She has brought me up in a way where I can be very independent.*”.

Many men recalled that their peers' reactions towards their GNC in childhood but mostly in adolescence were overwhelmingly negative. Name-calling such as woman, young girl, "ponnaya", a derogatory slang word for a homosexual man), gaanu kicha and lady-boy was by far the most common form of bullying in adolescence. However, only one participant recalled being 'roughed up' by male peers.

Most women recalled that their peers often held them in high esteem for being sporty and tomboyish. Some women recalled they had even been considered role models. For instance, Zari, a self-identifying lesbian in her late twenties recalled her school years, *"...people were fascinated with me because I was like a tomboy and...girls used to come to see... this special-looking smart girl..."*

## Discussion

One of the most salient findings was that both men and women recalled that their childhood GNC and gender-atypical behaviour was received with a good deal of latitude by adults. Because such childhood play and behaviour were not considered gender transgressions, few efforts were made to correct or punish such behaviour. Adults had not perceived young boys' preference for girly play (dress-up, wearing make-up), and girls' preferences for naughty and tomboyish behaviour as signs of later sexual identity. Instead such behaviours and self-presentations were either encouraged, as in the case of the girls, or not actively discouraged, as in the case of the boys.

Many participants recalled a shift in parental reactions from childhood to adolescence. Positive attention was replaced by sanctions on decorum. However, these sanctions were far more prominent in the recollections of the men towards their adolescent GNC than in the

recollections of the women. In other words, men recalled more pushback towards their adolescent GNC presentations than the women recalled during their adolescence.

A similar pattern was evident in relation to reactions by peers as well. Peers were recalled as being more unforgiving in their reactions toward boys' GNC in childhood and adolescence. The women recalled being valued by their peers for their gender-atypical behaviours and appearance as adolescents.

The period of adolescence is widely considered a stepping stone to adulthood, signalling a sexually, emotionally and physically maturing human. I argue that in the case of the men in this study, the gender differentiation was due to deeply entrenched heterosexualized gender systems and patriarchal norms in Sri Lanka, that compel adolescent boys to fit into gendered Sri Lankan norms of masculinity. In contrast, adolescent girls who embraced less feminine traits were, not necessarily seen as 'more masculine'. Instead, they were seen as possessing valued traits that arguably had little to do with gender stereotypes. An adolescent girl wearing shorts and t-shirt, who excels in sports is not considered an aberration especially in urban settings like Colombo. By contrast, an adolescent boy preferring the creative arts, and not engaged in sports is often perceived as unmasculine in many settings in Sri Lanka.

Existing research indicate similar trends to those of my study. For instance, scholars have documented the initial permissiveness to GNC in childhood and restrictions in adolescence in South Asia (Kuru-Uthumpala, 2013; Renade, 2018) and in the West, particularly towards boys (Spivey-Rita et al., 2018). Further, studies have documented how gender nonconforming adolescents experienced

pervasive harassment, and victimization from particularly peers for challenging stereotypical renditions of masculinity and femininity (Baams, 2018; Timmins et al., 2020).

## CONCLUSIONS

According to participants, there were striking differences in others' reactions depending on the participant's age and gender. Notable was parental latitude towards the childhood GNC of both boys and girls. Shifts in adult latitude was noticed around puberty arguably due to changing gender expectations and norms. Overall, the women recalled more positive feedback towards their gender atypical presentations and behaviours from peers than the men did in childhood and adolescence. The reactions that young boys experienced towards their GNC was more negative overall than the reactions young girls received towards the same, by adults and peers.

## Implications and Recommendations

These findings can broaden the existing understanding of the nuances of experiences LGB adults recall of growing up, particularly with adults and peers. Future research could begin by observing actual gender nonconformity and gender atypical behaviours in children and adolescence. Not all youngsters who report gender non conformity and gender atypical behaviours in childhood eventually adopt a LGB identity. By exploring early GNC, research could potentially identify the range of experiences persons have in their childhoods, to gain a deeper understanding of how LGB identity develops in context.

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## **Vulnerability Factors and Pathways to Sex Work: An Exploratory Study of Childhood Experiences of Abuse among Female Sex Workers in Sri Lanka**

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### **ABSTRACT**

The sex work is considered a grey area of morality. A considerable amount of research has shown a connection between childhood abuse and engagement in sex work as an adult. In Sri Lanka, very few studies have explored the connection between childhood victimization and being a sex worker. This research examines the reasons behind females moving towards sex work industry in Sri Lanka and the impact of their childhood abuse experience for that choice. As a qualitative study, stories of fifteen women involved in the sex work were explored with semi-structured interviews. Data were analysed using thematic analysis. A relationship between childhood abuse incidences and female sex workers in the sex work industry in Sri Lanka was identified. Physical abuse, sexual abuse, psychological & emotional abuse, and neglect in their childhood are the key factors reported by the participants. Insecurities in the home environment, absence of parental care, lack of education and lack of social support are the key experiences of the respondents. The study concludes that female sex workers who choose this industry as their means of income, often come from families that have more interpersonal difficulties and where they have had experienced abuse in their childhood. The relevance and generalizability of this conclusion to the wider sex worker population is difficult to determine, given the non-random selection of this sex worker sample.

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## INTRODUCTION

Protecting and caring for children is important as they are the driving force of the future world. However, the World Health Organization estimated that 1 out of 2 children or 1 billion children suffer some form of violence or abuse each year. Physical abuse, sexual abuse, neglect, and emotional maltreatment have been recognized as four general categories of child abuse (World Health Organization, 2006). In Sri Lanka, 8165 instances of violence involving children were reported to the National Child Protection Authority in 2020 (National Child Protection Authority, 2020).

Many pieces of literature show that childhood abuse is related to the later negative consequences as adults and that the cost must be borne by the whole society (Silbert and Pines, 1983). Children who faced child abuse incidents had more negative life outcomes as adults such as choosing a job that is socially unacceptable such as sex work (Widom and Kuhns, 1996). Women who receive money or goods in exchange for sexual services and who consciously define those activities as an income-generating method, even if they do not consider sex work as their occupation, are defined as female sex workers. (Overs, 2002).

A considerable amount of prior researches have shown a connection between people who have abusive childhood backgrounds and engaging in the sex work industry. Silbert and Pines (1983) found a high level of childhood victimization among street sex workers before their entrance into the sex work industry. 60% of the sex workers that participated in the study had been sexually exploited as a child by an average of two males each. Another study shows that women who engage in sex work have experienced high rates of physical and sexual abuse in childhood, as well as

parental substance abuse (Kramer and Berg, 2003). According to previous literature, early childhood abuse was a significant predictor of sex work for females. Sexual abuse and neglect were highly associated with sex work, whereas physical abuse was only marginally associated for females. But as a factor, childhood abuse and neglect are not associated with risk for promiscuity. According to these findings, there is strong support that shows a relationship between childhood victimization and subsequent sex work (Widom and Kuhns, 1996).

