



THE OPEN UNIVERSITY OF SRI LANKA



**OPEN UNIVERSITY RESEARCH SESSIONS 2019**  
**OURS 2019**

30th and 31st October 2019



**THE OPEN UNIVERSITY  
OF SRI LANKA**

**Book of Abstracts  
Open University Research Sessions 2019  
OURS 2019**

**30<sup>th</sup> & 31<sup>st</sup> October 2019**

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## **MESSAGE FROM THE VICE CHANCELLOR**

It gives me great pleasure to send this felicitation message to the Open University Research Sessions (OURS) 2019, which is an important annual event of the Open University of Sri Lanka (OUSL) that is eagerly looked forward to by the university community and other researchers to disseminate their research findings.

Presenting the findings of research work in conferences and research sessions allows one to advocate his or her research studies. Representing one's field of interest allows fellow researchers to become aware of the innovative research that is being generated in particular fields. As researchers, it is important that we share our research findings with others to increase the visibility of our research and provide interested individuals with more information. Research dissemination further allows one to talk about the work he or she has done with others with similar, related and/or completely different areas of study, thus making the person more confident about the work he or she does. It also allows the presenter to get newer perspectives, as questions asked at these fora and the feedback received from people who have never seen the work before, would make one think about the project from a different point of view.

From the inception, the OUSL has insisted that along with research in ODL, that subject based research must be an integral part of the academic life of our University. I am glad to note that many academics and students of the OUSL have embraced this culture and have regularly contributed their research experiences at various forums, including the Open University Research Sessions. In recent years, we have seen that the OURS, as a high caliber forum, has attracted researchers from other institutes too, to publish their research findings. I take this opportunity to thank all the researchers who have sent research papers to be presented at OURS-2019. It is my fervent hope that OURS-2019 would create a forum for presenting and discussing valuable research findings leading to enriching experiences to all the participants.

Let me also take this opportunity to express my appreciation to the Organizing Committee of the OURS-2019 and other staff who have contributed their time and effort to make this event a success.

Thank you very much and all the very best.

**Professor S.A. Ariadurai**  
**The Vice-Chancellor**

## **PREFACE**

The Open University Research Sessions 2019 (OURS 2019) is held from 30 – 31 October 2019. It commences with the inauguration on Wednesday 30<sup>th</sup> of October and continues until 31<sup>st</sup> October 2019 at the Open University of Sri Lanka's Colombo Regional Centre premises.

This year we received 142 abstracts and extended abstracts for reviewing and 81 abstracts were selected for presentation following a rigorous peer review process. The abstracts received cover a wide range of sub themes, Open and Distance Learning, Education, English Language Teaching, Engineering Technology, Health Sciences, Biological Sciences, Physical Sciences, Agriculture, Humanities and Social Sciences, Management, and Law. This volume contains the abstracts that were accepted for presentation and publication in the conference proceedings.

The Chief Guest at the inauguration of OURS 2019 is Professor B.A. Hussainmiya who is a visiting Professor in History, South Eastern University of Sri Lanka while the Guest of Honour is Professor Colvin Goonaratna, the Chancellor of the Open University of Sri Lanka. The invited speakers include Professor Suresh Canagarajah, Department of Applied Linguistics and English, Pennsylvania State University, USA, and Dr. Ruwan Ferdinando of the National Institute of Health Sciences, Kalutara. They will deliver keynote addresses under the respective sub-themes. We are very grateful to all of them for taking time off from their busy schedules to be with us at the sessions. The special feature of this series of events is a panel discussion on English language Teaching.

Organizing an event of this nature needs a collaborative and dedicated effort of all the members of the organizing committee of OURS 2019. Therefore, on behalf of the Senate Sub-committee for OURS 2019, I thank all the authors who submitted abstracts to the conference, all reviewers who helped in reviewing abstracts, language editors for editing them and Prof. S. S. Iqbal, former Director/Research, OUSL for her continuous guidance. My thanks also go out to the Professors of OUSL for agreeing to serve as Session Chairs at this event. We appreciate the service rendered by the members of the Senate Sub-committee for OUSL Research awards for selecting the awardees. The secretarial assistance provided by Ms. Hasanthie Chandrathilake, Ms. Madhushani Gamage and Ms. Jitha Nipunika is greatly appreciated.

We also wish to record our thanks to the Vice Chancellor, Professor S.A. Ariadurai for his ready support in carrying out our work to make this event a success.

Our Chancellor, Professor Colvin Goonaratna is gracing this occasion as the Guest of Honour. We are indeed happy and honoured by his presence.

We thank Dr. Jayantha Wattevidana, Acting Director CETMe and the staff of CETMe for creative work in graphic designing the invitation card, certificates, cover page of the conference proceedings and banners. The support received by Mr. B. M. P. Somaratna, Director Operations and Mr. B. A. D. J. Balachanadra, the Acting Printer for printing the books of Abstracts is also appreciated.

This year we are able to issue a conference bag to authors who have registered for conference sessions. This would not have been possible without the generous support of Siam City Cement (Lanka) Limited. Our special thanks go to Mr. Chanadana Nanayakkara, Marketing Manager of Siam City Cement (Lanka) Limited and Dr.Thushara Priyadarshana, Director/IRU, OUSL in this regard.

Finally, let me wish the very best to all the participants, and hope that there would be intellectually stimulating and academically productive deliberations at the Open University Research Sessions 2019.

**Professor S.R. Weerakoon**

Professor of Botany and Director/Research

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## **Address of the Chief Guest and Key Note address 1**

### **Challenges for Higher Education for all**

The meaning and functions of higher education have undergone transformation throughout the course of history. Over a period of time, higher educational institutions moved away from their original religious focus. Take for example, what happened after the period of renaissance and enlightenment in Europe. The real explosion in the field of knowledge and higher education came when the compulsion to keep focus on God as the creator of universe moved away to shift attention to man as the center and recipient of all knowledge. Thus Biblical higher education led to the breakup of knowledge into many areas of human endeavor, namely linguistics, science, humanities and technology. It was indeed a long process in human history. Islamic States too are now repeating that trend by favouring secular education dictated by changing economic needs. For many years, the role of universities was relatively straightforward: educate the youth and produce original research. But in an increasingly globalised world, tertiary institutions serve a more complex purpose. All in all both vertical and horizontal expansion of knowledge and higher education occurred in tandem with progress in human civilizational thinking and progressive patterns. Moreover, economic focus of communities from pastoral to agricultural to industrialization to technological to the current explosion in information technology determined the patterns of setting up and imparting appropriate higher education. Above all the success and failure of nations is largely determined by how much human capital a nation can muster and flourish. By human capital I mean a society of higher human intellect for learning to create, innovate and produce material comforts for their citizens. A major example of success based solely on developing higher education to increase human capital is the State of Singapore which lacks natural resources but solely depends on human capital to sustain its prosperity and security. My lecture will mainly focus mostly on the latest trends in providing broad opportunities for higher education many segments of the society. Today what is needed most is motivation to obtain higher education voluntarily or by paying for it to enhance not only their knowledge but skills to become useful contributors to the greatness of the nations in which they live.

Professor B.A. Hussainmiya  
Visiting Professor in History  
Southeastern University of Sri Lanka (SEUSL)  
Olivil  
Sri Lanka

## **Key Note Address 2**

### **Writing on the Wall: Limits of Identity Politics and Multiculturalism**

Identity politics was a much-needed intervention in social sciences and humanities to make spaces for diverse voices, communicative traditions, and cultural practices. However, some scholars wonder if it has ironically led to the discourses of nationalism and xenophobia becoming more dominant around the world today. Identity politics is based on claims of injury, recognition, and rights. Social groups which were historically marginalized sought recognition for their rights and representation. However, the discourses informing this politics can lead to negative outcomes. While the injured community has a right to be indignant against historic injustices and demand greater visibility in civic and expressive life, this seems to also breed resentment in majority communities. In an ironic twist, the latter begin to adopt a politics of injury, representation, and rights themselves to protect their own interests. Hence xenophobia.

In this talk, I develop another politics that must complement identity claims. Geographer Ash Amin (2012) calls this “the politics of the stranger.” What he means by this is reconstructing social spaces where co-existence is possible among strangers for new configurations of community. This politics is based on different premises. While identity politics is influenced by liberal discourses of community autonomy and individual rights, based on their claim for self-determination, Amin’s approach focuses on co-dependence, relationality, redistribution, and ethics. Rather than treating community or individuals as the starting point for defining rights, it focuses on space—or places where diverse communities meet for civic engagement. I will discuss how this approach leads to making spaces for everyone based on a relational ethics that looks beyond ability and self-interest to co-existing with other people, other beings, and the environment. It also has implications for communication, shifting focus from language to ecology. I will illustrate from my research with international science scholars in the US to demonstrate how they collaborate with others and draw from diverse resources in the spaces of their work to communicate successfully, though they acknowledge that they are poor in English.

Professor Suresh Canagarajah  
Edwin Erle Sparks Professor  
Director, Migration Studies Project  
Departments of Applied Linguistics and English  
Pennsylvania State University, USA

### **Key Note Address 3**

#### **From advising towards empathizing: Improving communication skills of health professionals**

Healthcare professionals are expected to stay abreast with a multitude of competencies beyond being experts of clinical disciplines. They need to be good communicators, advocates, collaborators, managers, professionals as well as scholars. It has been found that more than a quarter of hospital readmissions could be avoided with better communication among healthcare teams and between providers and patients. Better provider-patient communication improves not only such health care outcomes but also patient satisfaction, patient compliance with the treatment, provider-client relationship and also reduces malpractice risk healthcare.

Communication skills training is now being considered as an integral part of all healthcare provider training programmes. These are the soft skills that healthcare professionals need to be trained in. If healthcare professionals have not acquired these beforehand, communication skills training has shown to be effective in changing the way one communicates. However, it is evident that the existing training programs on communication skills have failed to show any significant impact in improving communication between health professionals and patients/clients due to many reasons. Structural barriers such as lack of space in healthcare settings such as busy OPDs, social barriers such as power-authority differentials between patients and healthcare workers and psychological barriers such as unrealistic expectations are some of them.

Nevertheless, we have observed some promising endeavors towards improving communication skills among health professionals in Sri Lanka in recent years. In the year 2011 one major step towards improving the communication gap was undertaken by the Government Medical Officers' Association with the establishment of a 'Communication Skills Trainers Core Group'. The 'Good Intern Program' initiated by the same movement introduced a prodigious element of communication skills. Furthermore, several communication skills training programmes have been conducted in the country and this movement has now trained more than 5000 doctors on communication and other necessary skills before they start internship and during service.

More recently an expert committee on communication skills was set up at the Sri Lanka Medical Association (SLMA). Partnering with the Postgraduate Institute of Medicine it has tried to provide medical experts with the necessary competencies in communications skills through experiential learning. Also, it has identified several key hospitals and trained communication skills trainers at these institutions as a pilot project. The trainers are expected to carry out training of fellow clinical staff at their respective stations.

But a lot still needs to be done with regards to improving communication skills of health professionals. One such challenge is training health professionals to be more humane and empathetic. Empathy is the capacity to understand or feel what another person is experiencing from within their frame of reference – that is, the capacity to place oneself in another's position. Many instances of empathy have been recorded among many species of animals but it is of special significance for humans since they have the ability to take this to deeper levels in helping out and healing fellow human beings. However, available evidence suggests that empathy is often lacking in modern health care.

Empathy is considered a basic component of all helpful relationships and is considered a core aspect of all effective, therapeutic consultations. Empathy is a complex multi-dimensional concept that has moral cognitive emotive and behavioural components. Clinical empathy involves an ability to: (a) understand the patient's situation, perspective, and feelings (and their attached meanings); (b) to communicate that understanding and check its accuracy; and (c) to act on that understanding with the patient in a helpful (therapeutic) way.

Engaging patients with empathy can lead to a better provider-client relationship. It is with empathy that we can engage and empower our patients and Carl Rogers has shown that empathy shown to a patient affects the therapeutic change, i.e., the healing process. With empathy and heart, we can help our patients feel good, valued and respected. Empathy allows us to engage and empower our patients to take charge of their health and well-being.

Health professionals are in the habit of advising patients instead of empathizing. So much needs to be done to change the role of healthcare professionals from advising to empathizing. Empathy can be improved and successfully taught at medical schools/training colleges for health professionals. However, any communication skills training including empathy should be experience based rather than lecture based. The SLMA core group also encourages experiential learning as one of the major methods of teaching communication skills.

To combat the current lack of empathy amongst healthcare professionals, many medical schools are implementing required academic programs. One such program is the Narrative Medicine program at Columbia University. For the first time in the history a narrative competition has been organized between medical faculties and also between training schools by the SLMA expert group on communication skills. Also, other new methods of teaching empathy need to be explored. It is not hypothetical to imagine a day when qualities such as kindness, compassion and empathy are taught to and at the same time learnt by healthcare professionals thus making the healthcare system more humane and caring.

Dr. Ruwan Ferdinando  
Consultant Community Physician  
National Institute of Health Sciences, Kaluthara

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**OPEN AND DISTANCE LEARNING  
(ODL)**



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## **THE DYNAMICS OF LEARNER RETENTION AND DROPOUT IN A PEER ASSISTED OPEN DISTANCE LEARNING ENVIRONMENT: A MATHEMATICAL MODEL**

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Student dropouts is one of the most significant challenges faced by open distance learning (ODL) institutions in higher education. The dropout rate is high in these higher education institutes in distance mode compared to conventional counterparts. It is obvious that the sustainability of these institutions depends on two factors: 1) the number of graduates produced and 2) how effectively the dropout rate is minimised.

Over the decades, many researchers have worked on modeling and analysing retention and dropout in distance learning in higher education. However, most of these predictive models rely mostly on data thus these models are extremely localised and the overall dynamic of the process is not captured.

This study aims to develop a mathematical model using a system of non-linear differential equations which investigate the retention and dropout dynamic of students in an ODL environment with minimum resources for the learner. The entire student intake is divided into two categories: 1) potentially retained and 2) potential dropouts. This study analyse show peer learning influences this dynamic. However, the change in the dynamic due to learner support from the teachers and institution itself is not addressed here.

The system is solved numerically using a vector of values for effective peer learning parameters and the simulated results suggest the proportion of potential dropouts declines as the efficacy of peer interaction increases. The outcome further reveals that most dropouts take place during the first 5-7 months after their academic program commences.

The effect of learner and institutional support is not considered in this model. Thus, it is expected that an improved model with this additional support for students may reveal more information about the process.

**Keywords:** Retention, Drop out, Dynamic, Mathematical Model, ODL

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## NETWORKING EDUCATION INTO THE FUTURE: WHY SOCIAL MEDIA? A REVIEW

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This review paper focuses on an emerging global trend in open and distance learning and higher education: the use of social media for instruction and learner support. Specifically, the review uses a wide range of sources to identify the key reasons for the readiness and adoption of social media for tertiary, as well as, open and distance learning within Sri Lanka.

The paper reviews the literature on the unique features of social media and highlights a number of significant factors that promote the adoption of social media for higher education. First, it reviews the literature on the emerging net generation of digital learners who assimilate knowledge differently through the use of social media as well as other web-based digital technologies. Second, the paper focuses on the literature related to increasing use of social media among youth in Sri Lanka, which illustrates the potential for the incorporation of the teaching-learning environment with social media platforms. Finally, the paper reviews the literature on the repurposing of social media, which is now primarily used for potentially distracting entertainment, by exploiting the underlying technologies and outcomes of social media for knowledge construction.

Furthermore, this review paper also recognizes the potential of social media for open and distance learning education to meet its unique and specific needs. Emphasis is placed upon the many facets of social media, such as its strengths in communication, collaboration, active participation, community building, information sharing and feedback. The authors of this review argue that these facets of social media provides an ideal teaching and learning environment for an effective open and distance learning system and that the development of a technology enhanced and mediated personal learning environment through the adaptation of social media in open and distance learning should be rigorously explored at the Open University of Sri Lanka. Finally, it is recommended that an undertaking such as developing a technology enhanced and mediated personal learning environment should begin with the study of the unique patterns of



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existing social media use among the stakeholders of the Open University of Sri Lanka.

Keywords: Networking Education, Social Media, Open and Distance Learning, Mediated personal learning environment

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## ENTERTAIN OR ENLIGHTEN? – SIGNIFICANCE OF MOBILE SOCIAL NETWORKING APPS IN INFORMAL LIFELONG EDUCATION

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Mobile learning emerged with the revolutionary development of Android, iOS and Windows based smartphones. For a decade and a half, its effectiveness has been largely researched in the context of schools and universities. However, according to the available literature, its significance on the working adult population has not been properly researched. This study was an extension of an existing m-learning research to find the significance of mobile learning on the Sri Lankan semi-governmental context with respect to lifelong education.

Research conducted during the last decade with students in universities and technical colleges have concluded that mobile learning was more effective in comparison to face-to-face learning in the classroom and the objective was to see whether there was a similarity between those findings and the results of this study. The WhatsApp mobile app was used for this study as it is platform independent and leads in the highest rank of Google Play Store apps. A sample of 60 semi-government workers in the age range of 25 to 45 was used with the application of mixed methods for data collection using a printed and mobile questionnaire, mobile and face-to-face interviews and discussions together with observations of the pattern of communication. The Mobile Learning Environment (MLE), which was created for the main project, with access to web-based Google forms, was used as the communication interface.

The results revealed that there was a higher demand for mobile-based learning opportunities in contrast to traditional teacher-centered learning. These workers have the issue of unavailability of time for conventional classes. Lack of motivation, low self-confidence, and fear of making mistakes prevents them in lively engagement in class discussions. Therefore, it was clear that the mobile-based approach such as m-learning would be ideal to cater to their needs and help them to learn at ease guaranteeing uninterrupted participation by adapting study time to suit their free time. Hence, it is obvious that there is an ongoing demand for m-learning in this context. However, there is a necessity to study further about the factors such as mobile literacy and technological affordance.

Keywords: Mobile learning, Working adults, Lifelong Education, Social networking apps

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# **AGRICULTURE**



## EVALUATION OF EXOTIC PUMPKIN HYBRIDS WITH LOCAL PUMPKIN VARIETIES IN THE INTERMEDIATE LOW COUNTRY 1 (IL1) OF SRI LANKA

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Pumpkin (*Cucurbitaceae*) is mainly consumed as a vegetable. There are five species cultivated around the world. They are *Cucurbita moschata* Duchesne ex Poir, *Cucurbita maxima* Duchesne, *Cucurbita ficifolia* Bouché, *Cucurbita pepo* L. and *Cucurbita mixta* Pang. Twelve varieties (Cheonlima, Goldma, Peta, Arela, Shiba, Gilda, LA1557, Monica, Katana, Padma, MK Spanchy, Supreema) of pumpkin was planted under randomized complete block design (RCBD) with two replicas at Makandura research field in Kurunegala district, Sri Lanka to evaluate the adaptability in IL1(intermediate low country) in Sri Lanka. The objective of this study was to identify the best performing pumpkin variety/varieties for IL1 of Sri Lanka. Nine exotic hybrid pumpkin varieties were evaluated with two recommended local varieties and one farmer growing F1 hybrid variety in Yala season, 2017. This research was conducted by observing and recording the following parameters- Growth parameters: plant vigour (2 weeks after transplanting), reproductive parameters: days to 50% flowering in the plot, total yield of a plot, average fruit weight and pest and disease incidences. The ranking scale was adopted to gauge the visual status of plant vigour. Farmer growing F1 variety ‘Supreema’ was served as the control. The vigour of all the varieties was reported very good or good except for the variety ‘Peta’. There were no significant differences in yield between farmer growing variety ‘Supreema’ and ‘Katana’ which belong to *C. maxima*. No virus damages were observed in ‘Katana’ while Supreema had over 15% of viral damage. The farmer growing variety Padma (*C. moschata*) which was introduced by the Department of Agriculture (DOA) Sri Lanka was not significantly different from other *C. moschata* varieties in the field trial. Overall, the Katana was the best performing variety according to this study.