Focusing on what are the risk factors that contribute to child abuse and neglect, according to previous research, environmental insecurity leads to child abuse (Beach et al, 2010). Further, factors such as alcoholism and lack of social support increase environmental insecurity (Carter et al, 2012) (Malpique et al, 1998). Considering about parental alcoholism, this factor contributes to child abuse and researchers have also found a relationship between parental alcohol addiction and parental preparation of physical child abuse (Downs et al, 1996). However, in the Sri Lankan context, very few studies have explored this relationship between childhood victimization and choosing sex work as a profession. Sex work is a controversial topic in Sri Lankan society. According to the law of Sri Lanka, the vagrants ordinance was introduced in 1842, and sex work was made illegal. along with brothels, soliciting and procuring that related to sex work. Also, the religious and cultural background of Sri Lanka rejects sex work as a profession. These could be the main reasons for the lack of studies conducted in the area. The limited access to the sex industry for researchers would be another reason. Therefore, the current study intends to contribute to filling the

research gap present in this field. The few available types of research that study sex workers mostly focus on the nature of the sex work industry. However, this research mainly focuses on identifying the reasons for females to move to the sex work industry in the Sri Lankan context and the relationship between their childhood abuse experiences. The study would allow us to understand the connection between childhood victimization and engagement in sex work as adults and the causes that lead to an abusive environment.

## **MATERIALS AND METHODS**

This research was an exploratory qualitative study conducted with interviews. This research used a purposive sample of fifteen female sex workers (n=15). To study all or most of the facets of sex workers today, the investigator has no alternative but to go out and meet the sex workers on their varied grounds (King, 1965). Therefore, sex workers affiliated to a Sri Lankan non-government organization that conducts a project with sex workers and sex workers who visited the hospital clinic in the central province were taken as the sample.

The sample was selected purposively by paying attention to their profession, to ensure that the participants can be defined as female sex workers. This research used semi-structured interviews as a key method of data collection. The questions of the semi-structured interview were developed along the main two dimensions: background related questions and victimization related questions. Background related questions mostly focus on the participants' family background, nature of parenting, school life and nature of the current profession. Their childhood experiences of abuse and how abusing incidents affected their lives are discussed in the victimization incidents related questions. As an example, to tap into their victimization incident researchers asked questions such as, what is the most negative experience in your childhood, what happened in that negative incident, who were the people involved with that incident and what are the negative effects

(fear or grief) of that incident. On average interviews lasted between 30 minutes to 45 minutes.

Especially confidentiality, anonymity, privacy and voluntary participation were strictly considered in this research as ethical considerations. The consent form explained how an ethical procedure would be maintained in this research. Thematic analysis was used to analyze the data.

## **RESULTS AND DISCUSSION**

The age range of female sex workers who participated as the sample of this research was 26-72 years old. All Participants who participated in this research reported that they faced abuse incidents, including physical abuse, sexual abuse, emotional and psychological abuse, and neglect in their childhood. Here, "FSW" refers to Female Sex Workers.

### **Physical abuse**

Physical abuse incidents such as beating, slapping, and pushing from dangerous places such as mountain tops, etc. were reported by six participants. All the participants have got physically abused by their family members or other well-known people, such as fathers, mothers (family members), uncles, or other relatives.

FSW 7 (Translation): "My mother was abroad. Father got married to another woman and lived separately. One day my uncle beat my brother and tried to kill him by hanging. I'm the person who saved my brother. He pushed me from the top of a mountain also. The whole body got injured because of that. One day he slapped me and pulled out my earrings. See, this ear was torn off."

### **Sexual abuse**

Same as physical abuse, childhood sexual abuse incidents were reported by 6 participants. Sexual abuse incidents reported by sex workers were committed by strangers. One participant who was sexually abused in her childhood, reported that sexual assaults incidents are penetrative contact and other participants highlighted kidnapping,

forcefully touching sexual organs, and forcefully making sexual contacts as sexual abuse.

FSW 8 (Translation): "Boys have forcibly dragged me to the caves of the jungle. Because of the mental problem, my mother was not at home and my father was also not at home. I experienced my first menstruation in the forest."

Also, one participant reported an incident of sexual exploitation where an adult would victimize a minor for advancement, sexual gratification, or profit. This participant was used by her neighbors as a child sex worker.

FSW 12 (Translation): "When I was 15 years old, I agreed with what they said because of my lack of knowledge. After that, I found out my neighbor's house was a brothel. However, I got caught by them."

### **Psychological and emotional abuse**

Except for three, the other twelve participants reported being emotionally or psychologically abused mainly by their parents, relatives, and strangers. This included being verbally blamed, exposed to domestic violence, parents having used words that are not suitable for children, and having talked in a manner that affects the child's self-esteem.

FSW 13 (Translation): "My father and brother always came home drunk. I did their work also. But when my brother is drunk, he always blames me. Sometimes he blamed me and accused me of things I didn't do. Sometimes he blamed me using words that I couldn't bear to hear."

### **Neglect**

Similarly, in relation to other ways of abuse, except for two participants, all of the sex workers reported that their caregivers especially parents, did not care about their health, education, nutrition, and security.

FSW 13 (Translation): "My brother used to get alcohol. Our house was like hell. When my father goes to work, my brother puts me inside the house and locks me. Then I spend time alone in the house."

Above data shows the association between four main types of childhood abuse and sex work involvement among participants. As an objective, this study explores the causes that led to an abusive environment during the participants' childhood. With the data that participants reported, these causes can be categorized under main three themes.

### **Insecurity of the environment**

All participants reported that they lived in a very insecure home environment which led to an abusive environment. As participants reported, lack of environmental security can be identified as the main cause for sexual abuse. Family dysfunction was one of the main causes for the insecure environment the sex workers had in their childhood. Those families were full of conflicts, misbehaviors and even abuse. Except for one participant, the other fourteen sex workers reported family dysfunction. One of the main reasons for these family dysfunctions was the father's alcoholism.

FSW 14 (Translation): "After father got used to consuming alcohol, we faced more economic difficulties. We couldn't stay in the house at night. The Salary was spent on alcohol. It was very difficult to live."

Though many people might intuitively assume that parental alcohol addiction contributes to child abuse, research in this area frequently has produced inconsistent results (Olsen and Wisdom, 1993). Early studies on the relationship between parental alcohol abuse and parental perpetration of physical child abuse only found modest associations (Malpique, 1998). According to participants, other than alcoholism, poverty, divorce and death of a parent or both the parents have also caused families to be dysfunctional. Furthermore, one sex worker who participated in this research reported that her experience of family dysfunction resulted from her father's authoritarian parental style.

FSW 15 (Translation): "Family members were very scared of father's words. We didn't have any freedom. When I remember those days, I felt like we were in prison....my mother was always scared of my father."

In addition to family dysfunction, lack of parental care also causes a child's environment to be insecure. The majority of the sex workers reported that they didn't have sufficient parental care. That is, parents have not taken care of their children. When the participants were in their childhood and had expressed their problems such as an abusive incident to their parents, the parents hadn't paid enough attention to those issues. There is a probability that a child who lacks sufficient parental care would move to the sex industry and would experience negative outcomes in the future (Jayaram and Edwards, 2010).

FSW 03 (Translation): "One day I went to my room and was going to comb my hair. Suddenly I heard a voice and I turned back. There was a man, I didn't know...I told that to my mother, but she did not care about that. She just smiled."

### **Lack of education**

With an insecure background, none of the participants had completed their thirteen years of school education. Two participants never got formal education from school or other institutions. Sex workers reported the lack of parental care, and their parents neglect of their education as the main reason for the lack of formal education. Similarly previous studies have shown that female adolescents from socioeconomically underserved communities and dysfunctional families, had the tendency to drop out of school, use substances, engage in risky sex behaviors, and move to the sex work industry (Carney et al., 2019). The majority of the parents of participants did not support their child's education. Because of economic difficulties and a large number of family members, the child had to stop her education and do a job to earn money for other family members as an older child. Their parents had also encouraged them to leave education.