Keywords: *Cucurbitaceae*, Intermediate Low Country (IL1), Yala season, Exotic hybrid pumpkin varieties, Plant vigor

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## COMPARISON OF EFFICIENCIES OF WALKLEY AND BLACK TITRATION METHOD AND COLORIMETRIC METHODS FOR THE ESTIMATION OF SOIL ORGANIC MATTER IN SRI LANKA

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This study attempts to render the correlation and enhanced efficiency of the Walkley & Black colorimetric method that is not a commonly practiced soil organic matter analysis method in Sri Lanka against the ordinary Walkley and Black titrimetric method used in Sri Lanka. 75 soil samples which lay amongst 0% - 8% organic matter content were selected based on data out of 400 samples which were previous analyzed using the Walkley & Black titration method for duplication using the Walkley & Black colorimetric method. Coefficient of determination ( $r^2$ ) of the Walkley & Black titration method with the Walkley & Black colorimetric method was 0.9 and demonstrated a strong linear relationship between amount of soil organic matter percentage of the above two methods. According to Bland Altman plot 72 samples measurements out of total 75 soil samples are in 95% limits of the agreement area. Efficiency comparison was done considering cost, complexity, speed of performance and environmental impacts of two methods when analyzing 100 samples. Cost analysis showed Rs 1: Rs 2.24 ratio between Walkley & Black colorimetric method and Walkley & Black titration method. From this study the Walkley & Black colorimetric method was recognized as less complex, more environment friendly and a more efficient method than the Walkley & Black titration method.

Keywords: Soil organic matter, Walkley & Black method, Titrimetry, Colorimetry

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**EFFECT OF MULCHING ON NUTRIENT STATUS OF GINGER  
(*Zingiber officinale* ROSCOE) GROWING SOILS IN LOW COUNTRY  
INTERMEDIATE ZONE, SRI LANKA**

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(*Zingiber officinale* Roscoe) is an economically important crop in Sri Lanka. Soil nutrient status is a key factor that influences Ginger yield. Soil mulching is an effective practice that can be used to enhance soil nutrient status. However, effect of mulching on soil nutrient status has not yet been tested for ginger cultivation. Therefore, this experiment was conducted at the Intercropping and Betel Research Station, Narammala to investigate the effect of different mulching materials on soil nutrient status of Red Yellow Podzolic soil. Five mulching materials: Straw (T2), Gliricidia leaves (T3), Polythene mulch (T4), Coconut leaves (T5) and Coir dust (T6) were tested with a control (T1, without mulching) using Randomized Complete Block Design with four replicates. Soil pH, EC, soil available nitrogen, available phosphorus and available Potassium were measured at monthly intervals and soil moisture was measured once per ten days before irrigation during the eight months from planting to harvesting. The highest value of soil EC (3.90 mS/cm) was observed in T3 treatment while the lowest EC (1.36 mS/cm) was reported in T4. Percentage of soil moisture was higher in T4 treatment compared to all other treatments. Significantly higher ( $P < 0.05$ ) percentage of soil available nitrogen was reported in T3 treatment. Soil phosphorous and potassium levels were also high in T3 treatment hence, the highest ginger yield was reported. The study reveals that the mulching of soil with gliricidia leaves enhances soil nutrient status and increases ginger yield compared to other tested mulching materials.

Keywords: Ginger, Soil mulching, Soil nutrients, Yield

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**INTERCROPPING PEPPER WITH TEA: FARMERS' PERCEPTION, TECHNOLOGY ADOPTION AND CHALLENGES FACED BY THE TEA SMALLHOLDERS: A CASE STUDY OF IMBULPE DIVISIONAL SECRETARIAT IN BALANGODA, SRI LANKA**

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Intercropping pepper in tea plantations has been a common practice of smallholders in the low and mid country regions of Sri Lanka. However, limited studies have been conducted in the line of crop management and technology adoption when tea is intercropped with pepper. Hence, the overall aim of this study was to carry out an investigation on tea-pepper intercropping systems practiced by smallholder farmers in Imbulpe with emphasis on farmers' perception on tea-pepper intercropping systems, technology adoption, and constraints faced. Ninety-two tea smallholders who have inter planted pepper in tea lands, in three different Grama Niladhari divisions of three tea inspector ranges of the Imbulpe DS were purposively selected in the study. A structured questionnaire survey was conducted to gather primary data. Results show that increased income and efficient land utilization are the two pull factors that attract farmers to adopt tea-pepper intercropping systems. The study revealed that the level of technology adoption in tea cultivation is relatively more satisfactory than that of pepper in intercropping systems. Poor extension services may be attributed to the low level of technology adoption by the farmers, particularly in pepper cultivation. Lack of labour, high labour cost, frequent price fluctuations of pepper and lack of market information are the major labour and marketing issues faced by the farmers. Poor crop management triggered by the lack of advisory programmes on tea-pepper intercropping systems was the most prominent management issue faced by the farmers. This study revealed that intercropping tea with pepper can be promoted among small holders in the area since it is a profitable venture. However, policies should be imposed to stabilize the price of pepper to improve the confidence of farmers. This study strongly recommends the necessity of having effective training programmes for farmers who practice tea-pepper intercropping systems on crop management and technology adoption.

Keywords: Intercropping, Tea, Pepper, Smallholder, Technology Adoption

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# **BIOLOGICAL SCIENCES**



## DEVELOPMENT OF AN OPTIMIZED PROTOCOL FOR THE EXTRACTION OF DNA FROM HUMAN BLOOD

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Extraction of DNA from suitable biological samples is considered to be the most primary and the most crucial step in many research studies related to genetics and molecular biology. Having considered human research, blood is a very typical tissue from which DNA is extracted to be used in a variety of studies involving the application of different techniques in molecular biology. Therefore, it is important that highly optimized protocols are made available in facilitating the extraction of DNA from human blood to ensure the smooth conducting of studies and to generate precise and accurate results. The specific objective of this study was to develop an optimized protocol for the extraction of DNA from human blood which is of sufficient quantity and optimum purity that could be used in further downstream processes and applications with more precision and reliability. DNA was extracted from human blood with the use of FlexiGene<sup>®</sup> DNA extraction kit by QIAGEN<sup>®</sup>. Even though the protocol provided with the commercial kit was followed unchanged, spectrophotometric absorbency results revealed that the DNA extracted did not have sufficient purity required for molecular cloning as it especially consisted of organic compound contamination. The  $A_{260}/A_{230}$  ratio for DNA which needs to be in the range 1.8-2.0 was detected to be only in the range 1.3-1.4. Eventually, the washing step with ethanol to remove the previously added 100% isopropanol to pellet out DNA from other impurities was repeated by doubling the volume of ethanol mentioned in the original protocol and the air-dry time to remove all the ethanol that was used for washing impurities was increased by nearly six times compared to that mentioned in the original protocol, from 5 minutes to 30 minutes. Having done the above modifications, the  $A_{260}/A_{230}$  ratio improved drastically from 1.4 to 2.2. In addition, the protein digestion to remove all the protein contamination happened optimally which is validated by the fact that the  $A_{260}/A_{280}$  ratio obtained was 1.73, which is very close to the ideal value for DNA which is 1.8. The size of the DNA pellet formed was also improved by increasing the amount of 100% isopropanol added, from 100  $\mu$ L to 150  $\mu$ L in order to effectively pellet out the DNA. Accordingly, the concentration of the DNA that yielded increased.



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The optimized protocol for the extraction of DNA was developed this way as an initial step of the study by modifying the original protocol.

Keywords: Concentration, DNA Extraction, Downstream, Purity, Quality

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## A COMPARATIVE WOOD ANATOMICAL STUDY ON HEALTHY AND INFECTED WOOD SAMPLES OF *Gyrinops walla* Gaetner ('WALLA PATTA')

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Agarwood oil obtained from a number of genera of the family thymelaeaceae is an expensive product in the global market. *Gyrinops walla* produces a fragrant resinous substance similar to agarwood produced by *Aquilaria* spp. and *Gonystylus* spp. in mature and damaged stems and branches when they become infected with a particular type of mould. The present study focused on anatomical characteristics in healthy and infected wood of *Gyrinops walla*. Anatomical features of transverse, tangential and radial sections of healthy and infected wood samples were stained with safranin and observed under a light microscope. The characteristics of wood colour, growth rings, vessel elements, ray parenchyma, axial parenchyma, intercellular spaces, tyloses and mineral inclusions and the distribution of phloem in wood sections were observed and described. Both healthy and infected wood shared similar anatomical characters. Anatomical observations revealed that brownish substances in ray parenchyma included phloem and xylem vessels signifying the functional importance of agarwood depositions in infected wood. The findings suggest that the xylem associated living cells of 'included phloem' of the wood play a crucial role in the formation of agarwood. Chemical studies on the cell contents of included phloem and xylem are required to confirm the presence of agarwood type constituents in *Gyrinops walla* wood.

**Keywords:** Agarwood, *Gyrinops walla* Gaetner, Included phloem, 'Walla patta', Wood Anatomy

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## IMMUNOMODULATORY EFFECT OF FRESH JUICE OF *Bambusa vulgaris* YOUNG SHOOTS

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The therapeutic potential of bamboo has been validated amply though the immunomodulatory potential has been scarcely evaluated. The present study investigates the immunomodulatory potential of *Bambusa vulgaris* for developing potential drug leads in the future. The immunomodulatory potential of fresh juice of *Bambusa vulgaris* young shoots (FJBV) using Wistar rats (N=6/group), orally administered with 3 doses of FJBV - low dose (LD-0.25 ml) 400 mg/kg, human equivalent dose (HED-0.5 ml) 800 mg/kg and high dose (HD-1 ml) 800 mg/kg - once daily for 2 consecutive days while distilled water was used for normal control (NC). Cyclophosphamide via oral route for positive control (PC-1ml) 10 mg/kg. Prescribed traditional dose (30 ml/day) was used to determine HED. Non-functional and functional immunological parameters elicited a significant immunomodulation with FJBV. Lymphocyte to neutrophil ratio was significantly low for LD ( $p<0.05$ ). Rat platelet counts and bone marrow counts were reduced for all three doses at post-treatment testing. Among them, significant platelet reduction was observed by HD ( $p<0.05$ ) and for bone marrow by both HED and HD ( $p<0.05$ ). Contrary, splenocyte counts were increased for all three doses of FJBV and a significant increment was observed for HD ( $p<0.05$ ). Functional response for phagocytic activity was lowered due to FJBV doses and significantly lowered for HED and HD ( $p<0.05$ ). Acute oral toxicological evaluation of FJBV challenges the safe administration of fresh juice for a longer period since it was implicated with a nearly significant haematotoxicity, and immunotoxicity. The findings of the present study provide ample verification of the traditional claim and health benefits of the FJBV young shoots as an immunomodulator.

Keywords: Immunomodulatory, *Bambusa vulgaris*, Acute Toxicity, Functional and non-functional

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## SPATIAL AND TEMPORAL VARIATIONS OF FISH ASSEMBLAGES AND THEIR ASSOCIATIONS IN THE KALA OYA RIVER BASIN, SRI LANKA

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The present study was carried out to determine the fish species composition, abundance and distribution in the Kala Oya River Basin (KOB), Sri Lanka to investigate how the distribution of fish species is affected by habitat variables such as lentic/lotic nature and disturbed/ undisturbed nature of land usage in the area. Fish samples were obtained from 08 sampling sites scattered throughout the KOB and among them, two represented lentic habitats and the rest were lotic habitats. Considering the land usage, five of the selected sampling sites were in a disturbed condition due to the input of various pollutants and high agricultural utilization activities. The other three sites were comparatively undisturbed by anthropogenic activities as they are situated along the Wilpattu forest boundary. Sampling was carried out in monthly intervals from August 2018 to January 2019. Cast nets (1/2" mesh size and 8/5" mesh size), hand net (36 cm \* 25 cm), underwater visual censuses of line transects and point counts were used for the sampling of fish species. Standard keys and descriptions were used to identify fish species. Diversity indices such as species richness, Shannon-Weiner diversity index, Buzas and Gibson's evenness and species dominance were calculated. Analysis of similarity (one-way ANOSIM) was performed to test significant differences in species diversity among sampling locations and sampling months to understand spatial and temporal variations of fish species composition. General water quality and environmental parameters were also measured to understand microhabitat conditions.

The study records 45 fish species belonging to 18 families and among them 10 endemic species were recorded. *Amblypharyngodon grandisquamis*, *Dawkinsia singhala*, *Devario malabaricus*, *Puntius bimaculatus*, *Puntius dorsalis*, *Puntius thermalis* and *Rasbora microcephalus* was the most common species throughout the study site. *Rasbora microcephalus* was the species with the highest abundance. Pairwise analysis of similarity shows significant dissimilarity in fish species composition in lentic and lotic habitats as well as in wet - dry seasons. There was no significant dissimilarity of fish species composition in disturbed and undisturbed habitats. Measured environmental factors did not signify detrimental impacts upon fish species throughout the study. However, further detailed study of environmental factors will provide better insight to understand the impact of environmental factors towards the abundance of fish species. The results of the present study clearly show that the KOB is rich in fish species diversity. Some fish species that were not recorded in earlier studies in the KOB were also recorded during the present study. Results of this study further indicates that fish species composition and diversity in spatial-temporal scale,



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and their relations to dynamic environment conditions provide insight for the necessity of conservation and management of the river basin community.

**Keywords:** Fish species diversity, Kala Oya river Basin, Underwater visual census

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**IS IT SAFE TO DRINK WATER IN MIHINTALE? A CASE STUDY  
FROM DISEASE ENDEMIC AREAS OF THE CHRONIC KIDNEY  
DISEASE OF UNKNOWN AETIOLOGY (CKDu).**

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Chronic Kidney Disease of unknown aetiology (CKDu) which is a major health concern throughout the North Central Province of Sri Lanka, may be strongly associated with the quality of drinking water. This study attempts to evaluate the cytogenotoxic potential of drinking water in Mihintale in the Anuradhapura District with an *Allium cepa* bioassay. Water samples were collected from drinking water sources and physicochemical parameters such as temperature, pH conductivity, Ca<sup>2+</sup>, Mg<sup>2+</sup>, total hardness, F<sup>-</sup>, nitrate, phosphate, and heavy metals such as As and Cd were tested with standard procedures. Common endpoints of the *A. cepa* bioassay; mitotic index and the percentage aberrations, were considered for cytogenotoxic screening. Among 30 samples collected the sources ranged from wells (19), tube wells (7), tap water (1), filtered water from a reverse osmosis system (1) and rain water (1). Principal components that determined the toxicity were derived as Ca<sup>2+</sup>, Mg<sup>2+</sup>, total hardness and conductivity that linked together (PCA, >0.8 of coefficient) to contribute to the ionicity of water. Thus, percentage aberrations were strongly and positively correlated with these parameters. As the second cluster of components of PCA, fluoride and pH contribute to moderately higher percentage aberrations. Filtered water and rain water resulted in minimum cellular aberrations; these sources can be treated as safe sources from a cytogenotoxic perspective. As declined contents of electrolytes in filtered water may possibly trigger unexpected health concerns, rain water harvesting could be recommended as a better alternative for ground water sources with an improved collecting system to avoid fecal and other contaminations.

Keywords: CKDu, Drinking water, Cytogenotoxicity, *A. cepa* Bioassay, Percentage aberrations

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## **DEVELOPMENT OF A NOVEL X CHROMOSOMAL STR BASED DACAPLEX PCR ASSAY FOR THE KINSHIP ANALYSIS OF THE SINHALESE POPULATION**

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The X Chromosome is of great importance to molecular forensics due to its unique inheritance pattern and recombination restricted to female individuals. With the use of X chromosomal STR markers (X-STR), it is possible to solve certain challenging kinship cases that other commonly used forensic markers (autosomal STR, Y-STR) cannot resolve efficiently. Being located on the same chromosome, X-STR markers tend to exhibit linkage groups that are inherited together from a single parent, and thus can be considered stable haplotypes. So far, more than 45 X-STR makers have been studied in various populations worldwide, which have been used to design numerous multiplex PCR systems. At present, X-STR analysis has not been established for the Sri Lankan population. As such, the aim of this study was to develop a powerful automated multiplex X-STR assay, appropriate for Sri Lankans and to test its applicability using a sample of the Sinhalese population.

Ten previously published X-STR makers covering three tightly linked clusters (DXS10079-DXS10074-DXS10075 on Xq12; DXS6801-DXS6789-DXS6809 on Xq21 and DXS7424-DXS101-DXS7133 on Xq22 and DXS8378 on Xp22) were selected based on their molecular weights to optimise a single decaplex PCR for automated fragment analysis. In-house constructed allelic ladders were validated (against 9947A and K562 standard DNA) and sequenced to confirm the repeat numbers. The amplified products were subjected to capillary electrophoresis (ABI 3500 Genetic Analyzer; Applied Biosystems) at Genetech, Colombo and were analyzed by GeneMapper IDX software (Applied Biosystems). The applicability of the 10 X-STR multiplex system was tested on 100 Sinhalese individuals (50% male) using finger pricked blood. DNA was extracted using the chelex method. Allele frequencies were generated for the 10 markers using Arlequin 3.5.2.

The novel decaplex assay is optimized to use only 0.5 ng DNA compared to 1-5 ng of DNA used in routine forensic practice. Genotyping data showed a high polymorphism with respect to all the selected loci allowing for a large haplotype diversity. Numbers of alleles observed for each cluster was; DXS10079-DXS10074-DXS10075:9-8-7; DXS6801-DXS6789-DXS6809:6-9-10; DXS7424-DXS101-DXS7133: 9-11-6. Six alleles were observed for DXS8378. Further none of the alleles in the selected 10 X-STR loci exceeded 50%



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frequency, reflecting the usefulness and validity of these loci in kinship analysis. In order to confirm its general applicability to the Sri Lankan population, it would be necessary to extend the assay to cover other ethnic groups in Sri Lanka.

Keywords: Recombination, Multiplex PCR, Linkage, Haplotypes, Alleles

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**PRELIMINARY INVESTIGATION ON TERMITE FAUNA (INSECTA: ISOPTERA) IN THE OPEN UNIVERSITY PREMISES, NAWALA, SRI LANKA**

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Termites are the most dominant arthropod detritivores and they are often in conflict with human endeavors. The present study was carried out to investigate termite fauna and their distribution, which cause severe infestations in the OUSL premises, Nawala. Four different sites were selected and standardized transect method of Jones and Eagleton (2000) was used for sampling termites. Several methods such as soil sifting, litter sifting, pitfall traps, hand picking, and bait traps were used to collect termites in each soil sample. The sampling was done once a month in each site from March-September in 2015. Termites collected from OUSL premises belonged to 3 families, Kalotermitidae, Rhinotermitidae and Termitidae. In family Rhinotermitidae two sub families and two species namely, Coptotermitine (*Coptotermes ceylonicus* (Holmgren) and Heterotermitinae (*Heterotermes sp.*) were identified. In family Termitidae, 3 species, *Odontotermes ceylonicus* (Wasmann), *O. feae* (Wasmann) and *O. horni* (Wasmann) belonging to the sub family Macrotermitinae were identified. Family Kalotermitidae had one sub family Kalotermitinae and one morpho species, *Cryptotermes sp.* Identified termite fauna belonged to two functional groups, subterranean termites and dry wood termites. OUSL premises were dominated by subterranean termite fauna representing three *Odontotermes sp.* Only one dry wood termite species, *Cryptotermes sp.* was found in one site. Subterranean termite species *O. ceylonicus* (Wasmann) was the most widely distributed and abundant termite species in the OUSL premises. Results also showed that the highest termite abundance was recorded in Site 03 with a high species diversity ( $H = -1.3918$ ). Abundance and species diversity were comparatively less in the other three sites (Sites 02:  $H = -0.6739$ , 04:  $H = -0.6817$ , 01:  $H = -0.8563$ ). Therefore, species specific control methods, proper management methods should be introduced to control both subterranean and dry wood termite fauna in the OUSL premises. Further studies should be carried out to investigate food preference levels of termite species and any biological control methods for eradicating termites in the OUSL premises.