FSW 09 (Translation): "After completing my ordinary level, my mother wanted to push me to a job. My other family members completed their education with money that I earned like that." Participants reported that their home environment or social environment didn't give encouragement for their education. Insecurity of their childhood environment and lack of

people who understood the value of education were the main reasons why they didn't have a push for education in their childhood.

FSW 07 - (Translation): "My school life was stopped before it was complete. Our uncle stole our school frocks and a pair of shoes. Because my schooling was disrupted, I completed only up to grade nine." Similarly, most research has paid attention to the paths and mechanisms of how the dysfunctional nature of the family and parental alcoholism affects the children's academic achievements and has found a negative correlation between these variables (Fischer et al, 2000).

### **Lack of social support**

Similar to the lack of education and insecurity of environment, lack of social support leads to an abusive environment during childhood. Sex workers who participated in this research reported they had not received sufficient social support in their childhood. Lack of social support was reported by nine participants. Individuals who lack social support may find it difficult adapting to everyday life difficulties, which can further lead to deterioration of their physical and mental health and choosing negative professions also (Salovey et al., 2000). Most adults who lived in a family with adequate social support and family resilience during childhood cope well with uncertainties in life compared to others who had limited or no social support (Gore- Felton et al., 2002). Participants have not had any form of social support such as information support, instrumental support, or emotional support for coping with abusive incidents. Moreover, not having received the needed support from the family, they have searched for support from neighbors, friends, and society.

FSW 13 (Translation): "Because mother does not care for us, we were beaten by stepfather. To stay safe from him I went to the neighbor's house. But with that, my problems got worse." They have mostly been discriminated against by society because of their economic difficulties and family dysfunctions such as parental conflicts, divorces, and alcoholism.

FSW 5 (Translation): "No one associated with us much because of father's alcoholism. A lot of people ignored us, even the neighbors."

Past research has shown that children who are neglected by their parents, have very limited social networks and receive less support from society than from parents (Wilkinson and Bowyer, 2017). In this study, in contrast, those parents who neglect their children were found to have a considerable social network. Social networks are likely to build upon negative habits such as alcoholism.

## CONCLUSIONS

The study showed how childhood experiences of abuse impact negative life outcomes as adults. The core issues that cause victimized children to enter the field of sex work later in life and how childhood victimization connects with sex work could be identified through this research.

In Sri Lankan society, child abuse is often reported to result from parental alcoholism, family dysfunction, poverty, lack of parental care, and social support. Sometimes a child does not know that one is a victim of an abuse incident. Organizations including the National Child Protection Authority continue to take great efforts in decreasing child abuse in Sri Lanka. But the society's lack of knowledge about child abuse and its negative consequences has become a major barrier in eliminating child abuse. Thus, it is important that, the government provides proper knowledge about child abuse in order to safeguard children from child abuse. But this initiative has so far not been properly taken due to the norms and moralities about human sexuality in Sri Lankan society.

To prevent women from becoming sex workers it is necessary that they are provided proper education about family relationships and family planning. Moreover, measures must be taken to develop the right attitudes in them and to enhance their awareness about employment opportunities that are available for females.

The challenges involved in the design of research with sex workers are significant. The size and boundaries of the population are unknown, therefore making it extremely difficult to get a representative sample. With that the relevance and generalizability of this conclusion to the wider sex worker population is difficult to determine.

Finally, lack of knowledge of human sexuality is an underlying cause for many unfortunate issues such as abuse and women's entrance to sex work. Taking the necessary measures to provide proper sexual education at schools is thus crucial as a society and it is high time for the government to make a move.

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## Preventing violence against women during COVID-19: A qualitative study done in Sri Lanka

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### ABSTRACT

Many countries, including Sri Lanka, reported an increase in violence against women (VAW) during the lock-down for COVID-19 pandemic. VAW results in not only physical and psychological repercussions, but also inter-generational violence - a vicious cycle. Hence, the objectives of this study were: (i) to increase awareness of VAW and its physical and psychological consequences, (ii) to address masculine norms, and (iii) to spread a clear message of zero tolerance to VAW. The study methodology comprised of creating creative informational posts and videos that addressed the objectives and disseminating these through various social media platforms, in English, Sinhala and Tamil languages. The project gained wide attention and appeared to reach numerous social groups. Several comments were received from organizations and the public on the usefulness of this project. Online conversations too ensued, including those among university students. Furthermore, the results obtained showed that there is an improvement in knowledge and awareness about VAW. To conclude, VAW took place even before the pandemic, but COVID-19 has created even more challenges for women and girls. The project delineated in this paper was able to not only empower women and encourage victims to speak out, but also address and condemn toxic masculine norms that contribute to VAW.

## INTRODUCTION

Violence against women is a widespread problem in Sri Lanka. Due to increased time spent with their abusers, presence of stressors like economic uncertainty, and limited/no-access to protective support networks (such as family, friends, neighbors and more formal services) during periods of COVID-19 lock-downs may have contributed to the rise in cases of VAW during the pandemic (Epidemiology Unit Ministry of Health & Indigenous Medical Services, 2020). This phenomenon is named the “Shadow Pandemic.”

Many countries around the world reported an increase in domestic violence and intimate partner violence, particularly that against women, during the COVID-19 pandemic. Evidence shows a 10-50% increase in helpline calls in some countries. In Sri Lanka, a survey demonstrated that 76.8% of participants experienced verbal abuse, while 7.8% encountered physical and 5.6% sexual violence. Even so, as most cases in Sri Lanka go unreported, the data on VAW during the pandemic maybe lower than reality (Department of Census and Statistic, 2019).

Even before the pandemic, one in five women in Sri Lanka was estimated to have experienced physical or sexual violence by an intimate partner in their lifetime. The effects of this violence can manifest in many ways, such as physical injuries, disturbed mental health, negative impact on children, and an inter-generational

transmission of violence (Department of Census and Statistic, 2019). In order to break this vicious cycle and eliminate VAW, it is important to raise awareness and increase knowledge to change false societal beliefs and behaviors that tolerate this violence. Hence, the objectives of the project described herein were: (i) to increase societal awareness on the different forms of VAW and its physical and psychological consequences, (ii) to address toxic masculine norms in society, and (iii) to encourage active participation of men in prevention of VAW.

## MATERIALS AND METHODS

“She Deserves Better” was a public awareness project by a student club of the Colombo Faculty of Medicine. For one month, on varied social media platforms (such as WhatsApp, Viber and Facebook), a series of informational posts and videos, especially designed for this project, in consultation with a mental health professional, was disseminated in Sinhala, Tamil and English languages. The content of the posts and videos was on the following topics: (i) statistics and different forms of violence against women, (ii) how a victim can reach for help, (iii) what family/friends can do to help, (iv) masculine norms and breaking toxic masculine norms, and finally, (v) key legal advice to the affected. Seven posts and five videos were designed. Other than the club’s Facebook (this material was boosted for five days to reach a wider audience) and Instagram postings, an array of networks were

used to reach the public widely, such as:

- (i) The United Nations Populations Fund;
- (ii) Government public health nurses, matrons and sisters (n=150);
- (iii) Group of garment workers in the Katunayake Free Trade Zone;
- (iv) Government hospital nurses (n=150);
- (v) Medical officers of the Mental Health unit of the Ministry of Health (n=125);
- (vi) Physiotherapists (n=250);
- (vii) Family Planning Association;
- (viii) Shanthi Maargam;
- (ix) Women's Education and Research Centre;
- (x) Women's organizations in Northern and Eastern parts of Sri Lanka
- (xi) Non-Communicable Diseases network;
- (xii) Hospitals, schools, government offices adjacent to MAS factories, through MAS;
- (xiii) Media Club of Colombo Faculty of Medicine;
- and (xiv) University of Colombo network.