Keywords: Termites, OUSL, Biodiversity, *Coptotermes ceylonicus*

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## **EFFECT OF MONOAMINE OXIDASEA (MAOA) ALLELIC VARIANTS AND CHILDHOOD MALTREATMENT ON VIOLENT BEHAVIOUR: PRELIMINARY INVESTIGATION ON CONVICTS IN SRI LANKA**

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Criminal violence imposes a massive burden on the economy, health care and law enforcement of a country. Hence, the deterrence of criminal violence is an important public health issue. Recently, much emphasis has been given to genetic predispositions in individual variations of violent behaviour. The activity shown by the MAOA enzyme coded by the MAOA gene has two major impacts on the neurotransmitter functionings in an individual. The high activity allelic variant of Monoamine Oxidase-A gene (H-MAOA) results in depressive behaviours in individuals while the low activity allelic variant of Monoamine Oxidase-A gene (L-MAOA) which results in the accumulation of serotonin is implicated in the development of violent behaviour. Further, genetic predisposition towards violent behaviour could be triggered by socioenvironmental factors such as childhood maltreatment. Therefore, the present study investigates the effect of MAOA allelic variants and childhood maltreatment and their interplay on violent behaviour of convicts imprisoned in Sri Lanka. Male convicts' categories as violent (N=31), non-violent (N=29) in Welikada Prison, Borella and age-sex matched individuals without any criminal record (normal control, N=31) were recruited for the study. All participants were surveyed for childhood maltreatment using the Childhood Trauma Questionnaire (CTQ). DNA was purified from buccal swabs obtained from participants and a Polymerase Chain Reaction (PCR) was carried out to detect MAOA allelic variants. The distribution of allelic variants and scores of CTQ were statistically compared. The PCR implication has resulted in 230 bp and 260 bp DNA fragments that resemble the 3R (L-MAOA) and 4R (H-MAOA) allelic variants of the MAOA gene, respectively. The L-MAOA variant exhibited a higher prevalence among the violent group while the H-MAOA variant predominated in both non-violent and control groups (P=0.04) indicating a genetic influence on violent behaviour. The CTQ scores obtained for emotional abuse (P=0.04, F=5.94) physical neglect (P=0.01, F=4.9) and physical abuse (P=0.00, F=14.1) were also significantly higher in the violent group than the other groups. However, physical abuse (P=0.04, F=4.84) and sexual abuse scores (P=0.03, F=5.18) were significantly higher among individuals who have committed violent crimes having the H-MAOA allelic variant. Thus, it could be inferred that childhood maltreatment may contribute to violent behaviour regardless of genetic influence in individuals in Sri Lanka. However, further studies are currently evaluating the potential



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interplay between MAOA alleles and environmental vulnerability factors. This pilot study may initiate a new area of investigation in behavioural genetic studies in Sri Lanka and will be beneficial to understand the multiple factors contributing to criminal violence in Sri Lanka.

Keywords: Violence behaviour, Convicts, MAOA gene, Childhood maltreatment, Sri Lanka

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# **EDUCATION**



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## **IDENTIFICATION OF ISSUES ENCOUNTERED BY STUDENTS IN COMPLETING THE RESEARCH DISSERTATION OF THE MASTER OF EDUCATION DEGREE PROGRAMME**

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Conducting educational research is important as it aims to provide reliable information regarding educational problems which lead to recommendation of informed solutions to those problems. Educational research can be defined as a 'purposeful and systematic' enquiry 'to solve a problem, illuminate a situation or add to our knowledge' (Forbes 2015). Therefore, the research component is a vital part of the Master of Education Degree Programme conducted by the Faculty of Education, The Open University of Sri Lanka. Our experience as a faculty is that the students, who have the potential to work as prospective researchers in the field of education, find it difficult to complete the research dissertation due to a variety of reasons. Therefore, the objectives of this study was to identify academic and personal issues faced by the students which affect their completion of the research study as well as to make suggestions to overcome the issues faced by the students in conducting their research study. Data collection was done by using a questionnaire for the students reading for the degree programme. A sample of 176 students who were in the second year of the Master of Education Degree Programme were the informants of the study. Data derived using the survey questionnaires were analysed both quantitatively and qualitatively. According to the findings, issues on the identification of a proper area of research, insufficiency of relevant literature and other related information on the proposed research study, unavailability of primary sources of data and research literature, lack of library facilities, the protracted time taken by the research supervisors to provide feedback, the difficulty of collecting data from several samples, the complexity of completing an action research and not being interested in the selected research topic were identified as some of the academic issues encountered by the students. In addition, workplace commitments, family commitments, health problems, insufficient support from family, problems regarding time management and travelling long distance to university were identified as personal issues. Preparing an action plan to meet the supervisors, conducting workshops for supervisors, preparing a checklist and comprehensive guidelines on writing and submitting the dissertation, maintaining a good rapport between the supervisor and student for sustaining their motivation are recommended to overcome the issues encountered by the students during the period of research study in this degree programme.

Keywords: Issues, Research Study, Master of Education Degree Programme

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## **ROLE OF TEACHERS IN DEVELOPING SELF-REGULATED LEARNING AMONG STUDENTS IN TAMIL MEDIUM SECONDARY SCHOOLS IN PUTTALAM**

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Self-learning is given a prominent place in the teaching-learning process. Self-Regulated Learning (SRL) means that students are able to practice self-control in their cognition, behaviour and feelings to achieve their learning goals. In this context, students can generate patterns of cognition, behaviour and feelings themselves to achieve their target learning goals. Teachers in the classroom can impact students' self-regulated learning skills. Based on the available data for the period from 2013 to 2017, it was observed that the achievement levels of the students in Tamil medium secondary schools in the division were low. The main purpose of this study was to find out teachers' role in developing self-regulated learning among students in the Tamil-medium secondary schools in Puttalam. To achieve the purpose of the study, two research questions formulated: RQ1: What are the teachers' perceptions towards self-regulated learning strategies that are used by students? RQ2: What are the self-regulated teaching-learning strategies that teachers use to develop self-regulated learning practices among students? 72 teachers were selected from 12 Tamil medium secondary schools in the Northern Educational Division in the Zonal Education of Puttalam using a stratified sampling technique. A developed questionnaire was employed to collect data from the teachers. Based on the analysis of the data, it was found that teachers opined that the students' use of the following SRL strategies was low: resource management (M=2.3, SD= 0.7) and self-evaluation (M=2.3, SD=0.8). In addition, teachers also stated that students had moderate practice in other SRL strategies: setting goals, planning, help-seeking, building the environment, memory, meta cognitive skills, self-motivation, self-control and self-monitoring. It was also found that teachers stated that they were at a high level of usage in the SRL strategies of setting goals, planning, responsibility, time management, resource management, help-seeking, building the environment, self-organization, memory meta cognitive skills, self-motivation, self-monitoring and self-evaluation in their teaching-learning process. However, further investigation using qualitative approaches is required, especially classroom observation of whether they are using such techniques in their teaching-learning process. It is recommended that teacher training programmes should make teachers aware of SRL practices and train them on SRL, which would facilitate the improvement of students' learning achievements.

**Keywords:** Secondary Schools, Self-Regulated Learning, Teachers' Role

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## TEACHERS' PERCEPTION OF ENGAGING IN QUALITY ASSURANCE PROCESSES IN SRI LANKAN SCHOOLS

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This study investigated teachers' perception towards engaging in the Quality Assurance (QA) processes in Sri Lankan schools. The QA process is mainly divided into internal and external evaluation. Internal evaluation is conducted at the school level, while zones, provinces and the Ministry lead the external evaluation. The methodological approach of this study was mixed. In this study, questionnaires were distributed among 128 teachers who were selected from five provinces through a stratified random sampling technique and 10 teachers were purposely selected for the interviews. Questionnaire data were analyzed using the Statistical Package for Social Sciences (SPSS) software and interview data were analyzed using a thematic analysis technique. The results revealed that the majority of the teachers (60) were aware of the internal and external evaluation process, but 38% of the teachers did not have a clear understanding about the evaluation guideline and circular. According to the teachers responses they thought that the QA process was an additional activity for schools. Further, most of the teachers (50) were unhappy about external evaluators' behavior and their responses. In addition, this study highlighted that teachers had problems such as over work, lack of motivation, and lack of time to become involved in evaluation activities. However, the majority of teachers (54%) understood evaluation as a powerful tool which can help improve quality in schools. This study recommended that teachers should be encouraged to implement the evaluation process. Further, zonal, Provincial and Ministry levels need to implement various strategies to enhance the evaluation process in schools. Moreover, evaluators should be trained continually by the Ministry of Education (MoE).

Keywords: Evaluation process, Implementation, Quality assurance, School, Teachers

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## **A STUDY ON THE ROLE OF THE PRESCHOOL TEACHERS IN PROMOTING CREATIVITY IN PRESCHOOL CHILDREN THROUGH LANGUAGE DEVELOPMENT**

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Early education preparation is essential for formal education. The richer the child's language, the better their prospect of fitting into and progressing effectively in the early school years. The development of language through creativity if initiated from the stage the child displays independence in language, contributes to the development of the personality of the child. This study investigates the role of preschool teachers in promoting creativity in preschool children through language development. The main objectives of the study were reviewing the current status of the teaching-learning process and identifying any problems faced by the preschool teachers in promoting creativity in young children. The survey method was used as the research design in this study. To achieve the objectives, samples were selected in the Colombo district using different sampling methods. Stratified random sampling method was used in the 1<sup>st</sup> phase for the survey. 225 questionnaires were sent to the selected preschool teachers and eighty-five responses were received. In the 2<sup>nd</sup> phase purposive sampling method was used to select twenty preschools for teacher interviews and classroom observations using suitable data collection instruments. The findings showed that most of the teachers did not use their knowledge to promote creativity during their teaching-learning process. Based on the mail questionnaire and interviews with preschool teachers it was revealed that the responses on understanding the importance of creativity was varied and minimal. The teachers' understanding of creativity was not adequate. Knowledge and the understanding of the importance of activities in promoting creativity was not adequate among teachers in both categories. Preschool teachers had not paid much attention to incorporate ideas of creativity although they prepared lesson plans. Most of the activities in both types of preschools had teacher-directed activities continued by the teachers, but there was no freedom for children to contribute. Both types of preschools attempted to provide stimulation to continue conversations but those were not continued, so a good opportunity was lost to develop creativity through conversations. The teachers did not have a clear idea of the concept of creativity stated by philosophers and educationalists. A poor understanding of using appropriate teaching methods to promote creativity was identified as a major problem faced by the preschool teachers. Although teachers use teaching methods such as drawing, storytelling and reciting poems no opportunities are being provided to express the children's ideas freely. Teachers did not have clear awareness about lesson planning or about suitable activities to



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promote creativity through language. The training received by the preschool teachers was shown to be inadequate. The majority of the preschool teachers mentioned that they are not psychologically motivated to handle children to orient them towards creativity, because the social demand for preschool education and parents' attitudes are competitive in society.

Keywords: Early Education, Creativity, Language development, Preschool children

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## **IMPLEMENTATION OF EFFECTIVE TEACHING METHODS WHEN TEACHING ENVIRONMENT RELATED ACTIVITIES AT PRIMARY LEVEL**

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Primary education is considered the most important period which provides a foundation for lifelong learning. Therefore, the government of Sri Lanka has taken several steps to enhance the quality of primary education. However, several studies have highlighted that the primary education system in Sri Lanka is still experiencing serious issues and there are malpractices related to teaching Environment Related Activities (ERA) at primary level. Thus, the present study attempted to identify the effective teaching methods of teaching the ERA subject at primary level, to examine how far teachers are aware of those effective methods and to investigate the implementation of those methods by teachers in the actual teaching learning process. The study was conducted in the Gampaha and Anuradhapura educational zones. The sample of the study comprised 144 teachers selected using the stratified random sampling method and eight key informants in the field of primary education. SPSS was utilized to analyze numerical data while qualitative data was analyzed descriptively. Both key informants and the teachers in the two educational zones identified observation, group method, assignment and role play as the most effective teaching methods whereas brainstorming, discussion, play and project method were specified as moderately effective methods. The lecture method, guided discovery, exhibition and programme learning were identified as the least effective teaching methods. Teachers have considered the nature of students and the practicability of methods when rating teaching methods according to their effectiveness. There was no considerable difference between teachers' awareness of effective teaching methods and most of them had rarely implemented those effective teaching methods in a regular manner in both zones. Instead of considering the effectiveness of methods, teachers tried to fulfill the short-term requirements related to the scholarship examination. Thus, a gap existed between the awareness of teachers on effective teaching methods and their implementation in the teaching-learning process of Environment Related Activities at key stage III.

**Keywords:** Environment Related Activities, Effective teaching methods, Primary Education

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## **A REVIEW OF LITERATURE ON THE INFLUENCE OF TEACHER AUTONOMY OVER THE USAGE OF STATE MANDATED CURRICULUM MATERIALS IN SCHOOLS**

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This paper was written based on a theme that emerged while reviewing literature for a larger research that investigated English literature teachers' usages and attitudes towards a state mandated teachers' guide issued targeting a benchmark examination in Sri Lanka. This review has attempted to incorporate several significant studies that observed connections between teachers, teaching materials and classroom instruction.

This review has mainly incorporated research articles and conference papers published between 1988 and 2015 that have investigated the use of curriculum materials in the classroom among teachers of different subjects; however, the majority of the research has been conducted in the United States targeting teachers of mathematics and sciences. They have appeared mainly in online journals, namely SAGE Journals, ERIC, Educational Researcher, JSTOR, Harvard Educational Review, and Elementary School Journal. The findings of the literature review suggest that there is a significant connection between teacher autonomy and the use of curriculum materials. As the literature advocates, teacher autonomy is seen as an integral part of good teaching and supports the perception that good and experienced teachers need not be told what to teach and how to teach. Hence, mandating the use of highly structured and detailed curriculum materials and teachers' guides has created negativity among some teachers. This review further points out, although the teachers are expected to use the teachers' guides in classrooms, the developers seem to be frequently overlooking the variances within the targeted teacher population and the differences in the classroom context. This situation can force teachers to disregard the use of previously set instructions and function autonomously. Drawing on the previous literature, this paper attempts to point out the need of conducting a sufficient number of exploratory workshops in order to incorporate teachers' perspectives and also to consider theories on teacher autonomy before designing and publishing curriculum materials.

**Keywords:** Classroom instruction, Teacher autonomy, Teachers' guides, Usage of curriculum materials

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**A STUDY TO DEVELOP A VALIDATED SCALE TO MEASURE THE  
LEVELS OF MOTIVATION AND ENGAGEMENT IN LEARNING  
AMONG EARLY ADOLESCENTS IN TWO LOW SOCIO-ECONOMIC  
DISTRICTS IN SRI LANKA**

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Low participation in learning of secondary students is a matter affirmed by examinations, mostly in low socio-economic districts in Sri Lanka. One of the central factors contributing to this situation may be students' motivation and engagement in learning. Therefore, this study tried to find out the levels of motivation and engagement among early adolescents. Motivation and Engagement Scale-Junior School (MES-JS) was employed to collect data and the confirmatory factor analysis was employed to measure the construct validity of the scale in relation to two low socio-economic districts. But it did not give a robust factor solution. Then, it was decided to conduct exploratory factor analysis (EFA). This paper aimed to investigate the EFA procedures conducted to derive a robust factor solution. This study employed quantitative research design to determine early adolescents' levels of motivation and engagement in learning in two low socio-economic districts in Sri Lanka. MES-JS (Martin, 2014) was administered among 100 Sinhala and Tamil-medium eighth grade students (50 students from each gender). The mean age of the students was 12.8 years. Schools were represented by type two government schools located in the Monaragala and Nuwara Eliya districts in Sri Lanka. This study used the PCA method of extraction to determine the final factor solution. The method used was the scree test in combination with eigenvalues to decide the number of factors to retain. The items in the four-factor solution demonstrated factor loadings between 0.601 and 0.823 and the four factors accounted for 59.05% of the total variance. The EFA analyses derived four factors in relation to early adolescents' motivation and engagement in learning in two low socio-economic regions of Sri Lanka. With an accurate and useful description of the underlying construct and with the theoretical meaning of the items in those factors, factor one was named "Failure Avoidance and Anxiety" (FAA), as it represents two lower-order factors (failure avoidance and anxiety) in negative motivation. Factor two was named "Positive Motivation" (PM), as it represents two lower-order factors (valuing and learning focus) in positive motivation. The third factor was named "Uncertain Control" (UC), as it represented most items in the uncertain control lower-order factor related to negative motivation. The fourth factor was named "Positive Engagement" (PE), as it represented all lower-order factors (planning, task management and persistence) in positive engagement. Overall, FAA and UC represent students' negative motivation for learning, and PM and PE represent students' positive motivation and engagement in learning.



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Keywords: Low socio-economic districts, Early adolescents, Motivation, Engagement, Exploratory factor analysis

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## AN INVESTIGATION OF THE COGNITIVE SKILLS REFLECTED IN EARLY CHILDHOOD DRAWINGS

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Children's drawings tell us about their psychological and physical development. Children cannot express themselves using words which is why drawings play an important role in communication. This study investigated how children in early childhood displayed cognitive abilities through their drawings. The main objective of this study was to identify cognitive skills shown through the drawings made according to the themes assigned by teachers. The study used the qualitative research method. The participants involved were pre-school children (N=12) and teachers (N=3) in the Maharagama Education zone, Western Province in Sri Lanka. Data was collected by the direct involvement of the researcher in the observation of children and studying the behaviours and responses of children and teachers. The data relevant to the study comprised friendly interviews, recorded information, photographs and pictures drawn by the children. With the assistance of educationalists well-versed in the field, the data was descriptively and comparatively analysed. One important finding of this study was that the drawings made by the children involved in the study contained not only real-life experiences, but also a combination of imaginative ideas. A large number could express themselves verbally. As a medium that can be used to promote speaking ability in children, most of these children had independently expressed creative ideas both verbally and non-verbally through their drawings. Moreover, most of the children manifested abilities related to basic mathematical concepts of objects and expressing spatial ability and using language relevant to spatial relationships. The study concluded that in early childhood, these children expressed their cognitive skills such as imagination, speech ability and basic mathematical concept through their drawings. However, the teachers should enhance their perspective and awareness towards their children's drawing to promote cognitive development.

**Keywords:** Basic mathematical concepts, Children's drawings, Cognitive abilities, Early childhood, Imagination, Speech ability

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**PERCEPTIONS OF STUDENTS ON INFORMATION AND  
COMMUNICATION TECHNOLOGY SUBJECT: WITH SPECIAL  
REFERENCE TO HIGH SCHOOL STUDENTS IN AMPARA DISTRICT,  
SRI LANKA**

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Information and Communication Technology (ICT) has turned out to be an essential cause of invention as well as the expansion of efficacy for various segments all over the globe. The implementation of ICT has become an interpretative portion of the education progression for school children both in outside and inside the classroom. As a result, the Sri Lankan government incorporated ICT into the school education in 2006 and has launched a new stream for GCE Advanced Level (A/L) called a Technology course in 2015. Therefore, this study was performed using a stratified random sampling technique by chosen samples from the respective stratum of 5 corresponding high schools in the Ampara district. A total of 300 questionnaires were issued among the students by written survey and email survey and out of these, 200 usable questionnaires were returned. Thus, the sample size was 200. This study was carried out to analyze the students' awareness in the ICT subject, the influence of computer facilities on students' choice of the subject, the influence of factors and parents' influence in the selection of the subject. Descriptive test statistics were also applied, and the necessary statistical analysis was performed using SPSS software. Further, 5% of the significant level was used in this study. The majority of respondents were males (56.5%), between 18-20 years old, and they had very negative perceptions and attitudes about the subject. Also, they strongly agreed that individual interest (42%) and career perusal (34.5%) were the main reasons to select the subject. 60.5% of students said the ICT subject prepared them to a great extent for their future career. 57% of them revealed that they had no computer laboratories and the equipment for teaching ICT (59%) was not adequate. Most of them had internet facilities in their schools (60%) which had influenced them tremendously to select the ICT subject (33.5%). Phone usage, technology adoption, computer laboratories, and availability of desktops and modems had significant influence on their subject selection. Teachers and parents had given guidance for their subject selection, but the principals had poor influence in relation to providing valuable guidance. They agreed that subject selection criteria orientations were very helpful in the selection of the subject (53.5%). The parents' or guardians' attitudes towards the ICT subject were positive (36%). Furthermore, the parents' or guardians' education level and their financial status were significantly related to the ICT subject selection. Therefore, this study recommends that the school principals should contribute their valuable



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support and guidance for their schoolchildren's subject selection criteria. Moreover, they should find ways to acquire computer laboratory and equipment for their schools. Also, the government should consider providing computer laboratory facilities and internet connectivity for all high-level schools. Indeed, it is recommended and necessary that school principals and teachers should arrange ICT subject awareness programs for students and parents/guardians for the betterment of society.

Keywords: Ampara District, High School, ICT, Influence, Parents, Students

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# **ENGINEERING AND TECHNOLOGY**



## **STUDY ON INFLOW TRAVEL PATTERN TO OUSL NAWALA**

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This study intended to analyse the inflow travel pattern to OUSL Nawala by identifying travel origins, and study the travel mode patterns and travel nature.

Pilot studies were conducted during midweek and the weekend to obtain an awareness of the size of survey teams for interviews and how to locate survey teams during the main surveys. Origin inflow pattern surveys were carried out via road side interviews on a Saturday (weekend) and a Wednesday (midweek), from 8:00 to 18:00 hours covering a 10-hour duration.

According to the questionnaire surveys the walkers and motorists coming to the OUSL through all four gates were contacted and more than 1000 respondents were interviewed. This survey captured around 58% of the total arrivals during the weekend and 56% during midweek. It was observed that a total of 51% of the university community were coming through Nugegoda. Most of them come from the Kotte DS division. Around 74% of community coming to OUSL use buses, while 9% come by trains.

As an outcome of this study a shuttle service of buses was designed to provide a better service to the OUSL users during rush hours (i.e. 8:00 am to 10:00 am). Shuttle services are proposed from Kotte, Kaduwela, Maharagama, Kottawa, Kesbewa, Gampaha and Dehiwala during weekends, and also from Kotte, Maharagama, Kaduwela, Kottawa, Kesbewa, Gampaha, Horana and Thimbirigasyaya during midweek.

**Keywords:** OD Pattern Study, OUSL Arrivals, OUSL Gate Study

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**FACTORS INFLUENCING CONSUMER PURCHASE INTENTION OF  
CLOUD COMPUTING SERVICE: A STUDY OF A DIGITAL SERVICE  
PROVIDING COMPANY IN SRI LANKA**

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Cloud computing is a technological innovation that more and more consumers are adopting because of its mobility and accessibility in storing data. With this state-of-the-art technology, information systems are shifting from traditional physical computers to virtual technology services with more benefits. The selected organization is a cloud service provider and their existing consumer demand is significantly behind the expected level. The purpose of this research is to examine the different factors affecting the customers' purchase intention of cloud computing services. A schematic diagram was developed based on social cognitive theory and the technology acceptance model to understand how perceived ease of use, perceived usefulness, ethical self-efficacy, innovation self-efficacy, performance expectancy and privacy impact purchase intention of cloud computing services. A survey questionnaire was used based on sixty-five potential customer responses to the selected organization. Data were analysed using Correlation and Regression analyses. According to the survey Perceived Usefulness, Perceived Ease of Use and Innovative Self-Efficacy significantly influence consumer purchase intention while Innovative Self Efficacy is the most influential factor.

**Keywords:** Cloud computing, Purchase intention, Perceived Usefulness, Perceived Ease of Use, Innovative Self-Efficacy, Ethical Self-Efficacy, Performance Expectancy, Privacy Concerns

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## **A STUDY TO INVESTIGATE THE IMPACT RESISTANCE OF CEILING SHEETS AND SEPARATION BOARDS MADE USING TEXTILE WASTE**

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Textile waste generation has rapidly increased with the rising levels of garment production. At present, all the textile waste is not being reused; they are generally dumped in open areas. That has created a huge environmental problem in Sri Lanka and all over the world. The main objective of this research is to investigate the impact resistance of ceiling sheets and separation boards made using textile waste.

The types of textile waste material and their combinations, resin type, suitable thicknesses for the planned composites and the weight ratios of textile waste material to resin were selected to perform the investigation. The test results of the composite samples were evaluated for various aspects to determine their suitability for the intended end uses. Thirty (30) composite samples were produced in 1x1foot size. In this study, the impact resistance and the weight of the samples were determined. The impact resistance of the composite samples of 25 mm thickness showed higher values than the impact resistance of the composite samples of 5 mm thickness for each of the three (03) fabric to chemical ratios. When each thickness was considered separately, it was evident that the breaking load of the tested composite samples increased with the increment of the chemical component. However, it was difficult to establish a relationship between impact resistance and fabric ratios used with the collected data. Further investigations should be carried out to determine the optimal fabric ratios. The values of the tested samples were compared with the two selected commercial products. As per the test results of the impact resistance of the tested composite samples, it is evident that the resulting values are higher than the selected commercially available products. It was also found that the developed composite samples can also be coloured using rubber, varnish paints and pigment dyes. Further studies should be carried out to investigate the compressive strength, tensile strength, thermal conductivity and possible water absorption etc. of the developed samples to perform a comprehensive comparison with commercially available products.

**Keywords:** Textile waste, Textile reinforced composites, Impact resistance, Ceiling and separation boards

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## **OPTIMIZATION OF PRODUCTION COST AND CURING TIME IN COMPRESSED STABILIZED EARTH BLOCK PRODUCTION PROCESS**

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Compressed Stabilized Earth Blocks (CSEB) made with natural soil as the main ingredient is a sustainable and eco-friendly alternative to burnt clay bricks and cement sand blocks. Excellent engineering properties, thermal comfort during any climatic condition and attractive appearance without plastering are added advantages of CSEB.

SLS1382: Part 1-3 specifies the standards applicable to CSEB in Sri Lanka. Engineering properties specified in SLS 1382 are dimensions, dry density, total water absorption, dry/wet compressive strength, bending strength, erosion resistance and linear expansion upon saturation with water. According to SLS 1382 a minimum cement content of 5% as a binder should be used and the produced CSEB should be cured for at least 28 days.

In this study, possibility of reducing the cement content further by partially replacing cement with fly ash, a pozzolanic material, was studied. Keeping the total binder content at 4, 6, 8 and 10% respectively, cement was partially replaced by mixing 5, 10, 15, 20, 25, 30, 35 and 40% fly ash. In addition, to further economize the production cost, above combinations of CSEB produced using a specially fabricated machine were tested after 7, 14, 21 and 28 days of curing. All the tests recommended in SLS 1382 were carried out.

Test results observed are very impressive. Even the CSEB produced with 4% binder (which is less than 5% specified by SLS 1382) with up to 10% fly ash replacement, achieved all required engineering properties stated above after 28 days of curing. All samples having binder content equal to or above 6% with fly ash replacement from 5 to 15% achieved the required engineering properties even after 7 days of curing. A cost analysis carried out indicated that the CSEB made with 6% binder with 15% of cement replaced with fly ash and 7 days curing, which satisfies all specified engineering properties, is the most economical out of the various combinations tested.

**Keywords:** CSEB, Cement, Fly ash, Blocks

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## **EFFECT OF CONTRACTOR'S PROFIT PERCENTAGE ON PRICE FLUCTUATION CALCULATED USING CIDA PRICE FLUCTUATION FORMULA**

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Price fluctuation is inevitable due to many reasons such as fluctuation of the price of oil, alteration in the technology and inflation in different parts of the world. When it comes to the construction industry, the fluctuations of the prices of construction inputs i.e. materials, labour, plant and equipment should be particularly studied since they can impact the contract cost significantly – ranging from the millions to billions in major projects.

The Price Adjustment (PA) technique for price fluctuations introduced by the Construction Industry Development Authority (CIDA) [formerly Institute of Construction Training and Development (ICTAD)] known as the “CIDA formula method for adjustment to contract price due to fluctuation in prices” has a constant of 0.966 based on a 15% fixed profit percentage according to the derivation of the formula. But the contractor’s overhead and profit margin vary widely and neither can be fixed for all projects nor for each and every construction contractor. Generally, it can vary according to the type of construction project and according to the contractor. Hence, the price escalations rendered by the CIDA formula do not represent the true fluctuation for a particular project or a contractor. Therefore, this study was carried out to investigate the degree of accuracy of the CIDA price fluctuation formula method compared to the conventional method using an automated spreadsheet. Furthermore, it discusses and interprets the deviation of the price escalation generated from the CIDA formula and the actual modified CIDA formula for contractor’s profit percentage.

The study shows the true escalation to a high-end contractor should be lower than the current escalation calculated by the CIDA formula for a particular project whereas a low-end contractor should be paid more than the current amount generated by the CIDA formula. Therefore, the current CIDA formula does not give the true price escalation from the point of view of the contractor’s profit percentage.

**Keywords:** Cost adjustment factor, Overhead and profit, CIDA formula method, Input percentage, Price escalation

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## OUSL ROUTE GUIDANCE NAVIGATION MOBILE APPLICATION

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The Open University of Sri Lanka is the premiere open and distance learning institution in Sri Lanka. The daily activity schedule of the university is published on notice boards by the Colombo Regional Centre along with the locations where these activities are held. All students registered with the Faculty of Engineering are given an activity diary at the time of registration for the degree programme. The activity diary contains course related details such as the type of the activity, the date and the time, without the venue of the activity being held. The information is given course-wise and the students have to filter the activities per day according to their registration.

Not knowing the location of an activity before arriving at the university makes it challenging to find the location and becomes a problem if the student is late. A person will take an average time of 15-17 minutes to walk from the Nawala entrance to Narahenpita entrance as shown in Google maps approximations.

As a solution to the above mentioned scenario this research aimed to develop a software system that will handle activity schedules and provide navigation instructions inside the university premises. The system consists of two main components a mobile app and a web application. Both components use a MySQL centralized database. The mobile application is developed using android technology and uses GPS technology with Google maps to guide students to class rooms. Some additional features such as checking of the upcoming schedules, all schedules and notices of updated activities are provided as well.

The web application is used to update schedules, classroom locations, change requests and is developed using web development technologies such as PHP, MySQL and Laravel framework and the web frontend uses HTML, CSS and Javascript. The web portal can be accessed by lecturers and the relevant administrative staff. The web portal does all CRUD operations of maintaining information of the solution where database updates are made.

The total solution will enable the students to know the locations of their activities before coming to the university and will provide navigation instructions to find the venue of the activity in a more personalized manner.

**Keywords:** Navigation, Mobile App, Web Application, Location

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## **ENERGY OPTIMISATION OF HOTEL BUILDING PROJECTS: CASE STUDY**

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In general, electrical power consumption in high-rise hotel buildings is comparatively larger than it is in other types of high-rise buildings. It is due to the extra lighting level requirement, air conditioners and hot water system requirements and also due to kitchen and laundry equipment. Due to this high electricity consumption, the monthly electricity bill will drastically increase. Therefore energy optimization plays an important role in the hotel sector. Thus several kinds of energy optimization including demand response (DR) activities and demand side management (DSM) activities can be applied to reduce electricity consumption and subsequently electricity bills can be reduced to save money.

This study proposed several optimization methods for an on-going hotel building project in Galle which has 12 floors and 100 guest rooms. DR activities, DSM activities, heat recovery from chiller condenser and the operation of kitchen boiler using bio-gas are proposed energy saving methods for this hotel building. Load calculation was also carried out after carefully analyzing the technical drawings of the hotel. The study emphasizes characterizing and describing DR control strategies for air-conditioning and ventilation systems. Under DSM lighting control strategies are also discussed and analyzed. This study discusses several DR and DSM activities which can be applied to hotel equipment to reduce energy consumption on the consumer side. This study also provides two other important energy saving opportunities such as heat recovery from condenser and the application of bio-gas plant for kitchen boiler operation. Using the above energy saving methods the monthly electricity bill was reduced by nearly LKR 700.000.00 and the total payback period was calculated at around 5 years if all four systems are implemented as discussed

Keywords: Demand Response, Demand Side Management, Energy consumption, Load calculation

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## **A STUDY ON GREEN CLOUD COMPUTING: APPROACHES AND STRATEGIES**

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We are rapidly moving towards a world that wholly depends on technology and it is advancing each day. As an alternative to the traditional office-based computing, network-based cloud computing is rapidly growing. However, the data centers providing services to users consume huge amounts of electrical energy, contribute to high operational costs and carbon emissions to the environment. Therefore, the industries are looking for technologies with Green Cloud Computing. Green Cloud Computing is the usage of computers and their related resources in an eco-friendly manner. Green Cloud Computing is considered to be a solution for the IT companies and users to use Cloud and its perks due to the fact that it reduces the negative impact to the environment and general costs by energy efficiency, carbon footprint and e-waste reduction. These technologies pave the way for companies to practice eco-friendly systems. This paper discusses the high-level system architecture of Green Cloud Computing and its major components. The approaches which have been proposed and presented by several researchers are explained in detail in the paper. The paper includes the concept of virtualization. Also, it includes the other approaches which have been proposed by several researches in order to reduce energy consumption and carbon dioxide emissions. The important features of Green Cloud Computing are also discussed in the paper.

**Keywords:** Cloud Computing, Green Cloud Computing, Virtualization, Live Migration

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## MODELLING CALL DISTRIBUTION IN CALL CENTRES

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Call centres have become popular among many industries as a method of centralizing information services by providing customer support and streamlining business processes. A call center typically has different call queues implemented for incoming calls based on their business requirements. But the call distribution to the desired call center agent is not always fair and efficient which results in low productivity and efficiency. This research introduces an effective, efficient and fair call distribution model to use in call centers.

To achieve the desired target, a suitable forecasting model was identified to forecast an hourly average call waiting time of calls in all the implemented queues in a call center. A simulator was implemented to simulate the call queue and thereby to test the proof of the concept. The extracted data were transformed into an algorithm written in Python and fed into the Holts Winter algorithm's additive method. Then a solution was introduced to capture the unpredictable scenarios where forecasting of the average call waiting time can differ from the predicted values. To guarantee fair call consumption, an algorithm was introduced for the allocation of calls from different queues to a common pool.

The histograms drawn for the data before and after applying the model show that the distribution is changed from negative skewness to a positive skewness which concludes that the model has improved the call distribution.

It can be concluded that call distribution can be optimized by reducing the call waiting time in queues, if all the calls in different queues are treated equally at all situations. Considering unpredictable situations and the last few months' calls waiting trends, the call allocation can be highly optimized.

Keywords: Call center, Performance, Call distribution model, Fairness

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## INVESTIGATION OF STRUCTURAL CHARACTERISTICS AND THERMAL PROPERTIES OF ASH CARBONISED FROM LOCALLY AVAILABLE RICE STRAW VARIETIES

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Sri Lanka being an agricultural country generates a significant amount of rice straw per annum as a by-product from rice production. As a general practice, rice straw is either burnt or ploughed into the field without being converted into a productive output. However, rice straw has a very high potential for the production of very effective secondary raw material such as filler in rubber compounds and pozzolanic material for cementing systems due to its random availability, very high silica content and relatively low cost. After burning rice straw at a controlled temperature, around 10 to 15 percent of mass rice straw is converted into high quality value added ash. Rice straw ash is rich in silica, alkaline and alkaline earth metals which can be used as a source of alkalis and silica in industrial applications. In this research, locally available rice straw varieties BG352 and Murunkan were converted into rice straw ash by carbonizing them at 550 °C for 6 hours. An extensive analysis was performed on rice straw ash to investigate its structural, morphological and thermal characteristics using X-ray diffractometer, scanning electron microscopy (SEM), and thermogravimetric analysis (TGA). The study reveals that the above rice straw varieties contain around 10 percent of ash with 70 - 75 percent silica rich residue. SEM micrographs show dispersion of silicon compounds dispersed across the rice straw ash surface. Presence of silica in amorphous form was confirmed in x-ray diffractogram along with secondary minerals arcanite and calcite. Crystalline percent of both rice straw and straw ash of the Murunkan variety is higher than that of BG352. Thermal analysis showed four endothermic peaks for rice straw ash where the third peak located between 600 - 850 °C is attributed to the amorphous silica. Thermal analysis also exhibits greater weight loss with lower crystallinity. It can be concluded that rice straw ash derived from locally available rice straw varieties BG352 and Murunkan can be employed as a silica rich source in industrial applications.

**Keywords:** Agricultural waste, Rice Straw Ash, Value addition, Structural characterisation, Thermal properties

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## DESIGN OF A HIGH PRECISION YARN EVENNESS TESTER

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Yarn evenness is a vital parameter in maintaining quality in fabric manufacturing where uneven yarn can result in poor quality in fabric. Moreover, uneven yarn has a tendency to break during the knitting process which will bring a production line to a standstill for some time. Consequently, high attention is paid in selecting yarn with an acceptable evenness for fabric manufacturing. Among many yarn evenness measuring techniques, the capacitance-based Uster machine and the image processing-based optical technique are very popular. The Uster technique passes the yarn between two capacitor plates where the capacitance variation in the arrangement reflects the yarn evenness variations. This technique is cost-effective but readings are severely affected by environmental factors such as humidity and the yarn material. Thus, the two camera-based optical technique is preferred in view of its high accuracy and lower dependency on external factors. The optical technique captures two images of yarn in planes perpendicular to each other and then calculates the diameters employing image processing which we named the 2D technique. Furthermore, the Uster machine outputs coefficient of variance ( $CV_m$ ) of mass per unit length readings while the optical technique outputs the diameter ( $d$ ) of yarn. We first brought the two dimensions to a single platform by using the fact that  $m = \frac{\pi d^2}{4} \times \rho$  where  $m, d$  and  $\rho$  represent the mass per unit length, cross sectional diameter and the density of yarn. Thus,  $CV_m = CV_{d^2}$  where  $CV_{d^2}$  represents the coefficient of variance of  $d^2$ . Moreover, we implemented a prototype optical testing unit including an adjustable camera. With this setup, the diameter readings of 10 selected sample reels of yarn were measured and the  $CV_{d^2}$  were calculated. At the same time, the same set of samples were measured for  $CV_m$  using the Uster machine.

We also proposed a three camera-based optical technique (3D technique) and expected the same to be more accurate since three cameras placed in planes angled 120 degrees to each other can capture the yarn diameter variations hidden to the two perpendicular planes in the 2D system. Using the same camera setup three camera-based images were captured, diameters calculated and the  $CV_{d^2}$  was also calculated. Moreover, the average diameters for each reel were also calculated under the two techniques.



From the results it was clear that the average diameter values were similar, but the CV values under 3D were higher than that under 2D. Since the CV value is the ratio between the variance and the mean value, it implies that the 3D technique had a higher variance value than the 2D for the same individual yarn reels tested. It can be concluded that the 3D technique was able to capture the variations in diameter better than the 2D technique. At the same time the 2D optical measurement-based CV value was higher than the Uster technique-based CV value converted to the same  $d^2$  dimension. However, we did not have the explicit mean values of the mass per unit length under the Uster technique so we could not directly conclude that the 2D technique was more accurate than the Uster technique. Measuring the mean value of the mass per unit length of a given yarn, converting the same to the mean diameter using  $= \frac{\pi d^2}{4} \times \rho$  and comparing with the mean diameter reading of the 2D optical technique could be interesting future work which enables one to perform a clear accuracy comparison between Uster and 3D techniques.

*Key words:* Yarn evenness, Uster technique, Optical technique, Coefficient of variance

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## **IMPROVING SEWABILITY OF 100% COTTON SINGLE JERSEY FABRICS USING SOFTENERS**

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Sewability means the ability and the ease of 2D fabric pieces to be qualitatively and quantitatively sewn into a 3D garment. Sewing damage due to poor sewability is one of the most troublesome problems for knitted fabrics faced by apparel manufacturers. Sewability depends on various parameters like fabric construction, structural parameters of knitted fabrics, fabric finishing treatments, sewing needles and sewing machine parameters. To reduce sewing damage, needles should have the ability to penetrate the fabrics easily. The L & M sewability tester can be used to measure the sewability of a fabric and sewability is expressed based on the sewing needle penetration force indicated by the tester. Low sewing needle penetration force means good sewability. Fabric softeners are fabric finishing agents that makes fabrics soft, brilliant, greasy and more elastic resulting unacceptable handling.