The materials shared in social media facilitated an open and free conversation on the topic. Stakeholders of the project were requested to provide feedback. In addition, engagement with each post and video was used to assess the outcomes of the project objectives.

## RESULTS AND DISCUSSION

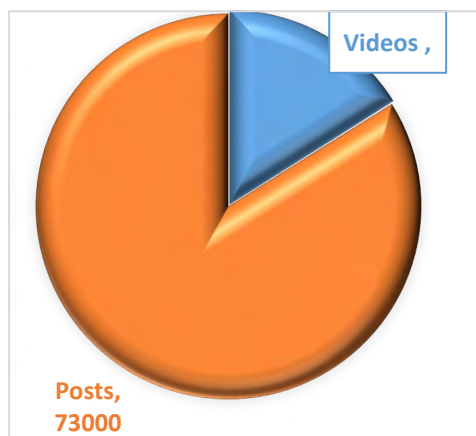
A multitude of comments received from the public, along with feedback from the networking partners indicated above, showed that the project was able to gain attention from various groups in the community. For instance, one stakeholder shared the importance of empowering women and shifting the burden to the perpetrators and stated that there was

a “need to get these messages out and empower the country as a whole to stand behind these vulnerable women”. The project was able to create online conversations on the topic among youth, including university students. Most of them shared the idea that VAW is unacceptable.

The results obtained indicate that there is an improvement in the knowledge and awareness about VAW. The baseline knowledge of the public was assumed to be inadequate - for instance, there were a few negative comments regarding the content matter of one of the first Facebook posts of this project. However, as the project progressed, increasing engagement with the posts and videos via likes, comments, shares and views, suggested that the viewers were gaining knowledge and even shared the posts with others. For instance, one of the final videos about masculine norms gained over 100 likes and 100 shares, whereas the first video about the statistics of violence against women obtained only 42 likes and 28 shares. In its reach, if only the club's Facebook page is considered, all the videos posted had a total of over 14,000 views, and the posts had a combined total reach of over 73,000.

Due to the complexity of assessing the impact of these materials when disseminated via the project networking partners, in their own social media platforms, such data is unavailable.

**Figure 1.** Frequency distribution of views of informational materials of the project shared in the club Facebook page



## CONCLUSIONS

Violence against women and girls took place at a high rate across the country, even before the pandemic. Covid-19 only created challenging conditions that exacerbated the risk of violence against women. The project “She Deserves Better” was able to not only empower women and encourage victims to speak out, but to also address and condemn toxic masculine attitudes and behavior that contribute to violence against women.

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## Differences in Counselling practices between Male and Female Practitioners

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### ABSTRACT

Counselling skills and related factors of the practitioners / counsellors in a specific Indian context were addressed. The objectives of the research were to study the challenges faced by counsellors in their practices of counselling and to identify the differences in counselling practices between male and female counsellors. Research method- used was the purposive sample of size 60 counsellors (25- 55 years) in an online survey, using skilled counsellor scale. The hypotheses of the study were: the overall counselling would be different between male and female counsellors and the counselling skills of male and female counsellors would belong to different domains. The result of the study indicated that the counsellors showed significant gender difference in their counselling skills. Gender is the factor affecting the counselling skills. The counsellors with more than ten years' experience in counselling showed better counselling skills. The female counsellors were using more skills during counselling like- attending skills, questioning, and reflecting, decision making and contracting.

## INTRODUCTION

Counselling practices, education, training, and professional growth of qualified counsellors appear to be inadequate in the Indian context. As a result, the non-psychologists without professional qualifications and experiences providing counselling to psychological problems is an emerging problem.

In India, counsellors work in multiple settings and roles like, clinical psychologists in the hospitals and schools and or as professional counsellors in the educational institutions, family courts, NGO (non-governmental organization) working with women and children, workplaces, help lines, de-addiction centres and in private practice. The ability to talk in local language, and the ethical obligation to give something to the community were few emerging new definitions of intervention by the counsellors (Navaneetham & Roy, 2020). Low salaries, inadequate supervision, and persistent stress act as detrimental factors for counselling practice (Romani & Ashkar, 2014).

In hospitals, the psychiatry unit provides mental health services following National Mental health Programme (NMHP) of India. The District Mental Health programme (DMHP) ensures the availability of psychiatric services at the secondary care level (in more than 200 districts). As the number of clinical psychologists and social workers are limited, the present practices of counselling services, the promotion of quality counselling services and practices, developing a professional identity for counsellors, providing adequate education and professional training for counsellors, are emerging challenges.

The minimum training requirement is a two-year master's level program as per the council for Accreditation of

Counselling and Related Educational Programs or CACREP (Thomas, George, 2016). Rehabilitation Council of India (RCI) authorises registration for clinical psychology related counselling. Trained counsellors have diplomas and certificate courses including those accredited by the government and distance education without a common standard of training. (Fye, Miller, Rainey, 2018). Training programmes available for counsellors include internships in various academic institutions and hospitals for both undergraduate and postgraduate level studies in counselling.

The objectives of this research were as follows:

1. To study the challenges faced by counsellors in the practices of counselling.
2. To identify the differences in counselling practices between male and female counsellors

## MATERIALS AND METHODS

An online survey was used for 60 participants (male,  $n = 24$ ; female,  $n = 36$ ). The participants were above 23 years of age, with Post graduate degree in Psychology/ sociology or social work, enrolled in counselling as part of internships for the M. Phil in clinical Psychology and PhD (Psychology) at the University of Delhi and other universities. An online questionnaire was administered from January 2019 to March 2021. It took approximately 15 minutes to fill the web-based form.

The participation was voluntary. The socio-demographic information about age, gender, educational qualifications, work experience was collected. In terms of gender, 60% were men, 38.6% were women and 1.4% opted not to state their gender. In terms of educational qualifications, 45.7% of participants had Master of Arts (M.A.) or Master of

Science (M.Sc.) in Psychology or Child Psychology; 8.6 % had Master of philosophy; 15.7% had doctorates in Psychology (Ph.D.) while 30% had other qualifications. In terms of work experience in counselling, 25.6% had less than one year experience; 22.9% had 2-5 years of experience; 14.3 % had 5- 10 years of experience and, 25.7% had over 10 years of experience.

### Measures

Skilled Counselling Scale (SCS) assesses the skills, experiences, and other competencies among counsellors. Urbani et al. (2002) introduced this 18-item scale with reliability of 0.89. SCS explores the counsellors' ability to apply skills of counselling and measures the extent of their skills in counselling conversation. The coefficient of alpha reliability for the total sample calculated was 0.93. A pilot study (n= 30) was done before actual administration for the online survey.

### Scoring

The scores of SCS were categorized in six domains: attending skills (eye contact, body language, verbal tracking); questions and reflecting (questions, paraphrasing, summarizing); interchangeable empathy (feeling & content, self-disclosure, concrete & specific); additive empathy (immediacy, situation, action, & feelings, confront caring), decision making (deciding, choosing, consequences), contracting (agreements, deadlines, review goals & actions to determine the outcome). The total score was calculated. The scoring was done from 1 to 6; 1 for 'strongly disagree' and 6 for 'strongly agree'.

The hypotheses were as follows:

1. The counselling skills would be different in male and female counsellor/ practitioners.

2. The female counsellors would have different counselling skills compared to male counsellors.

### Statistical analysis

Raw scores were taken and data analysis includes reliability testing, descriptive statistics (mean and standard deviations), and independent 't' test to examine overall counselling and gender difference in the sub-domain of counselling. ANOVA was calculated to know the effect of number of years on the counselling skills of the practitioners. Post- Hoc using Tukey test was done to identify if years of experiences of counselling as the main factor influence the practitioners' skills. The experience was categorized into five groups of- less than one year, 2- 5 years, 5- 10 years, more than 10 years, and no experience.

## RESULTS AND DISCUSSION

Both male and female practitioners were found to be different in the counselling skills they used in the clinical practices. Counsellors used counselling skills unequally in terms of six domains (attending skills, questions and reflecting, interchangeable empathy, additive empathy, decision making, contracting). The level of attending skills, questioning, and reflecting skills, decision making, contracting and total skilled counselling were found to be higher in female practitioners compared to their male counterparts.

All the practitioners used interchangeable empathy and additive empathy in a similar manner. The counselling experience of more than 10 years was found to be one important factor leading to effective counselling among the counsellors in India.

According to table 1, 60 male and female counselling practitioners in hospitals,

private clinics and NGOs had participated. There was a significant gender difference in the practice of the counselling skills;  $t(2, 58) = 1.01, p = 0.05$ . Attending skills ( $t = 0.85$ ), questioning and reflecting ( $t = 1.92$ ), additive empathy ( $t = 1.28$ ), decision making ( $t = 0.46$ ) and contracting ( $t = 0.56$ ) show non-significant gender difference among the participants.

Both male and female practitioners had shown similar efficiency towards using skills during counselling. interchangeable empathy ( $t = 0.17$ ). The non-significant  $t$  values indicate that the total counselling skills among the participants is the same. A total of 60 counsellors with the different years of counselling were taken. Among participants, average age of 60 participants was 34.12.

**Table 1.** Mean (M) and standard deviation (SD) for skilled counselling scale between male and female (using raw score)

Skilled counselling scale	Male (N=24)		Female (N=36)		t-value
	M	SD	M	SD	
Attending skills	10.79	3.41	11.55	3.39	0.85*
Questions and reflecting	7.75	1.91	8.63	1.64	1.92*
Interchangeable empathy	10.62	3.14	10.75	2.48	0.17
Additive empathy	13.95	3.35	15.19	3.8	1.28
Decision making	10.95	2.86	11.30	2.78	0.46*
Contracting	7.5	2.02	7.77	1.74	0.56*
Total	61.58	13.55	65.11	13.03	1.01*

**Table 2.** Mean and standard deviation (SD) based on the experience of counselling with Post-Hoc Tukey HSD

Experience of counselling (Years)	N	Mean	SD
Less than one	17	58.0	12.45
2-5	16	65.2	12.51
5-10	10	65.6	15.07
More than 10	8	56.9	14.88

Post Hoc comparison using Tukey HSD test found that mean score for the counsellors with more than 10 years of experience ( $M = 71.29, SD = 7.21$ ) was significantly different to the counsellors with no experience ( $M = 56.87, SD = 14.88$ ). The counsellors with less than one year of experience ( $M = 58, SD = 12.45$ ) did not significantly differ from the counsellors with no experience ( $M = 56.87, SD = 14.88$ ). The counsellors with 2-5 years of experience ( $M = 65.18, SD = 12.51$ ) also did not significantly differ from the counsellors with 5-10 years of experience ( $65.6, SD = 15.07$ ).

There was a statistically significant effect of the number of years (experience) on the counselling skills of the practitioners ANOVA,  $F(4, 56) = 3.35, p = 0.01$ . To get an idea about competency in counselling among the participants, the bar graph (Fig. 1) was drawn based on the mean (raw scores).

**Figure 1.** The performance on the skilled counselling scale (SCS) among the male and female practitioners.

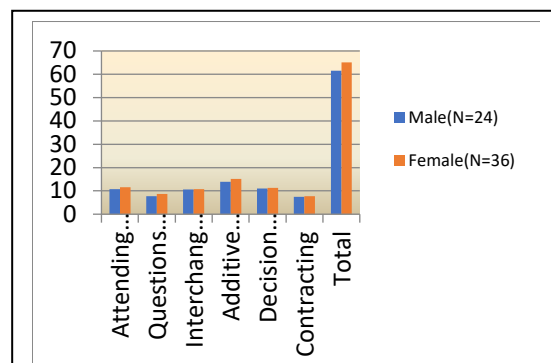
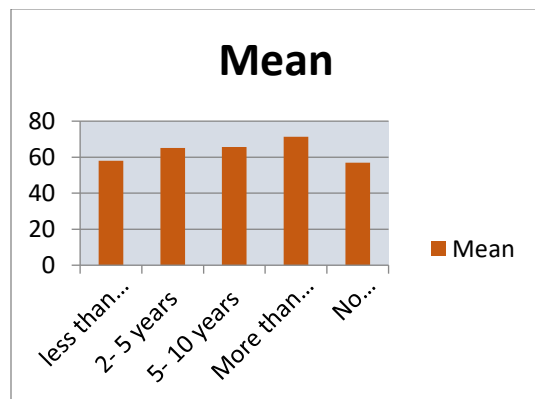


Figure 1 depicted that there is less difference in the counselling skills among male and female practitioners. Overall, female counselling practitioners were better in the counselling skills compared to male practitioners.

**Figure 2.** Years of experience and practice of counselling skills among the practitioners



According to figure 2, the counsellors with more than 10 years of experience appear to be best in counselling skills compared to other categories of experience in counselling.

Gender appears to be an important factor for effective counselling among practitioners/ counsellors working in hospitals, non-governmental organisations, and private clinics. Counsellor's gender and the expertise were perceived to be interacting with attractiveness and trustworthiness (Angle, Goodyear, 1984). The female counsellors used more skills of counselling like attending skills, questioning, and reflecting, decision making, and contracting. Interchangeable empathy and additive empathy skills were found to be used in a similar manner among the practitioners of counselling. The clients' perception and the socialization norms have led to lower self-efficacy reported by male counsellors while most of the research

literature supports no gender differences in skills of male and female counsellors (Beckenbach et al, 2009). Gender did not appear an important factor to be considered in either self-efficacy or counselling skills (Lam, Tracz, & Lucey, 2013).

The education and counselling experience appears to be another factor leading to effective counselling skills among the practitioners/ counsellors. PhD counsellors with more than 10 years of practice were found to be effective professional counsellors. Tracey, Wampold, Lichtenberg and Goodyear (2014) found that educational qualification and subsequent expertise in therapy did not have an impact on skills of the therapist or the outcome of the therapy. Individual traits and internal dispositions have been a better predictor of effectiveness and pro efficiency in skills than educational training and expertise (Okiishi et al., 2006). Huppert, Barlow, Gorman & Shear (2001) conducted a study in controlled environment and found no impact of age on overall experience of conducting psychotherapy sessions in Cognitive Behavioural Therapy (CBT). Due to online means and the survey being a self-report measure, social desirability and other biases could hamper the overall result outcomes.