For this study, 100% cotton single jersey fabrics from three different fabric areal densities (GSMs) with three stitch lengths were used. They were treated with silicone and cationic softeners with three different concentrations (10 g/l, 20 g/l and 30 g/l) and tested for sewability using three sewing machine needle sizes. The sewability values that were obtained are recorded and statistically evaluated. Needle sizes and softener types and concentrations were selected based on industrial applications in Sri Lanka. According to the results, needle penetration force has a positive correlation to the needle size. Because needle size is measured based on the diameter of the groove, the higher needle sizes have higher thickness at the groove area, which requires more force to penetrate the fabric. This may damage the fabric and possibly deform the knitted structure and unravel the knitted stitches in the fabric, which in turn will reduce sewability. Thus, needle penetration force demonstrates a negative correlation with stitch lengths. With lower stitch lengths, fabric cover factor is higher (denser the fabric) and has more stitch densities and therefore higher force is required on the needle to penetrate the fabric, which may also cause to damage the fabric and reduce sewability.

Fabrics treated with cationic softeners and silicone softeners show comparatively good sewability than untreated fabrics. When compared with the results obtained from treated fabrics, the silicone softener treated fabrics demonstrate better sewability than cationic softener treated fabrics. When using both softeners, the highest concentration, 30 g/l, gives the lowest needle penetration forces, and further, the needle penetration forces given by silicone softener-treated fabrics



are comparatively lower than that of cationic softener-treated fabrics. Therefore, silicone softeners improve the sewability of 100% cotton single jersey fabrics more effectively compared to cationic softeners, and for best sewability results, the softener solution with the highest concentration (30 g/l) can be recommended. Even though, silicone softeners give better sewability (lower needle penetration force) compared to cationic softeners, silicone softeners are double in price compared to cationic softeners in the market. However, it was found in the literature that silicone softeners give very important finishing effects on fabrics and garments in addition to sewability. Nevertheless, from a commercial point of view, cationic softeners are economical for use in the apparel industry to minimize seam damages and improve sewability. Therefore, apparel manufacturers have to select a suitable softener to improve the sewability of fabrics while considering cost effectiveness as well.

**Keywords:** Sewability, Single jersey fabrics, Cationic softeners, Silicone softeners, Needle penetration force.

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# **ENGLISH LANGUAGE TEACHING**



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**THE UNSUCCESSFUL STORY OF LANGUAGE TEACHING: AN  
INVESTIGATION INTO THE CONSTANT STRUGGLE TO TEACH  
ENGLISH AT UNIVERSITY WITH SPECIAL FOCUS TO THE  
UNIVERSITY OF RUHUNA**

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This study explores the factors that have made ELT at university level a struggle. It cannot be forgotten that the knowledge of English among undergraduates varies at entry and exit due to varied socio-economic problems. However, it is the responsibility of university lecturers to cater to their desires throughout their studies at the university. Since the majority of the ELTUs of the Sri Lankan government universities were unsuccessful in achieving the required objectives, this study was conducted to identify the reasons behind this failure and to recommend remedial measures that can be taken. The study was qualitative in nature and gathered data from fifty-five lecturers in the Faculty of Humanities and Social Sciences of the University of Ruhuna who were interviewed. The interviews were semi-structured. In addition, classroom observations were carried out during language learning sessions. The research followed a thematic approach in an inductive manner. Poor knowledge of English at entry, low attendance, less participation in learning, ragging, students' and non-language teachers' attitudes towards English, the priority given to core-course units, lack of motivation, and compartmentalization were reported as the challenges and factors which made teaching English a struggle. Thus, it is argued that there should be considerable changes in the system to equip undergraduates with the knowledge of English. Novel and innovative teaching methods with the use of advanced technology will hopefully help create a passionate language learning environment.

Keywords: Challenges, Socio-economic, Struggle, Undergraduate, University

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**A QUALITATIVE STUDY OF NOVICE RESEARCHERS'  
EXPERIENCES IN COMPLETING THEIR UNDERGRADUATE  
RESEARCH PROJECT**

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Research is an integral part of most of the undergraduate honours degree programmes and undergraduates are expected to complete a research project at the end of the final year. The final year students of the BA in English and English Language Teaching degree programme offered by the Open University of Sri Lanka are also expected to complete an independent research project and submit a dissertation. This task utilizes a range of skills already developed in the four-year programme which includes academic writing skills, information gathering skills and application of principles of research methodology and it is mentored by a member of the academic staff. This process also poses a series of new challenges and opportunities by comprising tasks that require independent work such as identification of an area of research, creating a feasible research design, data gathering, data analysis, and writing up. Given the new demands of this particular component of learning it is important to understand the challenges faced by students and the strategies that they employ in successfully navigating the various components of this process. Hence, the present study attempts to study the research experience of BA in English and ELT undergraduates who completed the project in the year 2017/2018 and identify the challenges faced by them. The study revealed areas which need attention when providing support to undergraduate research students.

**Keywords:** Undergraduate research, Challenges of novice research, Thematic analysis

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## ENGLISH LANGUAGE LEARNING AMONG STUDENT TEACHERS: EXPERIENCE AND DEMANDS

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The English Language Learning of student teachers has been studied less frequently by researchers. There is reason to believe that the language learning experience of student teachers is different from the language learning experience of other learners as they are influenced by the professional demands that will be placed on them in the future. As Braine (2010) explains, the non-native speaker English teachers' professional confidence and "self-perceptions" depend on their competence in the language. If so, the future professional image of a student teacher should have an impact on his/her present language learning. This leads to the belief that student teachers should invest time and effort in improving their language skills. In such a backdrop, the current study was conducted to investigate the English language learning experience of a group of student teachers reading for the Bachelor of Education in English Language Teaching in the first year at a state university. The focus-group discussion method was used to collect data from a purposive sample of 5 undergraduates and the results were organized thematically. The participants stated that continuous language assistance is essential for them, and that the lessons should focus on grammar. The participants also expressed displeasure in the assumptions made regarding their language competence, and stated that irrespective of their proficiency level, they need to be provided with language assistance. It was also clear from the discussion that the responsibility of becoming teachers in the future highly affected their urge to develop good language skills.

Keywords: Language assistance, Language learning experience, Professional demands, Student teachers

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## **DIVERSE DIRECTIONS: SOME CONTEMPORARY DEVELOPMENTS IN UNIVERSITY ELT**

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This paper examines a few of the tensions, considerations, and implications of a recent decision made by Sri Lanka's University Grants Commission (UGC) to upgrade existing English Language Teaching Units (ELTU) and English Language Teaching Centers (ELTCs) to Departments of English Language Teaching (DELT). Furthermore, nine of the fifteen ELTUs in State Universities have been upgraded to DELTs since 2016, the majority of them following the adoption of this policy decision by the UGC. Based on the first stage of a much larger research into contemporary developments in English Language Teaching (ELT) in state universities, the data for this paper is drawn from publicly available information and data relating to the need for and funding available to improve ELT at tertiary level as well as proposals made by five of the nine ELTUs to request upgrades to Departmental status. Utilizing a qualitative content analysis methodological approach, this paper explores the approaches to ELT as well as the construction of both the learner and the ELT institution through these documents. The study finds that funders such as the World Bank and policy makers such as the UGC articulate the value of ELT within the context of the "world of work". In contrast, the DELT proposals analysed for this study highlight a far more complex articulation of the concerns and priorities for ELT in State Universities. This paper identifies tensions relating to professional focus, course delivery, final product, and aim of ELT at university level. It also highlights the tensions between the needs of globalization and the concerns about local contexts. It concludes by pointing to the diverse approaches to ELT across state universities and notes the need to pay attention to how these varying approaches navigate the tensions highlighted in this paper as DELTs are further institutionalized within the State University system in Sri Lanka.

**Keywords:** Sri Lanka, University, Tertiary Education, English, English Language Teaching

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## **PERCEPTIONS OF THE VISITING ACADEMICS ON COURSE MATERIALS OF ENGLISH FOR LEGAL STUDIES PROGRAMME IN THE OPEN UNIVERSITY OF SRI LANKA**

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EAP (English for Academic Purposes) is a needs driven activity; that is, EAP courses, in their design and implementation, aim to address the future academic needs of their participant students (Bruce, 2015). According to Bruce (2015) EAP and such other courses are called *bridging courses*, the underlying idea being that the course forms a metaphorical bridge over which the students can get from where they are, in terms of their current knowledge, skills and educational development, to where they need to be in order to participate in the discipline specific courses of the university. In this process, the teachers' role in identifying and addressing the learning needs of students is crucial to the success of the learning outcome. As such, this study was conducted with the objective of finding out the views of the visiting academics who teach in the English for Legal Studies (Part 2) about the course materials currently being used.

Course materials play a central and a dynamic role, specifically in the courses offered in distance mode. As the course is offered in distance mode, it needs to cater to the demands placed by distance education materials, the mode of delivery and the requirements of the stake holders (learners, teachers, materials writers, language experts and the institution). This study explored the blend of the needs and suggestions of stakeholders (visiting academics) with the mode of delivery and institutional requirements to produce the optimum course outcome. The outcome of the study directly contributes to the development of the new course in English for Legal Studies which is being designed with a supplementary online component.

A sample of 19 visiting academics were selected as a purposive sample to represent the regional centres where day schools are conducted for the English for Legal Studies Programme. Data were collected using a questionnaire and a semi-structured interview as research instruments. Data were analyzed qualitatively and quantitatively

The results revealed that many aspects of course materials need improvement. Though the visiting academics in general acknowledged the high relevance and specificity of materials as ESAP (English for Specific Academic Purposes) materials, supplementation in terms of activities and subject specific content has been suggested. The study concluded with several suggestions from the visiting academics to further update, revise, supplement and make the course more inclusive by taking the less proficient learners into consideration.

**Keywords:** English for Legal studies, course materials, visiting academics, ESAP

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## Featured Panel Discussion

### Revisiting and Re-envisioning approaches to ELT research

Presenters:

Dr. Sreemali Herath – *Post Graduate Institute of English, The Open University of Sri Lanka (smher@ou.ac.lk)*

Ms. Pavithra Charuhasini Wathuge - *General Sir John Kotelawala Defence University (charuhasiniwathuge@gmail.com)*

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Ms. Dilini Ranasuriya - *University of Vocational and Technology (diliniranasuriya@yahoo.com)*

Moderator: Ms. Mihiri Jansz (*Post Graduate Institute of English, The Open University of Sri Lanka*)

English language teaching as a discipline has been researched through quantitative, qualitative and mixed approaches. All these approaches have been valuable in establishing a solid understanding of the complex processes involved in teaching and learning a second language. However, choosing a method that allows us to unravel such complexity is crucial. Very often researchers struggle with the choice of the methodology and the data collection tools that would best yield the data they need to answer their research questions. This panel brings together researchers and classroom practitioners who work in diverse tertiary contexts and research on topics that impinge on language teaching in different ways. Drawing on from their own empirical research, each presenter talks about how they re-envisioned ELT research through their methodological choices to explore their research questions. Each presenter will talk about their research problem, the research method they used to explore their respective topics, why they chose a particular method, and data collection tools that were used to collect data. They will also talk about the challenges and dilemmas in doing ESL research. The panel will create opportunities for open discussion for the audience to share experience and ask questions.

# **HEALTH SCIENCES**



## ENDOCANNABINOID SYSTEM: A NOVEL DRUG TARGET FOR PARKINSON'S AND ALZHEIMER'S DISEASE

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Neurodegeneration leading to Parkinson's Disease (PD) and Alzheimer's Disease (AD) has become a major health burden globally. Current treatments target controlling symptoms but no therapeutics are available to arrest the neurodegeneration or repair the degenerated neurons. Thus, the demand for novel research on the two disorders is imperative. This literature study aims to identify the research scope of current therapeutics and the use of endocannabinoid system (ECS) as a potential drug target for PD and AD within the country and globally through published literature. A wide literature survey was conducted using the key-terms "Parkinson's", "Alzheimer's", "endocannabinoid", "THC", "CBD", and "Sri Lanka" with Boolean "AND" on the Google Scholar search engine and NCBI database. PD characterised by progressive death of dopaminergic neurons and intracellular accumulation of Lewy bodies enriched in  $\alpha$ -synuclein leading to motor-symptoms frequently treated with L-DOPA and deep brain stimulation. Recent gene modification and remodelling techniques such as CRISPR through human embryonic stem cells and induced pluripotent stem cells have shown to be a promising strategy for personalised medicine. AD characterised by extracellular deposits of amyloid  $\beta$ -senile plaques and neurofibrillary tangles of tau protein commonly uses choline acetyltransferase enhancers as therapeutics. The ECS is currently being studied as PD and AD drug targets where overexpression of ECS receptors exerted neuroprotection against PD and reduced neuroinflammation in AD on a global-scale. No published data of ECS based research for PD and AD were identified within the country. The THC and CBD cannabinoids of plant *Cannabis sativa*, has shown neuroprotection for PD and AD animal models, yet triggered toxic effects on patients when administered directly, therefore, understanding the precise molecular cascade following cannabinoid treatment is suggested focusing especially on gene expression to identify drug targets for preventing and repairing neurodegeneration.

Keywords: Parkinson's disease, Alzheimer's disease, Endocannabinoid, THC, CBD

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## **KNOWLEDGE, PRACTICES AND BARRIERS AMONG HOSPITAL CLEANERS ON SAFE WASTE TRANSPORT AT THE KANDY TEACHING HOSPITAL**

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Safe waste transport is the process of transporting health care waste that is generated during diagnosis, treatment or immunization of humans or animals in any health care facility from generated area to storage, without any hazards to the environment and the community. Waste transport is equally important as waste segregation in effective waste management. In this study safe waste transport is defined as transport of segregated waste from wards, clinics or special units to the main waste storage area. Hospital cleaners are the designated personnel for waste transport at the Kandy Teaching Hospital.

The aim of this study was to examine the knowledge, practices and barriers among hospital cleaners on safe waste transport at the Kandy Teaching Hospital. Methods: A quantitative non experimental descriptive study. An interviewer administered questionnaires to a convenience sample of 160 hospital cleaners in the Teaching Hospital Kandy. Data analysis was carried out with descriptive statistics using Microsoft Excel.

The results revealed that 53% of cleaners had enough knowledge regarding safe waste transport measures. Among the participants 56% were aware of World Health Organization recommended transport measures such as using carts or trolleys and 67% of cleaners had knowledge about the importance of wearing protective equipment. 51% of cleaners engaged in malpractices during safe waste transport where 95% of participants used only polythene bags for waste transport. Furthermore, 53% of cleaners showed that they have been affected by some possible barriers to effective waste transport. It is stated that 57% of hospital cleaners were not provided with sufficient heavy duty gloves, masks and boots while 69% revealed that they were not provided training regarding safe waste transport.

Study findings highlighted that knowledge and practices of cleaners are at an acceptable level which is more than 53% but barriers inhibit the appropriate practices. Therefore, strengthening of educational and training programs is needed.

**Keywords:** Health care waste, Safe waste transport, Hospital cleaners, Teaching Hospital Kandy

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## DEVELOPMENT OF SUGAR-FREE CINNAMON BISCUITS AND EVALUATION OF ITS QUALITY CHARACTERISTICS

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Biscuits are a popular snack food consumed in Sri Lanka. Sugar-free biscuits with natural sweetening substances have become popular at present due to the health concern over high sugar foods. Cinnamon (*Cinnamomum zeylanicum*) contains a natural sweetening substance named mannitol in addition to its main active ingredient cinnamaldehyde. This study was carried out to develop sugar-free cinnamon biscuits and an evaluation of its quality characteristics. Biscuits were formulated partially replacing wheat flour with rice flour (100:0, 75:25, 50:50, 25:75, 0:100) and fully replacing sugar with cinnamon powder (5g, 10g, 15 g) and baked in an oven at 180 °C for 10 minutes. The prepared biscuits were subjected to physical, nutritional and sensory analysis to evaluate the suitability of biscuit for consumption. Based on the results of this analysis, formulation of wheat flour and rice flour (25:75) with cinnamon powder (15g) was found as the most preferred formulation. The nutritional content of this formulation is carbohydrate 56.02%, protein 5.76%, total fat 25.46%, ash 4.02% and fibre 5.07%. Results of sensory analysis revealed that there was no significant difference between wheat based flour sugar-free cinnamon biscuit and the developed composite sugar-free cinnamon biscuit. Aerobic plate count was zero during three months of storage period. Zip-lock bag can be selected as primary packaging due to its durability and paper board was selected as secondary packaging material due to eco-friendly attributes. In conclusion, cinnamon can be a potential source to replace sugar with good keeping and eating qualities.

Keywords: Biscuits, Sugar-free, Cinnamon

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## THE RELATIONSHIP BETWEEN SELF- EFFICACY AND PERCEPTIONS OF ILLNESS SEVERITY

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Self-efficacy refers to a person's belief in his or her ability to organize and perform certain actions in order to achieve goals. Self-efficacy has been identified as one of the most influential predictors of health-related behaviours. Medical prognoses may change self-efficacy which influences certain health outcomes. Research also suggests that the way an individual views his or her illness may have an impact on determining health outcomes. The aim of this investigation was to examine the link between patients' perceptions of severity of illness and susceptibility to illness and their self-efficacy. A sample of 164 individuals who were selected using convenience sampling completed a questionnaire assessing their beliefs and perceptions related to severity of illness and susceptibility to illness, and self-efficacy. Findings suggested that there is a significant relationship between individuals' perceptions of the severity of illness and their self-efficacy levels. Accordingly, if they were to develop certain health problems, those who perceive their illness as severe seem to have high levels of self-efficacy. Individuals with strong self-efficacy beliefs will regulate their motivation, mental processes, and also the environment to successfully engage in certain health behaviours that lead to positive health outcomes.

Keywords: Health, Self-efficacy, Severity of illness, Health behaviours

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## **MULTIPLE SCLEROSIS AND NEUROMYELITIS OPTICA: A CASE-CONTROL STUDY OF SERUM OXIDATIVE BURDEN AND VITAMIN D LEVELS**

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Oxidative burden arising from an imbalance of oxidant-antioxidant balance, and lower vitamin D levels has been identified as potential risk factors in demyelinating diseases such as Multiple sclerosis (MS) and Neuromyelitis Optica (NMO) which are of autoimmune origin. The current study explored the oxidative burden of MS and NMO patients based on oxidative stress, antioxidant parameters and serum vitamin D levels. Neutrophil-Lymphocyte Ratio (NLR), Total protein (TP), Nitric oxide (NOx) and Lactate dehydrogenase (LDH) were the oxidative parameters tested and the antioxidant parameters: Total antioxidant status (TAS) and Catalase (CAT), and Vitamin D were measured. The study consisted of 2 test groups: MS, and NMO, 2 control groups: disease controls (OND) and healthy controls (HC) (15 participants/group). While levels of NLR ( $p>0.05$ ), TP ( $p<0.05$ ) and NOx ( $p<0.05$ ) were higher in MS patients, in contrast the levels of LDH ( $p>0.05$ ), TAS ( $p<0.05$ ) and CAT ( $p>0.05$ ) were higher in NMO patients. Vitamin D levels of MS and NMO patients did not show a difference and levels were similar to HC. Thus, the higher oxidative burden was evident in MS patients than NMO patients and vitamin D might not be a risk factor in the Sri Lankan context. Further studies on the underlying mechanisms of the oxidative burden would be useful to implement antioxidant therapy to treat these diseases.

**Keywords:** Multiple Sclerosis, Neuromyelitis Optica, Oxidative stress, Antioxidants, Vitamin D

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## COMPARISON OF PERCEIVED QUALITY OF LIFE BETWEEN PATIENTS WITH MYOCARDIAL INFARCTION FOLLOWING THROMBOLYTIC THERAPY AND PERCUTANEOUS CORONARY INTERVENTION

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Assessing the quality of life (QOL) of patients with Myocardial Infarction (MI) following different treatment options helps to determine the success of the management and to ascertain QOL related problems. This study aimed to compare the perceived QOL between patients with MI following thrombolytic therapy and Percutaneous Coronary Intervention (PCI) at the medical and the cardiology clinics at the National Hospital of Sri Lanka (NHSL), Colombo.

This was a descriptive comparative study conducted in March 2018. A sample of 50 adult patients of both genders who had undergone thrombolytic therapy or PCI due to acute MI during the month of December in 2017 was recruited for each group using a convenience sampling technique. Ethical approval was obtained for the study. All the patients consented voluntarily and signed informed consent was obtained. In addition to socio-demographic information, QOL was assessed using the interviewer-administered Sinhala version of SF-36 of the questionnaire which comprises eight domains: physical functioning, role limitations-physical, bodily pain, general health, vitality, social functioning, role limitations-emotional, and mental health. The score of each subscale was computed onto a scale of 0–100 where a high score denotes a high QOL and vice versa. The majority of the participants were males. 73% (n=73) and were between 46–60 years old (82%). A high proportions of patients in both groups had hypertension and diabetes (>74%). Most of the QOL scores obtained for patients with MI following thrombolytic therapy were lower than 50% (mean 19.0 – 48.5). Compared to the QOL of MI patients who had undergone thrombolytic therapy, MI patients who had undergone PCI had significantly higher QOL scores in the eight QOL domains of SF-36 ( $p<0.0001$ ). A remarkable difference of QOL scores was found in domains of role limitations-physical and role limitations-emotional between these two groups (Mean 19.00 vs 95.50; 37.33 vs 98.00 respectively,  $p<0.0001$ ). The majority of MI patients who had undergone thrombolytic therapy and PCI were males and had diabetes and hypertension. The QOL of patients with MI following thrombolytic therapy was poor. The QOL of patients with MI was significantly improved after PCI than thrombolytic therapy.

Keywords: Myocardial Infarction, Percutaneous Coronary Intervention  
Quality of Life, SF-36\*

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## **EFFECT OF QUALITY AND QUANTITY OF HUMAN DNA EXTRACTED FROM FORENSIC HAIR SAMPLES FOR SUCCESSFUL PCR AMPLIFICATION**

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The introduction of PCR to Forensic Science has significantly expanded the ability to analyse DNA from small and degraded biological samples. Forensic hair plays an important role in identifying individuals during criminal investigations. Since the amount of DNA present in hair samples are less, PCR has been frequently unsuccessful. Therefore, this study was conducted to identify the causes for failure of PCR amplification of DNA in forensic hair samples and to find a possible solution to overcome the problem. The study was conducted with 443 hair samples and analysed as DNA forensic evidence at GENETECH Colombo. Qualitative and quantitative data on the hair samples and their success in PCR were assessed. A comparative analysis of a set of samples were incorporated in order to suggest a better analysis method. The results of the study showed that extracts from hair with root contained 6.44 ng/μL of DNA and they produced a rate of 31.8% of successful PCR amplification while hair without root contained 8.47ng/μL of DNA, but produced only 18.0% rate of successful PCR amplification. There were no significant associations between the amount of DNA ( $p=0.433$ ), quality of DNA on the success of PCR. An increase in the number of PCR cycles caused an increase in the success rate by 16.67%. These results concluded that the amount of DNA in hair samples and quality of the extracted samples does not affected for the success rate of PCR amplification. The failure rate of PCR amplification of DNA from forensic hair can be overcome by increasing the number of amplification cycles in the PCR procedure.

**Keywords:** Forensic hair, Deoxyribonucleic Acid, Polymerase Chain Reaction

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## **DETERMINATION OF CHANGES IN RBC PARAMETERS OF MRI SAMPLES STORED AT ROOM TEMPERATURE**

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Thalassaemia is the most common inherited genetic haemoglobin disorder in the world. The prevalence of  $\beta$ -Thalassaemia carrier state in Sri Lanka is estimated at 2-4%. Department of Haematology at the Medical Research Institute (MRI) serves as a national thalassaemia screening centre under the "National thalassaemia prevention programme" conducted by the Ministry of Health. Full Blood Count (FBC) is done as the first step in thalassaemia screening of fresh EDTA specimens. The samples with low haemoglobin (Hb) or low red cell indices (MCV<80fl/ MCH<27pg) are subjected to the HPLC (High Performance Liquid Chromatography) test which is performed as the confirmatory test. Blood specimens are frequently delivered to the Department of Haematology at MRI after a significant post collection interval at room temperature (RT). As the diagnostic procedure completely relies on laboratory test parameters of RBC and HPLC, precise and accurate test results are very important for correct interpretation.

The objective of the study is to see clinically significant changes in RBC parameters in the FBC test during 24 hrs when samples are kept at RT.

A Sysmex XN-1000 fully automated FBC analyzer was used to perform FBC on specimens. In this study 2 cc EDTA (K<sub>2</sub>EDTA) blood was collected from ten volunteer participants. The first FBC testing on the ten samples was done within 10 min of bleeding, and subsequent three testing cycles were done during 24 hrs on samples kept in RT (22 °C). For each FBC estimate, five (05) repetitive tests were done initially and mean values were considered to be the target value for each parameter. Deviations from the target value for each test parameter through 24 hrs were calculated. CV (coefficient variant) for each parameter within the runs and between runs for 24 hrs was calculated.

Clinically acceptable best performance laboratory CV range for parameters of RBC, Hb, MCV and MCH are 2%, 1.5%, 2% and 1.2% respectively. CV values of RBC, Hb, MCV and MCH for each sample in scheduled time interval and overall values did not exceed more than the values mentioned above. Mean RBC, Hb, MCV and MCH values of each sample in each interval fluctuated within (+/- 4%) of the initial mean value of its parameter. This study reveals that the mean values of each sample of RBC, Hb, MCV and MCH during the study period fluctuated within the clinically acceptable limit of the target value. This study indicates that the accuracy and the precision are within the accepted limits. Thalassaemia screening parameters in FBC tests done on Sysmex XN-1000



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analyzer could be taken as clinically reliable for 24hrs on samples stored at RT. However, the present study that was done with a small number of samples and needs to be further expanded with a large number of samples.

Keywords: RBC parameters, room temperature, Sysmex XN-1000 analyzer, time (24 hrs)

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## **FACTORS AFFECTING LOW BACK PAIN AMONG THEATRE NURSES AT THE NATIONAL HOSPITAL OF SRI LANKA**

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Low Back Pain (LBP) is one of the most common occupation related diseases that occurs among theatre nurses providing comprehensive care in a specialized unit. The present study was aimed at examining the reasons for LBP among operating theatre nurses at the National Hospital of Sri Lanka (NHSL). This was a descriptive cross-sectional study conducted among 200 permanently employed nurses working in operating theatres at the NHSL in early 2018. Nurses from both genders suffering from LBP and those were permanently employed for more than two years in the operation theatres were included in the study. A content validated, pre-tested, self-administered questionnaire was completed by 153 nurses who volunteered for the study. This study was approved by the Ethics Review Committee of the NHSL. All the participants signed an informed consent prior to participating in the study.

The majority (96 %) of nurses were females and aged between 31-40 years. A majority of the participants had not engaged in any exercises. Most of the nurses had been working 5-10 years as a theatre nurse (45 %) and almost two-thirds of them did more than 200 duty hours per month. Most nurses used public transport to travel to work. Most of the nurses with LBP maintained a standing position for long periods (81 %), transferred heavy patients between operation table and trolley (76.6 %) and frequently lifted patients and equipment (80 %). Nurses with LBP also experienced work demand (74 %), shortage of staff (78 %) and no breaks between working hours (74%). Nurses' traveling mode, absence of regular exercises, increased duration of working hours and years in the theatre, remaining in a standing position for long periods transferring of heavy patients and lifting patients equipment frequently seems to be connected with their LBP. Further, high work demand, shortage of staff and no breaks during working hours were linked with increasing LBP among these nurses. As nurses work in operating theatres experience LBP, it is necessary to have individual and institutional precautions in order to prevent LPB among this group.

Keywords: Low back pain, Theatre nurses, Factors

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## **NURSES' ATTITUDES TOWARDS TEAMWORK IN MATERNITY WARDS AT DE SOYZA HOSPITAL FOR WOMEN, SRI LANKA**

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Teamwork among healthcare professionals is important as it aims to improve efficiency, coordination and quality of care, overcome staff shortage issues and minimize errors. Even though extensive studies can be found in American and European regions, limited research has been conducted in the South Asian region on teamwork. The purpose of this study was to assess nurses' attitude towards nurse-medical officer relationship, nurse-midwife relationship and nurse-health care assistant relationship when working together as a team within the context of the maternity wards at the De Soyza Hospital for Women (DSHW) in Sri Lanka. A quantitative descriptive design was used in this study. A self-administered questionnaire was given to 200 nursing officers at DSHW to collect data. Descriptive statistics were used to present the socio-demographic characteristics and the perception of nurses' towards health care teams. Ethical approval for this study was obtained from the Ethical Review Committee of the National Hospital of Sri Lanka, Colombo 10. Most of the statements regarding nurses' attitudes towards the nurse-medical officer relationship received 55% agreement. Interestingly, nurses' attitudes towards the nurse-midwife relationship was also similar to the nurse-medical officer relationship. Relatively less agreeable responses towards the nurse-health care assistant relationship were observed. Even though most statements received more than 50% agreeable responses, very low agreeing responses were also received. For an example, the statement about health care assistants' voluntary contribution to the tasks assigned to the unit obtained only 41.5%. According to the study findings, nursing professionals have responded by agreeing to most statements whereas less agreement can be seen regarding communication with medical officers. The nurse-midwife teamwork relationship is also at a good level according to the study. However, less agreement was seen for voluntary participation of midwives in the tasks assigned to the unit. A similar response was also observed in the nurse-health care assistant relationship. Comparatively, low agreement was observed for attitudes towards nurse-healthcare assistant teamwork relationship than nurse-medical officers, and nurse-midwife team work relationship. Thus, the teamwork relationship between nurses and health care assistant at the maternity wards of DSHW must be improved in order to provide high quality patient care.



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Keywords: Teamwork, Nurses' attitudes, Nurse-medical officer relationship, Nurse-midwife relationship, Nurse-health care assistant relationship

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## SELF-PERCEIVED ABILITY OF RESEARCH SKILLS AMONG UNDERGRADUATES

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Undergraduate research is an important component in the curricula of degree programmes in universities worldwide. Since the academic community considers undergraduate research as the most powerful instructional tool, there is an increased tendency to ensure that undergraduate students gain the expected outcomes from their research experience. This study was conducted to evaluate the research skills of final year undergraduates in three Health Sciences degree programmes: Nursing, Pharmacy and Medical Laboratory Sciences at The Open University of Sri Lanka. In this quantitative descriptive study, final year undergraduates in three Health Sciences degree programmes; Nursing (n=187), Pharmacy (n=31) and Medical Laboratory Sciences (n=44) at the Open University of Sri Lanka were included. The perceived ability of 14 research skills of undergraduates were assessed using a previously validated instrument following content validation. A self-administered questionnaire was completed by the participants. All the participants signed an informed consent form prior to their participation. Most of the participants were females (n= 216, 78.5%), married (n=195, 70.9%) and were between 30-39 years (n=183, 66.5%). The lowest possible score which denoted research skills was 14 and the highest possible score was 70. Accordingly, the mean scores which denoted the research skills of MLS, Pharmacy and Nursing undergraduates were 56.4, 56.26 and 51.26 respectively which indicate a satisfactory overall self-perceived ability of research skills among undergraduate students of all three degree programmes. The self-perceived ability of research skills in designing an experiment or theoretical test of a hypothesis, statistical analysis of data, interpretation of results, and writing a research paper for publication were not satisfactory compared to the rest of the research skills. According to the findings of this preliminary study, most of the self-perceived ability of research skills among undergraduate students were at a satisfactory level while some skills were not. Hence it is useful to adopt strategies to improve undergraduate research skills and take action to enhance students' learning opportunities. Further study in this area is warranted by incorporating an observational component in the study.

Keywords: Research skills, Undergraduates, Health sciences degrees

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## INCIDENCE AND RISK FACTORS FOR LOWER LIMB AMPUTATION AMONG PATIENTS IN THE SURGICAL SECTION, NATIONAL HOSPITAL OF SRI LANKA, COLOMBO

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The amputation of a limb or part of a limb has psychological, social and economic influences on patients' lives as well as on their families. Thus, it is important to identify the incidence and risk factors which lead to lower limb amputation (LLA). Therefore, the present study aimed to investigate the incidence and risk factors for LLA among patients in the surgical section, the National Hospital of Sri Lanka (NHSL), Colombo. This was a descriptive longitudinal study conducted among patients with LLA during the period of February to July 2017. A sample of 100 patients with LLA was recruited for the study using a convenience sampling technique. Data were collected using a content validated, pre-tested, self-administered, questionnaire. Ethical approval for the study was obtained from the NHSL, Colombo and all the patients signed informed consent forms prior to their participation. Data were analysed by descriptive statistics and Pearson's Chi-square test on SPSS version 21.

The LLAs were more common among males (74%), between 40-60 years of age (57%), married (83%), and those with toe amputations (48.42%). Higher proportions of LLA were seen among people with monthly income more than Rs. 20,000 per month. Sixty to eighty percent of patients had diabetes mellitus. Risk factors for LLA based on toe amputations were found to be diabetes mellitus ( $p=0.001$ ), peripheral vascular disease ( $p=0.010$ ) and retinopathy ( $p=0.034$ ), and a history of amputation ( $p=0.001$ ). However, there was no association between the presence of toe amputation and patients' gender, BMI, educational level, employment, income, civil status, smoking, and presence of complications including hypertension and neuropathy ( $p>0.05$ ). Since the main reasons for LLA were connected with diabetes mellitus and its complications, careful management in controlling the disease and follow-up care would be beneficial in the prevention of LLA.

Keywords: Lower limb amputation, Toe amputation, Diabetes mellitus

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# **HUMANITIES AND SOCIAL SCIENCES**



## LIVING THE BUDDHIST WAY: ROADSIDE BUDDHA SHRINE WORSHIPPING IN COLOMBO

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More than in any other period of the history of this country, the current socio-political environment suggests the importance of studying religious phenomenon, as tense situations in our everyday lives are connected to (politicized) religious practices. We recently witnessed how vandalization of roadside buddhist shrines in the mawanella area was allegedly committed by some extremist muslim groups instigated by the preacher Zahran Hashim who was the leader of the national Thawheed Jamath (alias NTJ) group in Sri Lanka (Griffiths 2019). Anyone travelling around the city of Colombo would notice the hundreds of Buddhist, Christian and Hindu shrines located on either side of public roads, junctions, roundabouts and communities, etc., in addition to conventional religious places of all religions. These roadside shrines are constructed and maintained by the Buddhists, Catholics and Hindus and that is testimony for the increase in religious density or religious influence (profane). This phenomenon testifies to the willingness of the people in the city to worship at these roadside shrines. Even though, not many people/ devotees gather at a particular time of the day in these shrines, it seems they are very active, evident in the way these roadside shrines are maintained and organized. Given this context a study was conducted to understand why and how city folk worship at roadside shrines though they live in a rationally organized city. The analysis of the ethnographic data collected for five months on worshipping at roadside Buddhist shrines reveals that they have been in existence for several decades. The analysis suggests that the usage of a functionalist perspective to study the worshipping pattern can open up and reveal new realities, which go beyond the simple explanation of inter- and intra- religious tensions and identity clashes as put forwarded by some scholars. Uncertainty, risks, corruption, immorality, lack of law and order etc., have contributed to the increase of these roadside shrines in Colombo. In a way one could say that the proliferation of shrines denotes the mismatch or lopsided development of social institutions with the development and expansion of the liberal socio-economic, political and cultural value system. Finally, this could be interpreted as “living the Buddhist way”, an everyday struggle to live amidst the changing socio, political-economic spaces in the city in line with lord Buddha’s teaching while staying connected and living in a morally justifiable manner (dhārmika) to him/herself and to the society.

Keywords: Urban religious practices, Roadside shrine worshipping, Buddhist beliefs, Secularism, Religious competition

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## **FOOD NATIONALISM: THE CRISIS OF GIVING AUTHENTIC FOOD TO SONS AND DAUGHTERS IN SRI LANKA**

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The food producing and distributing mechanism in Sri Lanka has become more complex and connected with national and international companies, trade agreements and the global political economy. Food production and distribution has become an industry especially after the green revolution project was introduced for agriculture in Sri Lanka in the 1970s. Food production and supply is very vital for any community as it determines the existence, wellbeing and development of the members. This recognition has contributed to considering and giving high attention to agriculture in Sri Lankan society. This has meant that agriculture has been politically significant during the period of pre-colonial kings and the post-colonial modern majoritarian democratic system introduced by the colonial masters in Sri Lanka. The post-colonial politics and nation building projects have given much priority to agriculture in shaping a Sri Lankan identity which is greatly moulded by a harmonious lifestyle nourished by Buddhist philosophy introduced to the country during king Devanampiyatissa's era in the kingdom of Anuradhapura. Serena Tennekoon (1988) in her analysis of religious rituals explains how the post-colonial, Sri Lankan state-led development politics gave higher prominence to agriculture respecting Buddhist values. In performing this ritual, 30 silver pots of water (jala puja) collected from the kotmale reservoir were offered in the opening ceremony to five Buddhist religious places, namely, the Temple of the Tooth Relic in Kandy, Jaya Sri Maha Bodhiya in Anuradhapura, Kiri Vehera in Kataragama, Kelani Viharaya in Colombo, and Mahiyangana Raja Maha Viharaya in Mahiyanganaya. Presently the country's food production is linked to imported seeds, manure, various chemicals, machines and other needed inputs. This has led to local agricultural methods having to negotiate with foreign technologies. In this context the country faced an invasive worm attack called "Sena Caterpillar". This destroyed many hectares of vegetable and grain cultivation in general and maize cultivation in particular during the latter part of 2018 and the first few months of 2019. Against this backdrop, a research was conducted using the content analysis methodology. Findings were elicited by primarily analyzing the parliamentary debate conducted on 22 January which continued on 23rd January 2019 and the analysis of the Divaina newspaper discussions during the period December 2018 and February 2019. Furthermore, 20 interviews were conducted with farmers from no 104 Mullegama Grama Niladhari division which falls under the Madulla divisional secretariat (ds) in Monaragala. The main objective of the research project is to discuss the link between the homegrown food production and nationalist sentiments. The research findings highlighted the existence of features of food nationalism which mainly emphasized the threat to local food production



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and food varieties from local and international elements. It tinted the value of protecting authentic food varieties against the alien and invading food varieties from other external sources, which may (or may not) have connections to local forces (traitorous) that wished to capture state power, legally (or illegally). According to the arguments put forward by various parties in the parliamentary debate and the discussions and media briefings published in the Divaina newspaper, the country has to devise a well thought out mechanism to feed local sons and daughters good food to protect their health and nutrition. In this process, a lot of fears and anxieties regarding the future generation, the country's national security, internal and external conspiracies, the role of the parties with vested interests, the effect of multinational cooperation and their nation's interests which (may) operate against the national interests were emphasized.

Keywords: Sena caterpillar, food nationalism, Politicization of food production, National anxieties, Local farming communities

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## HUMAN SECURITY IN POST-WAR SRI LANKA

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Human security, in other words, people's freedom from fear and freedom from want, is being overlooked in recent development agendas in Sri Lanka. As a result, Sri Lanka is now experiencing multi-layered human security failures among which increasing poverty is a critical issue. In this backdrop, there is growing consensus that the state should adopt a human security approach in post-development recovery mechanisms in which needs, and expectations of the people are addressed.

Therefore, by using a 'case study research' method with the support of secondary data gathered from extensive desk research, this research examined the ways in which human security of the people have been addressed by Sri Lankan Governments through four national state sponsored poverty alleviation schemes in post-war Sri Lanka (2010 – 2018).

The findings of the research reveal that despite the country's major poverty challenges, the focus of the poverty alleviation programmes of the government have predominately been confined to economic development. The poverty reduction programmes have paid little or no attention to specific human security needs. Human security priorities in post-conflict settings should go beyond relief, rehabilitation and reconstruction. It should also look at recovering people's lives and lifestyles, to ensure a future for their families. The fulfilment of these basic needs would address the root causes of conflict.