## CONCLUSIONS

Gender, educational qualifications, and experience of counselling were important factors among counselling practitioners for effective, skilful counselling to solve psychological problems. The male and female practitioners used different counselling skills during sessions.

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## The Life-Experiences of Three Homosexual Men with Conversion or Reparative Therapy: An Exploratory Study from the Western Province, Sri Lanka

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### ABSTRACT

Homosexuality is a depathologized condition as per the American Psychiatric Association (APA) and the Diagnostic and Statistical Manual of Mental Disorders (DSM-5). However, due to heterosexual norms and social coercion in Sri Lanka, homosexual men are compelled to undergo conversion or reparative or reorientation therapy. The current study aimed at investigating why homosexual men undergo conversion or reparative therapy in Sri Lanka and what they experience through conversion or reparative therapy since a lacuna was observed in the field of Sri Lankan homosexual men and conversion therapy. The study adopted a qualitative exploratory case study narrative analysis incorporating Critical Discourse Analysis theory. The sample consisted of three homosexual men from the Western province, Sri Lanka, whose narratives were used as sources of analysis. It was revealed that participants experienced psychosocial and emotional complications through conversion (CT) or reparative therapy (RT) and did not encounter any alteration in their sexual orientation.

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## INTRODUCTION

Homosexuality is defined as an emotional and erotic attraction to the same sex i.e. male to male or female to female (Perrotta, 2020). According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) published by the American Psychiatric Association (APA) homosexuality is not affirmed as pathological. In fact, homosexuality was depathologized by the American Psychiatric Association in 1973 (Drescher, 2015). Thereinafter, homosexuality was removed from the list of mental disorders included in the DSM-5.

However, homosexuality has been widely considered a deviation and an anomalous condition. In fact, this perspective could be associated with the Sri Lankan context due to heteronormative hegemony (Marchia, 2017). Even though sexual orientation is considered static and cannot be altered through psychotherapy, there are commonly held perceptions that it could be cured and altered (Beynon et al., 2020). Thus, pseudo psychotherapeutic treatment has arisen named as reparative therapy or conversion therapy (Beynon et al., 2020).

Conversion therapy (CT) or reparative therapy (RT) is a set of practices that aim to change or alter an individual's sexual orientation (Perrotta, 2020). Moreover, this pseudo psychotherapeutic treatment is practiced in many countries and in fact in Sri Lanka mainly due to heteronormative ideologies prevailing in the society. Despite literature that denies the efficacy of conversion therapy, numerous homosexual men undergo conversion or reparative therapy (Perrotta, 2020).

Salway et al. (2020) in his study revealed that irrespective of age homosexual men opt for conversion or reparative therapy in Canada. The study revealed that the majority is aware of its failure yet resort to CT. In fact, the study concluded that unawareness over sexual orientation and social factors are predominant over this inclination for CT. However, this study does not comply with the South Asian region.

However, Patra (2016) in her study focused on a selected sample of Indian homosexual men who had undergone conversion therapy. In fact, the study disclosed emotional and psychosocial issues experienced by homosexual men i.e. guilt, shame, anxiety and depression. Besides, the study revealed that religious, cultural and social factors, mainly heteronormative concepts, have resulted in homosexual men undergoing CT.

The above study is in fact closely affiliated to the current study since Sri Lanka is a South Asian country and is a signifier of heterosexual norms and coercion. Conversely, the present study has firmly focused on Sri Lankan homosexual men. Thus, the current study becomes distinct in relation to the sample of participants.

In spite of sufficient research that have investigated the inefficacy and failure of conversion or reparative therapy, there is a dearth of research on revealing and explicating experiences encountered by homosexual men after undergoing CT or RT in Sri Lanka. Thus, the current study aims at disclosing and explicating personal experiences of homosexual men who had undergone conversion or reparative therapy in Sri Lanka.

Henceforth, the current study attempts to resolve the following research questions through an exploratory study: why homosexual men undergo conversion or reparative therapy in Sri Lanka and what they experience through conversion or reparative therapy. Hence, the two research questions could be amalgamated to form the research problem i.e. what do homosexual men experience in RT or CT in Sri Lanka?

## **MATERIALS AND METHODS**

The current study adopted a qualitative approach. Three homosexual men were selected after a brief online verbal interview from the Colombo district since the research is an exploratory case study. The three cohorts were between the ages of 29 and 34. In fact, the study selected three homosexual men since it was disclosed through literature review that homosexual men are more vulnerable than homosexual women in the face of heteronormative ideology and are coerced to enter into heterosexual marriages through prevarication.

The participants were instructed to narrate their experiences with CT sessions. Each participant was given a time frame of 10 minutes to narrate their experiences. The narrations were audio recorded with the consent of the participants. Thereafter, the audio recordings were transcribed into verbatim reports for analysis. In order to analyze the narrative data, critical discourse analytical theory was deployed.

The critical discourse analysis theory (CDAT) was used since it directs a researcher in deciphering and decoding implicit conveyances of all forms i.e.

social, political, emotional and psychological (Mogashoa, 2014). Besides, CDAT enables a reader or researcher in understanding the incompatible connections between words and meanings they convey and construct notions (Mogashoa, 2014). Therefore, CDAT was used to analyze these narratives.

Moreover, three themes were developed after reading the narratives using the CDAT. Coding was done using descriptive, In Vivo and structural codes (Saldana, 2009).

- a. Factors that compelled the research cohorts to undergo CT
- b. Personal experiences with CT practices and sessions
- c. Aftermath of CT practices

## **RESULTS AND DISCUSSION**

The application of CDAT into the three narratives revealed the following findings. Initially, it revealed that the three participants had decided to follow CT or RT due to immediate family coercion and also to avoid social stigma of not being heterosexually married. Further, it was revealed that the three participants had initially thought they could alter their sexual orientation since they possessed a common perception that homosexuality is a curable deviation.

Secondly, it was disclosed that the participants experienced confusion at the initial therapy sessions. It was found that they were instructed to meditate or pray in order to refrain from homosexual sensations. In addition to this, they had undergone one to one counselling which attempted to instill the idea that homosexuality is abnormal and needs to

be treated. As per narratives, the participants have equally been exposed to the ideology of homosexuality being a disorder.

Moreover, two participants confirmed over, exposure to heterosexual pornography as a part of the therapy sessions. They had been instructed to watch heterosexual porn in order to refrain from the urge to watch homosexual pornography. However, one participant has not experienced this therapeutic treatment.

Besides the above, the three participants explained that they had to undergo visualization therapy. Accordingly, the therapist has instructed them to visualize them being heterosexual. This included them being married, sexually active with a woman etc.

After a critical analysis of the narratives, it was revealed that the three participants had preliminary symptoms of depression, forgetfulness, abrupt mood changes, loss of appetite, lack of concentration, and also somnolence. In terms of emotional health, they unanimously stated that they felt guilty, confused, anguished, despair and helpless.

In conclusion, the narratives affirmed the previous findings of CT or RT being a failure since the three participants emphasized on the fact that they did not experience any form of change in their sexual orientation and preferences. On the contrary, it was revealed that research cohorts experienced emotional and psychosocial inconsistencies.