The findings of the research, therefore, recommends state-sponsored poverty alleviation programs to be aligned with regional (provinces) specific socio-economic data/statistics through which area-specific poverty related issues can be addressed. With province-based poverty reduction goals and programmes, the unique development challenges in the directly war-affected North and East of the country can be gradually overcome. The overall goal setting and policy making of state-driven poverty interventions should be done by a central committee of experts represented by economic, social, cultural and defense sectors with required proportion of gender, and ethnic compositions. Through such an approach, the necessary levels of human security of people will be realized and sustained and current and potential conflict fault-lines among communities can be tackled effectively.

Keywords: Sri Lanka, Human Security, Poverty, Post-Conflict Development

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## **EVOLVING NARRATIVES OF FEMININITY AND MOTHERHOOD: REWORKINGS OF THE (ANTI) HEROINE IN DISNEY PRODUCTIONS**

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The adaptations of fairy tales into films have preoccupied many researchers and the heroines and anti-heroines of Disney productions have been subject to many speculations. Critics have observed the evolution of the "Disney women" from passive and obliging figures to icons of power and agency. This research paper argues that the recent Disney "princesses" as well as the "anti-heroines" display an intriguing duality which invests them with power as well as motherliness, nurturing as well as potential for violence. The paper suggests that this duality subverts the previous traditions upheld by Disney as well as by reputed tellers and collectors of fairy tales. Traditionally, heroines and anti-heroines such as witches, step mothers, etc., are perceived as polar-opposites in a system of binary cultural identification. This research finds that this evolving "new" heroine has affinities with the pre-patriarchal goddess figures that critics such as Adrienne Rich have explored.

Keywords: Fairy tales, Films, Disney, Gender, Motherhood

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**A PHILOSOPHICAL ASSESSMENT ON THE EFFECTIVENESS OF  
CENSORING SOCIAL MEDIA TO REDUCE ITS NEGATIVE EFFECTS  
THAT CREATE SOCIAL TURMOIL (WITH ESPECIAL REFERENCE  
TO THE POST-EASTER ATTACK CONTEXT)**

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Sri Lanka, during the past few years, experienced several occasions of temporary censorship of social media in the aftermath of the disastrous events that happened in the country, mostly instigated by different ideological and religious points of view. The government took steps to censor social media to contain the negative effects of hate comments and false news that were spreading rapidly through social media, feeding into the fear, distrust and the unrest of the general public. In philosophical literary references, this situation has a similarity to the Platonic suggestion of the complete banishment of art in his ideal city state, advocated in his masterpiece; 'The Republic'. Plato supports a complete banishment of art, highlighting the dangerous potential of art to corrupt the minds of the people. The aim of this paper is to examine whether an external censorship of social media is effective in contemporary Sri Lankan society, as a means of reducing the negative after effects of disastrous events. In this paper, contextual analysis (related to the Easter attack on 21st of April 2019) will be used to examine the reaction of different parties in the post-Easter attack context and to examine how these reactions intensified social negativity. 'The Republic' by Plato will be used in the paper as a primary reference when tracing the similarity between the Platonic conception of the banishment of art in his ideal state and contemporary censorship of media. And the ideas of the postmodern philosophical thinkers; Jean Lyotard and Jean Baudrillard will also be used to explain the Sri Lankan social context at present. Thereafter, the primary data gathered through a sample of social media posts (posted in the aftermath of the April 21st Easter attack) will be critically and comparatively analysed to examine whether the censorship of art is an effective and desirable solution in contemporary society. However, external censorship of social media, as a means of reducing the negative effects of social media (especially in the aftermath of a catastrophic event like the Easter attack), is neither effective nor desirable in contemporary society. Therefore, internal self-regulation of media, in the form of a code of ethics, that everyone who uses media should follow, might be a better solution although the practicality of this suggestion is highly debatable.

Keywords: Social media, Negative effects, Censorship, Effectiveness, Post-Easter attack context

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## AN INVESTIGATIVE STUDY OF FOOD CULTURE IN ANCIENT CEYLON THROUGH INSCRIPTIONS (FROM 1<sup>st</sup> CENTURY A.D. TO 13<sup>th</sup> CENTURY A.D.)

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In any country 'food' receives precedence over all the other main cultural aspects. Food culture is interconnected with other cultural aspects of a society. Inscriptions, chronicles and literature works provide evidence to the early existence of a developed food culture in ancient Ceylon. Inscriptions are the most trustworthy archaeological source. The research problem of this study is to explore the rich food culture of ancient Ceylon, from 1<sup>st</sup> century A.D. to 13<sup>th</sup> century A.D. (up to end of the Polonnaruwa era) by scrutinizing inscriptions. The objective of this study is to find out the food culture through inscriptions erected from the 1<sup>st</sup> century A.D. to 13<sup>th</sup> century A.D. Out of the inscriptions written during this period food is mentioned in the Maharatmale inscription, Eppavala inscription, Madirigiriya inscription, Rambawa inscription, Anuradhapura slab inscription, Galapatha Vihara rock inscription, Udakandara rock inscription, Polonnaruwa council chamber inscription, Tonigala inscription, Budanhela pillar inscription, Mihintala pillar inscription, Anuradhapura Gal Oruwa inscription and the Badulla inscription. The food items mentioned are boiled rice, gruel, green gram, curd, honey, sweet (madu), sesame, flemingia (undu), butter, salt, green herbs, coconut, turmeric, fenugreek, ginger, eight kinds of beverages (the juice of rose apple, mango, plantain, kind of wild plantain, eugenia - kind of rose apple, water lily, honey, and plum mixed with water). These items are mentioned in various forms. Most inscriptions show them as offerings to the sangha community. Inscriptions about food offered to sickly or morbid sangha, are also found. A completely different kind of inscription has also been found. This is the Tonigala inscription where deposits were made in a banking system. The items included paddy, flemingia and green gram. In addition, it is evident that chena cultivation and home cultivation were well established. This shows that Ceylon was an agricultural country. The Badulla inscription mentions an occasion where a ban had been imposed on food. In this study, it was apparent that the diet of ancient Ceylonese basically comprised plant origin carbohydrates, with high fibre content, fats and oils, vitamins, minerals, and all other nutrients from cereals and green vegetables. The diet fulfilled the daily basic energy requirement to satisfy the large caloric demand required for the immensely hard life style of the time with limited facilities, erratic weather conditions as well as a nutritionally balanced healthy diet.

Keywords: Consumption, Food culture, Inscriptions, Sangha community, Social class of donor

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## **DIGITAL MEDIA ECOLOGY: THE USES AND GRATIFICATIONS OF SOCIAL MEDIA FROM A MCLUHANIAN PERSPECTIVE**

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This review paper attempts to explore the applicability of 20<sup>th</sup> century theories with special emphasis on the McLuhanian perspective to the contemporary social media sphere, and the relevant trends and developments. The research establishes 20<sup>th</sup> century theories as the moment of understanding and introduces the social media ecology as the moment of instability to create a discourse and subsequently to develop a speculative moment to explore the rationale for uses and effects of social media and its futures. The McLuhanian perspective looks at media as an extension of man and an ecological system within which human culture grows. Theodor Adorno identified this as a consumer culture that makes the individual isolated, facilitating the capitalist mechanism. Digital convergence and web 2.0 has created a media environment with attributes that are different to traditional media environments. Web 2.0 is able to facilitate interactivity, information sharing, collaboration, among other things to develop an active and participatory social media environment that even a Marxian would appreciate. On the surface, the social media environment tends to comply with the 20<sup>th</sup> century media theory and results in a more productive and user centered ecological system creating a societal culture. But, when its explored in depth it reveals that hidden algorithms and big data manipulations draw a different picture; a culture of control, surveillance, individualization and manipulation.

Keywords: Media Ecology, Digital Convergence, Social Media, Big Data

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**WHEN GENEROUS GODS OFFER “BACKHOE-ARM LOAD OF GEMS”: FOLK IDEAS FOUND AMONG GEM MINERS OF THE SABARAGAMUWA REGION**

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Though Folktales are considered carriers of cultural axioms, there is a tendency to overlook such details owing to the notion that folktales are created/heard/told by ‘common folk’ with the term ‘folk’ usually conveying ideas of ‘unsophisticated’— and even ‘uneducated.’ However, folkloristics, or scholarly study of folklore (folktales being an item of folklore), has opened up a world of cultural possibilities embedded in folklore which not only include cultural conjecture but also cultural prejudices. The present study focuses on deep-seated cultural postulates of gem miners of the Sabaragamuwa region through a focused reading of their folktales. Through a close reading of a collection of tales titled *Sabaragamuwe Menik Kathandara saha Sinharaje Withthi* (Gem-related Tales from Sabaragamuwa and the Events of Sinharaja), which feature 110 folktales and myths told by those involved in the gem industry, this study intends to understand the deep-rooted ‘folk ideas’ of the gem miners. Using folkloric definitions of ‘folk ideas’ this study attempts to locate and analyze the folk beliefs of a community of people bonded by a common desire—to find valuable gems.

Keywords: Folklore, Folktales, Folk Ideas, Myths, Cultural Postulate

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## POTENTIAL USES OF LITTLE MILLET (*Panicum sumatrense*), AVALUABLE CEREAL NEGLECTED IN CONTEMPORARY WORLD

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Cereals play a major role in human diet as they are rich in energy, protein, dietary fiber, vitamins and minerals. The dietary fiber found in cereals has been proved to reduce the risk of developing diabetes mellitus, obesity, heart diseases and constipation. Traditionally millets, the minor cereals were grown and consumed widely in Sri Lanka. Yet, little millet (*Panicum sumatrense*, known as ‘Saamai’ in tamil), a round shaped cereal which adds several health benefits to consumers is neglected in contemporary world. This study was conducted with the objectives of investigating the value and use of little millet in traditional dishes and to find out the level of awareness about little millet among the young generation. Data were collected via interviews, field observations and group discussions with cultivators, sellers and consumers of little millet in Jaffna district. A questionnaire was distributed among randomly selected 60 males and 60 females between 18- 25 years old – 32% males and 39 % of females know about little millet while only 2% of them consume the cereal at home. Even though the crop can withstand drought conditions and can be grown in a short period, cultivation and consumption rates of this cereal are very low. The farmers who know the traditional value of little millet cultivate and use it for household purposes. ‘Dosa’, ‘idli’, porridge, milk rice, ‘payasam’, ‘kesari’, ‘uppuma’ and ‘kozukkadai’ can be prepared from little millet and people replace the cereal with rice for lunch. Elders responded that apart from its food value the little millet has medicinal value. In the past it was used to treat poisoning and heal broken bones. Little millet is rarely found in retail shops and it is found mostly in Tamil medical shops. The younger generation knows the cereal as food for pigeons. Since wheat and rice are readily available in shops and wheat plays a major role in bakery foods, the demand for those cereals are high. The forgotten cereal, little millet has to be promoted to build a healthy nation. Awareness should be carried out via demonstrating healthy recipes from little millet in order to improve the nutritional status of the community.

Keywords: Millets, Little millet, ‘Saamai’, Cereals

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# LAW



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**‘YOU SHOULD ESTABLISH GUARD, WARD AND PROTECTION  
ACCORDING TO DHAMMA’: THE CONSTITUTIONAL MANDATE OF  
EXECUTIVE PRESIDENCY AND THE BUDDHIST TEACHINGS OF  
KINGSHIP**

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This research intends to conceptualise the constitutional duties of the Executive Presidency under the Second Republican Constitution of Sri Lanka in light of Buddhist teachings of kingship. The research begins by exploring the theoretical foundations of the role of religion as a source of law that validates the applicability of Buddhist teachings of kingship in the context of the constitutional power of the Executive President. This analysis is based on two phases. First, provisions related to good governance which make the Executive President responsible and accountable to the Constitution, Parliament and the general public. Second, the provisions relating to the protection of subjects which mandate that the president should respect, protect and fulfil people’s rights. This research highlights the importance of Buddhist teachings of kingship as a set of moral and ethical values that can be used in evaluating and interpreting the constitutional mandate of the Executive Presidency. Finally, it proposes that applying the norms and concepts underlying the Buddhist teachings of kingship in the ongoing constitutional amendment process can enhance the democratic nature of the office of the Executive Presidency.

Keywords: Buddhist teachings of kingship, Executive President, Good governance, Protection of subjects

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## **DOUBLE STANDARDS AND CHALLENGES AMONG INDUSTRIALIZED AND INDUSTRIALIZING COUNTRIES IN THE CONTEXT OF CLIMATE DIPLOMACY**

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Climate Diplomacy has been developed through many challenging phases. There is no accurate definition for climate diplomacy. However, the term “climate diplomacy” refers to activities of sovereign states for resolving issues related to global climate change through representations and negotiation. Climate change is one of the greatest challenges of the twenty first century which needs to be addressed through diplomacy and international governance. Developed nations can assist developing countries to overcome adverse effects of climate change through climate diplomacy. For an instance developed states can provide capacity building through technical and financial assistance and accept climate refugees of less developing countries. This research examines how countries engage in climate diplomacy, significant milestones in climate diplomacy, the Sri Lankan experience in climate diplomacy as an industrializing country and finally the challenges of climate diplomacy. The applicability of diplomacy and world governance in the context of climate protection are addressed by two main approaches: bilateral climate diplomacy and multilateral climate diplomacy. This paper explores how world leaders and world politics are involved in relation to this issue. The main documents that are consulted are the United Nations Framework Convention on Climate Change (UNFCCC) and, the pinnacle of modern climate diplomacy, the Paris Agreement of 2015 and the Kyoto protocol. This research concerns nationally determined contributions as well. The research was carried out as a normative research and thus it was based on a literature survey pertaining to international treaties and, diplomatic incidents relating to Climate Diplomacy.

Keywords: Climate diplomacy, Environmental law, International governance, Bilateral agreements, Multilateral agreements

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## **OPTIMIZATION OF COURT INVOLVEMENT IN CONSTRUCTION ARBITRATION IN SRI LANKA- LESSONS FROM INDIA AND ENGLAND**

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Construction industry is the process of constructing a building or a public and private physical improvement such as roads, railway, power plants, bridges or dams, etc. These are engaged with local and foreign regulations, employment issues, technical issues and also different profit margins. Construction industry is a complex field. This complexity derives mostly from the construction projects and contracts and extends to the level of disputes between parties. Such disputes can be concluded at any level of construction and these litigations tend to be the most intensive and multifaceted compared to other civil disputes. However, the traditional way of court litigations does not truly address the technological background of these disputes. It requires a process for resolving these disputes through an independent mechanism which involves an independent and impartial third party with expertise and knowledge about the field. These processes are recognized as Arbitration, Mediation, Conciliation and Negotiation. The objective of these methods is to be an alternative to court litigation and to ensure confidentiality and understanding among the parties, saving costs and utilize highly technical support. This study argues that Arbitration is the best method to solve construction disputes as it includes more sophisticated features like low cost, short time period and well-planned output (the arbitral award). Though it has been established as an alternative to court litigation, arbitration still does not function completely outside the judicial system. Court intervention in the arbitration process cannot be refused and court assistance in the process maybe sought at many stages. Basically there can be no arbitration without the assistance and the guidance of the judiciary. This can cause a delay in the process of arbitration and undermine the real objectives behind the process. The methodology of this research is based on case analysis and literature review of articles. The literature review suggests the necessity of minimizing court intervention in Construction Arbitration. Progressive Arbitration modules which have been carried out in other jurisdictions like India and England which can be used as a guideline for Sri Lankan law are reviewed in this research. A questionnaire survey to identify the level of knowledge of professionals regarding Construction Arbitration and the necessity of optimizing court intervention was also conducted. Therefore, the main objective of this study is to analyse the implementation of a new legal framework which can avoid the problems that can occur due to court intervention at many levels of the Arbitration process. In conclusion the study makes suggestions to ensure effectiveness of the process by obtaining guidance from other jurisdictions.



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Keywords: Construction Industry, Arbitration, Court Intervention, Optimization, Legal framework

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## **REMORSELESS PROGENIES ACTIVE IN CRIMES: A MEDICO-LEGAL PERSPECTIVE ON JUVENILE PSYCHOPATHS**

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Justice Kagan in Miller's case has identified that the developments in psychology and brain science show fundamental differences in juvenile and adult minds. The human mind has a direct influence on conduct. Delinquency is a product of strain and anomie, and is basically a learned process. An abnormality in mind simultaneously influences the conduct of a human being which has a tendency to do harm to society as a whole. A 'psychopath' is a human with a personality disorder in which all the emotional and cognitive faculties are impaired and continued in anti-social behaviour. In the general sense, psychopaths are adults but in rare instances juvenile psychopaths are in existence. A juvenile psychopath is a different disposition from average children of the same age, being estranged from the natural playfulness and coyness in youth, and lacking emotions, empathy, moral rationality, and conscience. 'Juvenile psychopathy' is a result of sociological, biological and neurological factors but basically psychopaths emerge due to social drawbacks. Defects in parenting, parental insensitivity, harsh maternal intrusions, lack of facilities and weak family relations have been identified as the basis for juvenile psychopathy. It has generally been accepted by the law that there is a justification for punishing the psychopaths but scholars' arguments state that psychopaths, having no moral rationality, are possessed only by the shame and guilt for their failure in anti-social conduct and not for their inability to comply with the standards of human society. Simply, they are not members of the moral community. The author has adopted a literature review involving primary and secondary sources of law. The study has aimed to examine the traits of juvenile psychopaths and the applicability of criminal law principles. The author's proposition is that the punishment is not the solution in the issue of juvenile psychopathy but the positivity that deals with the social reconstruction around him/her.

Keywords: Juvenile Psychopathy, Conscience, Moral rationality, Law

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## **RIGHT TO WORK IN THE CONSTITUTIONS OF INDIA AND SRI LANKA: A COMPARATIVE STUDY**

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Enforcement of right to work is widely discussed as an important frontier in human rights and in acceptance of the universality and indivisibility of human rights. Hence, the right to work is required to ensure meaningful protection of all other rights. Art. 6 of the International Covenant on Economic, Social and Cultural Rights (ICESCR) expressed the right to work. International society is a group of states sharing in the working of common institutions. Cooperation on the basis of honouring agreements is part of the primary goals of international society. However, the State is both the 'Principal Violator' and the 'Essential Protector' of human rights of its citizens. The constitution is the supreme legal document of the State and constitutional guarantees of rights of the citizen are provided therein. India and Sri Lanka are members of the South Asian subset of the international society and are culturally interrelated. Constitutions of both nations embody a Bill of Rights. Article 19 (1) (g) of Indian constitution (1949) and Article 14 (1) (g) of Sri Lankan constitution assure freedom of occupation. However, both Constitutions are silent on the assurance to comprehensive employment corresponding to said Article 6 of the ICESCR. But the Indian constitution embodies the same as an unenforceable but aspired duty of the State. Article 23 of the Indian constitution guaranteeing the right against exploitation which is not observed in the Sri Lankan constitution. Article 14 (1) (d) of the Sri Lankan constitution which assures the right to form and join a trade union is not specifically stated in the Indian constitution but derived from the constitutional provision on association and fortified through case law. Provisions analogous to those enumerated in the Part IV of Indian constitution on Directive Principles of State Policy in relation to right to work are not observed in Sri Lanka as such provisions aspire to address a class of social, cultural and economic issues peculiar to India.

Keywords: Constitution of India, Constitution of Sri Lanka, Right to work

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# **MANAGEMENT**



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## **ANALYSIS OF ORGANIZATIONAL FACTORS CAUSING EMPLOYEE RETENTION OF UNIVERSITY ACADEMIC STAFF IN THE PUBLIC SECTOR UNIVERSITIES IN SRI LANKA**

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The success of any organization mainly depends on the contribution that each employee makes towards organizational processes. In that process the retention of the employee is very important to maintain the organizational process smoothly. Brain drain is a major problem in today's society. In the preliminary study which was done by researcher for this study using the interview method over 50% of University academics indicated their next step was to go to foreign countries like the United Kingdom, Australia, and the USA. The main purpose of this research was to investigate the significance of the factors (appraisal system, employee compensation, training and development opportunities, employee empowerment and the work environment) increasing the retention rate of the academic staff in the public sector universities in Sri Lanka and to identify the nature of demographic variables (age, gender, and marital status) and how those variables act as a moderate variable and influence the relationship between the organizational factors and the level of employee retention rate. Out of the 4957 academics, the researcher selected 350 public sector University academics who are representing 15 public sector Universities in Sri Lanka as a sample for the present study (Stratified Random Sampling). Primary data were collected through the questionnaire and results were derived using the SPSS statistical package. According to the research outcomes the most influential variable is Training and Development opportunities and also there is a negative effect of the appraisal system on employee retention rate so both variables have a significant effect on employee retention but other variables such as employee compensation, employee empowerment and the work environment have no significant effect on employee retention. There is also no moderating effect of age, gender and marital status on the relationship between organizational factors and employee retention. The result indicates that most of the University academics believe the employee retention rate is at the average level. Authorized persons can implement a proper appraisal system, and categorize the employee compensation as retirement plans, disability insurance, offering more training and development opportunities to the University academics within the country with the collaboration of foreign Universities, delegating authority to the University academics to get decisions related to their day-to-day work done at the University, offering more facilities related to the work environment to increase the employee retention rate because employee retention is a very important area to cover. It will create happy workers who talk positively about the industry, help others and go beyond the normal expectations in their career.