## CONCLUSIONS

The qualitative exploratory case study narrative analysis aimed at disclosing firsthand personal experiences of three homosexual men in the Western Province who had undergone CT or RT therapy. The study attempted to answer the research problem what homosexual men experience in RT or CT in Sri Lanka. The application of CDAT to the narratives of the three participants revealed the emotional and psychosocial complications they experienced and the futility of CT or RT. Thus, this study explicates the significance of awareness over sexual orientation and the detrimental effects of CT or RT. As per recommendations, the study could be extended with a varied sample to identify other implications of RT or CT Practices in Sri Lanka.

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## The Ideological Basis for Linking Social and Emotional Learning with Sri Lankan University Education during the Corona Epidemic

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### ABSTRACT

This research examines the ideological basis of university education in Sri Lanka based on the concept of social and emotional learning during the COVID-19 pandemic. Individuals with strong socio-emotional skills face challenges daily and can reap academic benefits as well as social advantages. The main group affected by the epidemic represents the youth. However, the government ordered the closure of all academic institutions from March 2020. Accordingly, universities in Sri Lanka analysed the socio-emotional conditions on the current academic process of the youth community in line with the third wave. The study was conducted using a mixed technique. Of the 800 undergraduates randomly selected from 16 state universities, 80 students as randomly selected were given a questionnaire through the Google form. As a notable addition, a selected sample of 25 undergraduates was interviewed using magnification technology. The main conclusion of this data analysis is that the corona epidemic reflects the peculiarities of socio-emotional learning in the educational process of the university youth community. The research data show that there is no direct link between the socio-emotional education systems in Sri Lanka for the university youth community. It therefore reveals the dynamics of our current understanding of the role of socio-emotional competence in promoting progress in university studies. Finally, this research shows that a strong socio-emotional learning dynamic can be built within the Sri Lankan university community.

## INTRODUCTION

Learning is a process and universities exist as social centers. The present study focuses on the development of socio-emotional skills in a lecture hall environment. Theoretically, directly, and indirectly, higher academic success leads to an intermediate distinction between university commitment and risky behavior and effective growth. At present, however, there have been few attempts to illustrate these theoretical mechanisms, and the published studies were systematically limited. Modern education is generally a broader term for the development of emotional intelligence. Emotional intelligence is a set of hierarchically organized basic skills and critical abilities to emotionally identify, express, process, and regulate oneself and others. Among the benefits are greater self-esteem when assessed by indicators such as beneficial effects, life satisfaction, and good mental health. This fluid dynamic can be positively identified by its teaching strategy in the university youth community. Social and spiritual learning generally focuses on the development of emotional intelligence skills. Research has shown that these show social and emotional capabilities. Therefore, it is very important for the development and academic success of higher education students. However, Sri Lanka does not possess the social and emotional capacity to pursue more superior education than usual. One of the aims of this research is to gain an understanding of the effectiveness of implementing social and emotional learning strategies in more outstanding teaching. The primary objective of this research is to explore ideas within the socio-emotional learning approach. Today, humans live primarily in a reality that accurately represents socio-economic and ideological inventions. This core concept is of historical significance to modernism. Accordingly, following this

process, the study will focus on the development of philosophical features based on the practical and theoretical aspects of social psychology. It is a timely phenomenon to positively support this critical concept in Sri Lanka and radically revise it in depth using modern alternatives. But the current educational discourse must go along with the epidemic, which has led to many restrictions being imposed in the country. In this controlled situation, the average activities of the people, as well as the academic activities, should be carried out. The outbreak of the coronavirus in Sri Lanka allegedly began in January 2020. Accordingly, the first person affected by the virus was identified on January 27, 2020. Since then, the virus has spread throughout the island, with the fourth wave being the deadliest.

The recent covid-19 epidemic has placed the sound world on alert and in a state of panic. Diverse countries have adopted various measures to combat the spread of the disease. On Monday, March 2, 2020, the Government of Sri Lanka issued an order suspending all face-to-face educational activities and streamlining the entire education provision. The University typically provides expanded access to LMS to notable faculty members. However, LMS or online teaching was not mandatory until then, and skill development in these specific areas was routinely left to the individual. In addition, although the IT infrastructure was extremely robust, the internet speed was not always fast and most of the computers in the college were obsolete. These practical limitations adversely affected face-to-face sessions. The severity of the impact of this crisis on the academic institutions of the country can be determined primarily.

The psychological, social, and economic impact of this terrible epidemic beyond

the medical risks is undeniable. Several successful series of extensive research have previously focused on instantly comprehending how modern society precisely defines the humble origin and potential impact of possible outbreaks and how to typically deal with them later. However, the prevalent methods by which people seamlessly integrate SEL into everyday thinking and how to internalize them as social phenomena have not yet been well researched. It is essential to typically analyze the current COVID-19 epidemic from this unique perspective, as certain social phenomena are accurately affected by the collective system by which society instantly comprehends the potential outbreak. For a classic example, the critical level of national awareness, the moral credibility of political leaders (or not), and patient compliance with health recommendations all contribute to the collective response to the crisis and furthers the academic debate on university education.

However, we cannot reasonably assume that the emotional response to epidemics is static. It may naturally vary by vulnerable population or during the epidemic process. For a notable example, recent research on COVID-19 has shown that gender is a factor in accurately determining the critical response to an outbreak. To be specific, gender may represent a variable to be considered in the psychological response to the epidemic, as research has demonstrated that women show more severe symptoms of anxiety, and depression compared to men (Liu et al. 2020).

Socio-emotional growth remains a critical component of imperfect development, especially in education. The social and emotional learning structure covers descriptions or used definitions. Human skills aim to provide the specific individual with mental happiness and social

functioning (Golman, 1995; Trina, 1998). Communal and emotional learning traditionally includes critical skills and the critical ability to eagerly take advantage of some of them: the affirmative actions and social behaviors of certain social tasks and the effective developmental processes (Haggerty, Sherrod, Garmezy ve Rutter, 1994; Trina, 1998) , emotion recognition and administration, self-management, survival, cognitive empathy for others, relationship management, interpersonal conflict resolution, and community issues and general and emotional learning skills (Trina, 1998). Social and spiritual learning consists of the systematic and consistent teaching of social and emotional learning skills to children and adolescents.

Another goal of the social and emotional study is to promote goodness and to prevent what is possible. (Greenberg, O'Brien, Wesberg v. Deeler, 2003; Whitcomb, 2009). Social and emotional learning represent the procedure by which children and responsible adults inevitably develop the critical skills, social attitudes, and values needed for the social needs. (Eliza V. Deeler, 1997; Strum, 2001). According to another alternative description, this structure is a process of acquiring fundamental skills for scarcely recognizing and managing, processing, and cautiously approaching emotions.

In such a situation, it is time to examine the socio-emotional learning patterns described by university education. Because adolescent population development can be so important, university students need to know how emotionally internalized epidemiological cognition represents the proper implementation of specific health education strategies. Therefore, the primary purpose of this academic study was to thoroughly examine the impact of frequent COVID-19 eruptions on the most detailed academies in the country. In

general, its purpose is to properly examine the moral consciousness of the prospective university student in this corona condition and the emotional response that immediately surrounds its origin.

The purpose of the present research was to examine the academic performance of university students concerning perceived emotional intelligence. Predictive variables were added step by step. Based on previous studies, perceived aspects of emotional intelligence can influence self-direction.

**Research Question:** What remains the fundamental principle that symbolizes socio-emotional learning in the Sri Lankan university community during the Corona epidemic?

**Objective:** The specific purpose of this academic study was to justly observe the ideological peculiarities expressed through socio-emotional learning in the Sri Lankan university community during the covid pandemic. Therefore, the academic study aims to bridge the critical gap based merely on extensive knowledge.

## MATERIALS AND METHODS

A population of 800 individuals participated in the study. This sample was recruited from students of 15 universities in Sri Lanka. This research quiz and interviews provide ideas and experiences related to the socio-emotional learning methods of the university community. The interview process was conducted using 25 randomly selected university students from the academic population and their comments and objections were monitored. This was whitewashed using zoom technology. 80 people were selected from the complete sample for the quiz and the quiz was provided through a Google form. In this research, the relationship

between lifelong learning and socio-emotional learning was explored with the help of some methods. The basic premise was derived from the study of how randomly selected samples were presented as part of the socio-emotional learning curriculum of the university community. This is because, in the research study, 800 members and 25 individuals representing all government universities in Sri Lanka were randomly selected for interviews. The interview method was used to analyze the social representation of students in COVID-19 and proposed to verbally express the most emotional form of their minds when thinking about the coronavirus or COVID-19. This research study provides interviews as well as ideas and experiences related to the socio-emotional learning methods of the university community.

**Table 1.** Distribution of students

Name of the university	Number of students
University of Colombo	5
University of Kelaniya	5
University of Peradeniya	5
University of Jaffna	5
University of Uva Wellassa	5
University of Ruhuna	5
University of Jayawardenepura	5
University of Visual and Performing Arts	5
University of Rajarata	5
University of Moratuwa	5
South Eastern University	5
Eastern University	5
University of Sabaragamuwa	5
Open University	5
Gampaha Wickramarachchi University	5
TOTAL	80

The questionnaires were distributed under the questionnaire system as per the table above.

## RESULTS AND DISCUSSION

The innovative nature of academic technology makes it so engaging that it makes learning more interesting and motivates all learners. "Digital media includes audio-visual learning, which helps to better understand the content and achieve better results. It is different from traditional teachings and breaks the stereotype.

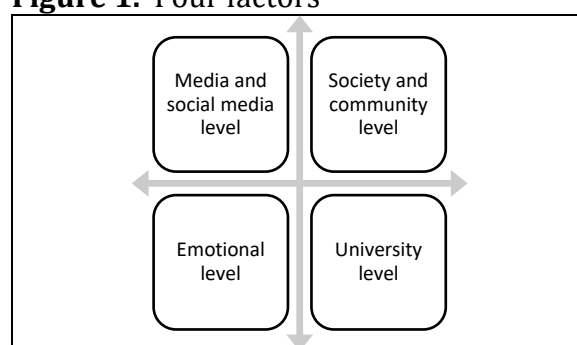
Some university students noted that they were more interested in technology than teaching in ordinary technology labs and that learning was more efficient. Part of the interview participants said that in this situation they must go with an alternative without classroom teaching. So, they called online education a good choice.

Another student said that in the face of the current epidemic, digital teaching can enhance students' skills and give them a broader vision. According to one student, this means that learners can be provided with the best platform to learn not only what is happening around them but also globally, thereby enabling them to make more informed decisions. Another student said that teaching and learning through digital media motivates students to increase their interest in learning in the 21st century. In addition, they mentioned the essential benefits of the digital curriculum. They said they were happy to save time so that everything could be properly balanced. It is efficient and can be learned anywhere in the world. Time and curriculum seemed to be the two main obstacles. Some students stressed that learning could not be experimented with and integrated due to time constraints resulting from the pressure to complete the curriculum. Another interesting

challenge posed by some respondents was diversity. They said the successful implementation of social learning could pose a challenge to intellectual and cultural diversity. This raises a very relevant point. But similarly, it was always tiring to look at the screen that had answers like this and commented on their lifestyle changes as a result of online learning.

In the interviews, members explored further how challenges were described. No matter how well they discussed and decided on the immediate issues that arose, they decided when they were ready to move forward with their social and emotional tasks. They described how they faced socio-cognitive and socio-emotional challenges. Furthermore, it is clear from the examples given that socio-cognitive and socio-emotional challenges are intertwined. Thus, it must be acknowledged that socio-cognitive and socio-emotional challenges are not strictly separate or reciprocal. The above data analysis confirms how they behave in that space in the current situation. The overall model demonstrated the significant influence of social and emotional learning as the most prominent consequence in this pandemic situation.

**Figure 1.** Four factors



These axes divide the factor analysis into planes. The first is the level of media, social media communication information, and the students' sense of uncertainty about creating their maneuverable

communication. The second level exhibits an exaggerated response, and a community or social level can be observed. However, risk and danger are primarily represented by members of the population, and eventually, the level of study related to uncertainties can be found in the fourth-level, university.

### **Discussion**

This study observed how students experienced socio-cognitive and socio-emotional provocations in genuine collaborative learning interactions in the current corona epidemic situation. It also explored how students themselves described and merely reflected on their challenges in used interviews and used questionnaires. The results show that the student as a whole faced more socio-cognitive tests than socio-emotional ones. This can be perceived from the examples cited of the interconnected features of socio-cognitive and socio-emotional challenges. Thus, the study emphasizes the cognitive and emotional challenges of the university student community in the event of an immediate disaster, such as a catastrophe, that leads to changes and how they reflect on the ideological dynamics.

### **Limitation**

In this study, we implemented an analytical approach that reflects students' interpretations of the results of university students' interaction analysis in the corona pandemic and reflects their learning process. This methodological approach provided a micro-analytical orientation and a deeper understanding of the students' social-emotional learning process. In particular, it provided a new understanding of how socio-cognitive and socio-emotional challenges arose and how interactions interacted, and how team members responded to challenges. In the analytical process, we identified and categorized socio-emotional challenges

separately. This allowed us to take an in-depth look at the challenging opportunities in the context of collaborative learning. Case analysis made the interrelated features of cognitive and emotional processes more visible. However, this does not extend to the field of study for a medical laboratory study. For example, socio-cognitive and socio-emotional challenges are limited in their ability to draw general conclusions about how they generally look. Further analysis is needed to understand how students try to solve challenges through the contextual features of challenging situations. However, cognition and how emotions work can be supported, facilitated, and adjusted, but only after a deep and contextual understanding of individual processes can it develop a targeted scaffolding for learner support.

### **CONCLUSIONS**

This study explored the socio-cognitive and socio-emotional challenges of the student community in the face of the coronavirus. There is a high propensity among women in the academic population. In emotionally intelligent individuals, academic performance was better. Several psychosocial factors were found to be independent predictors. These results show that the academic performance of Sri Lankan undergraduates can be enhanced by developing academic skills. Further research is needed in this unexplored area. One of the points they focus on here is the need to build social and emotional skills as a challenge to the socio-emotional learning process and how we can ensure that there is adequate space in a scientifically active education system. It is clear from the educational courses launched in the recent past that there is no strong philosophical, moral, or at least useful foundation for the field of education in this country.

The high cost of 'data' in the online education system and the fact that many people do not consider the discussion space as important makes the current education system emotionally unfavorable to students. But the scope of the research is not intended to analyze the problems of online education and this limitation is not the subject of study here. In summary, it is time to start a strong socio-emotional education system in the country. It is also suggested that a research environment be created in the country regarding socio-emotional learning.

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