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Keywords: Employee Retention, Public Sector Universities, University Academics

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**NON-FINANCIAL REWARDS AND JOB SATISFACTION OF  
ADMINISTRATIVE OFFICERS OF THE UNIVERSITY OF SRI  
JAYWARDENEPURA, SRI LANKA**

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Some people love their work because it is interesting and provides them with psychological satisfaction too, more than money. There are many contemporary research studies supporting the effectiveness of non-financial rewards as a motivation tool for employee job satisfaction. This study also will try to shed light on this issue and aims to demonstrate whether there is a significant relationship between non-financial rewards and job satisfaction of the Administrative officers in the University of Sri Jayewardenepura. Non-financial motivators such as Achievement, Advancement, Recognition and Responsibility were identified based on the literature. A census survey was conducted among all Administrative officers using a questionnaire to collect primary data and Correlation and Regression analyses were used to analyse them. Results show that non-financial motivators successfully predict job satisfaction. 72% of the variation in job satisfaction is explained by non-financial rewards. Responsibility is the most important non-financial reward which affects their job satisfaction while Recognition and Advancement are respectively significant for job satisfaction.

Keywords: Non-Financial Rewards, Achievement, Advancement, Recognition, Responsibility, Job Satisfaction.

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## **EFFECTIVENESS OF PERFORMANCE APPRAISAL PROCESS AND STAFF PERFORMANCE OF A COMMERCIAL BANK IN SRI LANKA**

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Performance Appraisal (Evaluation) is considered the most significant and indispensable tool for an organization. It provides useful information in making decisions regarding various personnel aspects such as promotions and merit increases. This research was conducted to identify the factors affecting staff performance and its impact on staff performance. The role of the supervisor, nature of evaluation, communication and evaluation time frame were identified as the predictors of staff performance as per the literature. The study was directed by a quantitative methodological approach using a sample of 100 staff members of the Uva Sabaragamuwa region in a local commercial bank of Sri Lanka. Data were collected through a questionnaire and were analysed using correlation and regression analyses. As per the findings, time duration and communication have significant positive effects on staff performance. Meanwhile, 65.7% of the variation in staff performance is explained by the effectiveness of the performance evaluation process.

**Keywords:** Staff Performance, Effectiveness of Performance Evaluation Process, Role of Supervisor, Nature of Evaluation, Communication, Evaluation Time Frame

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## **DEXTERITY TESTS SCORES AND EMPLOYEE PERFORMANCE OF SEWING MACHINE OPERATORS**

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Garment manufacturing plants depend highly on human labour and their performance is one of the crucial factors that stimulate the well-being of the organization. These garment factories concentrate greatly on recruiting and selecting appropriate employees. The selected garment factory highly focuses on dexterity tests to check the competence of employees at the recruitment stage. Based on their actual performance, it is doubtful whether these current dexterity tests have a significant ability to predict operator performance. The core purpose of this study is to examine the job performance prediction ability of current dexterity tests used for employee selection. Seventy-six experienced sewing machine operators were re-tested for four types of current dexterity tests – Marble, Pin board, Cards and Puzzle – and the scores were compared with their actual performance. Correlation and regression analyses were used to analyze the research data and only 14% of the variation in work performance was explained by dexterity test scores as per the findings. There is no relationship or impact shown between dexterity tests and performance. Thus, the study shows that no significant job performance prediction could be seen through the current dexterity tests practiced at present by the garment factory.

**Keywords:** Job performance, Dexterity test, Sewing machine operator

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**FACTORS AFFECTING EMPLOYEE MOTIVATION  
(IN REFERENCE TO NATIONAL FILM CORPORATION, SRI LANKA)**

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With the massive advancement of technology and the working speed of the modern world, employees' capability and motivation is greatly required for the success of an organization or a company. As productivity depends on employee motivation, it can be enriched and improved by creating a work environment that exploits the factors that affect performance. A broad literature analysis has been carried out to identify the most favourable factors that affect the motivation levels of employees in different fields from different countries. Through the literature review five factors were derived as the main variables that affect employee motivation. Those were salary benefits, working conditions, supervision, advancement and organizational policy. The purpose of this study was to check whether the so-called factors affect employee motivation and performance. This was a case study at the National Film Corporation in Sri Lanka, which implemented a descriptive research design and a cross-sectional analysis. The study involved collection of primary data from a sample of 52 employees from various departments of the National Film Corporation, Sri Lanka. The non-probability sampling method of convenience sampling was used in the study. Questionnaires were used to collect primary data. The data has been analysed using statistical models so as to arrive at the established research hypotheses and objectives using SPSS and Excel software. A normality test was done to check on the data given to respondents and a reliability test was carried out to test how reliable the data which was gathered from the respondents was. Correlation Analysis was done to find the association between variables. This study revealed that there was a positive relationship between employee motivation and independent variables, namely salary benefits, working condition, supervision, advancement and organization policies. Salary benefits and employee motivation have a higher relationship ( $r=0.863$ ,  $p<0.05$ ) while the organization policies and employee motivation have a lower relationship ( $r=0.595$ ,  $p<0.05$ ). It is recommended that both managers and employees be trained for ease of understanding and transparency.

Keywords: Discipline, Employee Performance, Motivation

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**AN EMPIRICAL STUDY ON THE FACTORS INFLUENCING THE  
DISCLOSURE REQUIREMENTS OF CORPORATE SOCIAL  
RESPONSIBILITY OF LISTED MANUFACTURING COMPANIES IN  
SRI LANKA**

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Corporate Social Responsibility (CSR) can be identified as a new trend in the business world. It affects the business directly and indirectly. Managers always try to earn the maximum level of profitability to satisfy the shareholders' interests. But it is essential to satisfy the interests of all the stakeholders' interests as well as shareholders. The study was conducted to analyse the factors influencing the disclosure of CSR information of listed manufacturing companies in Sri Lanka, and some of the manufacturing companies were selected as the samples for this study. The researcher also hopes to analyse the effect of company size, company age, profitability and company leverage to CSR. To do so, a regression analysis was carried out to test the impact of influencing factors on CSR. The b value is 0.048. The b values -0.005, -0.31 and -0.051 reveal that company age, ROE, and company leverage tend to move in the opposite direction.

Keywords: Corporate Social Responsibility Disclosure, Company Size, Company Age, Profitability, Company leverage

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## **INSTITUTIONAL FACTORS BEHIND FINANCIAL FRAUDS IN THE CORPORATE SECTOR: A CASE STUDY OF SRI LANKA.**

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This research concerns institutional factors causing financial fraud in the corporate sector. At the end of the 1970's Sri Lanka introduced Neo-Liberal economic policies undermining state controlled economic policies and this opened new development avenues for the active involvement of private sector enterprises. In national and international economic affairs with all the positive development brought about by these particular changes, there seems to have been criminal phenomena occurring and profiting from the opportunities made available by the socio-economic changes. One important aspect of this criminal impact is crimes against the corporate sector in the country. Newspapers reports and complaints made to the police indicate evidence of a developing phenomenon of crimes against corporations which have not been so far addressed from a criminological perspective. Accordingly, the central problem of this research study is to identify the causes and consequences behind financial fraud against the corporate sector. For the purpose of data collection, 66 criminal cases were selected from the Fraud Investigation Bureau in Sri Lanka. Structured questionnaires and interviews were used as the key method of data collection. The research results flag that Forgery, Criminal Breach of trust, Misappropriation and Cheating were the main criminal offences recorded in the corporate sector.

Financial frauds against the corporate sector have been perpetrated by both internal employees and external parties. The majority of institutions have become victims due to their trust in customers. Lack of internal control including an insufficient monitoring system, inadequate segregation of duties, and irregular audit supervision were the other reasons for frauds to occur. Irregular audit supervision must be updated according to the institutional framework. Employee monitoring and supervision should be established and carried out consistently within organizations.

**Keywords:** Financial Crimes, Corporate Sector, Institutional Factor, Cheating, Sri Lanka.

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# **PHYSICAL SCIENCES**



**ON STAR CRITICAL RAMSEY NUMBERS RELATED TO STARS  
VERSUS  $K_{1,m} + e$  FOR SMALL  $m$**

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After the publication of the original paper by F. P. Ramsey, the new area of Graph Theory, namely Ramsey Theory, emerged with the contribution of the paper by Paul Erdős and George Szekeres, published around 1935. According to this paper, for any two graphs  $H, G$  and any red/blue colouring of  $K_n$  represented by  $K_n = H_R \oplus H_B, K_n \rightarrow (H, G)$  if there exists a red copy  $H$  in  $H_R$  or a blue copy  $G$  in  $H_B$ . Using this notation, the Ramsey number  $r(m, n)$  is defined as the smallest positive integer  $N$  such that  $K_N \rightarrow (K_m, K_n)$ . Erdős et al., proved that, for any  $m \geq 2$  and  $n \geq 2, r(m, n)$  exists and satisfies  $r(m, n) \leq r(m - 1, n) + r(m, n - 1)$  and  $r(m, n) \leq \binom{m + n - 2}{m - 1}$ .

The exact determination of Ramsey numbers for small graphs has been attempted by many mathematicians in subsequent years. In 2010, Hook and Isaak, introduced Star-critical Ramsey number  $r^*(H, G)$  which captured the attention of many researchers in recent years. The Star critical Ramsey number  $r^*(K_{1,n-1}, G)$  for any simple graph  $G$  is defined as the largest integer  $k$  such that  $K_{r(K_{1,n-1}, G)-1} \sqcup K_{1,k} \rightarrow (K_{1,n-1}, G)$ . In this paper, starting with  $G = K_{1,2} + e = K_3$ , we exhaustively find Ramsey numbers  $r(K_{1,n-1}, K_{1,m} + e)$  for  $(1 \leq n \leq 5, 2 \leq m \leq 7)$  and subsequently based on this, we find Star critical Ramsey numbers  $r^*(K_{1,n-1}, K_{1,m} + e) (1 \leq n \leq 5, 2 \leq m \leq 7)$ .

Keywords: Graph theory, Ramsey theory, Star critical Ramsey numbers, Mathematics, Subject Classification: 05C55, 05C38, 05D10.

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## A PRELIMINARY STUDY ON A FLUORESCENCE SENSOR FOR EFFICACY ASSESSMENT OF CHEMOTHERAPY TREATMENT IN LUNG CANCER PATIENTS

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In Sri Lanka lung cancer patients generally present themselves at the late stages of the cancer and consequently they are treated with chemotherapy irrespective of the type of cancer. Both non-small cell lung cancer and small cell lung cancer are treated with different sets of chemotherapy and the response to the chemotherapy is monitored after the treatment cycle using the images. Hence, there is an urgent need for a biomarker to detect the efficiency of chemotherapy. DNA methylation-based biomarkers have proven to be more specific and sensitive than commonly used protein biomarkers. Hypermethylation of CpG islands is a sign of malignant growth and profiling of methylation in circulating tumour DNA (ctDNA) has gained increasing attention as potential biomarkers.

Accordingly, this study aims at developing a fluorescence biomarker that could potentially be used to detect the epigenetic alterations in circulating tumour DNA (ctDNA) isolated from blood plasma of lung cancer patients. The blood samples were collected at the pre and post chemotherapy period of 5 lung cancer patients admitted to the Apeksha Hospital. The ctDNA isolated from the patient blood plasma were subjected to the Fluorescence assays. The attempt made to develop a fluorescence probe to detect chemotherapy efficacy from ctDNA with 1,10-Phenanthroline-5-amine was very successful. The binding constant was determined by UV-Visible spectroscopic method.

The blood samples taken after chemotherapy treatment was treated with 1,10-Phenanthroline and 1,10-Phenanthroline-5-amine. The binding constant ( $K_b$ ) of the resultant solution and number of binding sites ( $n$ ) in ctDNA strands were determined using UV-Visible spectroscopic method and fluorescence spectroscopic method. It was found that 1,10-Phenanthroline-5-amine ( $K_b=49.3\pm 0.05$ ) has the greatest binding affinity in ctDNA than 1,10-Phenanthroline ( $K_b=22.6\pm 0.05$ ) which was determined by fluorescence spectroscopic method whereas the binding affinity of that 1,10-Phenanthroline-5-amine ( $K_b=45.3\pm 0.05$ ) and 1,10-Phenanthroline ( $K_b=19.6\pm 0.05$ ) by UV-Visible spectroscopic method. The higher number of binding sites in ctDNA 1,10-Phenanthroline-5-amine ( $n=10$ ) than 1,10-Phenanthroline ( $n=1.2$ ) were determined by fluorescence spectroscopic method. Also, 1,10-Phenanthroline-5-



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amine has a higher Stern-Volmer constant ( $K_{SV}=13.7$ ) compared to 1,10-Phenanthroline ( $K_{SV}=1.66$ ).

The same procedures were carried out for the blood samples taken before chemotherapy treatment with 1,10-Phenanthroline and 1,10-Phenanthroline-5-amine. The ctDNA in pre chemotherapy samples with the above two compounds show less binding affinity and lower number of binding sites compared with the post chemotherapy sample. Thus it can be concluded that 1,10-Phenanthroline-5-amine is a better fluorescence marker than 1,10-Phenanthroline to determine the efficacy of the chemotherapy and hence could be developed as a potential epigenetic marker. An extended study with a higher number of patients with shorter chemotherapy period involving a series of testing within the chemotherapy cycle will further validate the use of fluorescence biomarker for clinical applications.

**Keywords:** Circulating tumour DNA (ctDNA), Stern-Volmer constant, Fluorescence sensor, 1,10-Phenanthroline-5-amine.

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## EFFECT OF HYDROGEN BONDING ON THE FLUORESCENCE OF PROTONATED 1,10 PHENANTHROLINE AND 1,10 PHENANTHROLINE-5-AMINE

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1,10-Phenanthroline is an important chelating bidentate ligand for transition metal ions and its excitation and emission wavelengths in acetonitrile are 267 nm and 364 nm respectively. Upon protonation, 1,10-Phenanthroline shows a red shifted emission peak at 415 nm. 1,10-Phenanthroline-5-amine a derivative of 1,10-Phenanthroline excites and emits at 280 nm and 515 nm in acetonitrile respectively. It has an increased fluorescence quantum yield than pristine 1,10-Phenanthroline.

Solvent polarity and environmental effects have prominent consequences on spectral properties of fluorophores. Linear Solvation Energy Relationship (LSER) is used to qualitatively understand the above effects. Microscopic parameters such as  $\alpha$ ,  $\beta$  and  $\pi^*$  are used to explain the variations of solvent properties. Hydrogen-bond acidity of a solvent is described by a scale of  $\alpha$ , hydrogen-bond basicity of a solvent is described by a scale of  $\beta$  and solvent dipolarity/polarizability is described by a scale of  $\pi^*$ .

In this study, the effect of hydrogen bonding on the fluorescence intensity of protonated 1,10-Phenanthroline (fluorescence peak at 415 nm) and 1,10-Phenanthroline-5-amine (fluorescence peak at 515 nm) at different solvent environments were studied. The effects of hydrogen bonding from different organic solvents with distinct polarities (methanol, water, DMF, DMSO, dichloromethane and chloroform) were tested.

Fluorescence of both peaks was quenched by solvents. Stern-Volmer plots were generated for every solvent quenching process.  $\beta$  values of the hydrogen bond accepting solvents with protonated 1,10-Phenanthroline gave a linear correlation for Stern-Volmer quenching constant whereas  $\alpha$  values of hydrogen bond donating solvents with 1,10-Phenanthroline-5-amine gave a linear correlation for Stern-Volmer quenching constant.

Thus, it can be concluded that hydrogen bond accepting solvents quench fluorescence of protonated 1,10-Phenanthroline whereas hydrogen bond donating solvents quench fluorescence of 1,10-Phenanthroline-5-amine. Due to the formation of hydrogen bonding complex between the chelating core of the fluorophores and the solvent molecules, the fluorescence of fluorophores decreases.



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Keywords: Linear Solvation Energy Relationship (LSER), Stern-Volmer plot, Fluorophore, 1,10-Phenanthroline-5-amine.

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## **A GREEN APPROACH FOR SURFACE HYDROPHOBIZATION OF MICROCRYSTALLINE CELLULOSE USING SUNFLOWER OIL**

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Incorporation of natural fibers into synthetic polymers in fabrication of polymer based composites have attracted immense research interest owing to its biodegradability, low impact on environment, economic feasibility, conservation of energy and availability in modern automotive, aerospace and different engineering applications. Among all the other natural fibers, cellulose, the most abundant of all, prevailed in the composite industry with its great contribution in reinforcing polymers. To make cellulose a more ideal candidate, microcrystalline cellulose (MCC) has been derived, impregnating a higher degree of crystalline regions.

Together with MCC's high aspect ratio and high surface area it also gives rise to enormous surface hydroxyl (OH) groups leading to prominent hydrophilicity prone to agglomeration. This creates a bottleneck in dispersing MCC in non-polar environments such as hydrophobic polymers. Consequently, there is a heightened demand on surface modification of MCC to improve the surface hydrophobicity and thereby to achieve compatibility with hydrophobic polymers.

Ultrasonication assisted pathway was utilized without using any acid or base catalysts to prepare sunflower oil bio diesel with higher energy recovery. Biocompatible sunflower oil ethyl esters (SFEEs) or sunflower oil bio diesel was used in this study to graft and replace OH groups on MCC surface avoiding typical toxic, unstable and expensive modifiers prioritizing green chemistry.

SFEE treated MCC showed positive results in all characterization techniques. New bands were pronounced in FTIR spectra at 1745, 2855 and 2920  $\text{cm}^{-1}$  ascribed for ester carbonyl, asymmetric and symmetric  $\text{CH}_2$  bonds of aliphatic fatty acid chain stretching vibrations respectively for modified MCC. Similar XRD diffractograms confirmed the negligibility in crystal structure changes in the modification process. Thermogravimetric analysis suggested that the improved thermal stability of modified MCC is broadening the processing temperature window. Qualitative confirmation was taken with the wettability test where modified MCC migration to non-polar dichloromethane from polar aqueous phase indicating its improved hydrophobicity.

Surface OH groups of MCC were reacted with SFEEs to improve its surface hydrophobicity and to achieve uniform dispersability in non-polar environments



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making them ideal for the hydrophobic polymer composite fabrication. This study bestowed a greener, industry-friendly approach widening the usage of sunflower oil to render MCC surface hydrophobicity. This surface modified MCC can be used for various modern engineering applications.

Keywords: Microcrystalline cellulose, Sunflower oil ethyl esters, Surface modification, Transesterification

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## **4-MERCAPTOBENZOIC ACID FUNCTIONALIZED SILVER NANOPARTICLES FOR THE DETECTION OF TRIVALENT CHROMIC IONS**

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Chromium is one of the heavy metal ions which is significant due to its various roles and it commonly exists in trivalent ( $\text{Cr}^{3+}$ ) and hexavalent ( $\text{Cr}_2\text{O}_7^{2-}$ ) oxidation states. Trivalent chromium is an essential nutrient for humans and plays a major role in maintaining normal body metabolism. Nevertheless, high levels of  $\text{Cr}^{3+}$  can cause toxicity effects as it can damage cellular components. Moreover, it is also an environment contaminant, especially in water and food due to various industrial and other human activities. Therefore, development of novel sensitive and selective methods for the detection of trace chromium ions is of high importance. In this study, a facile and selective method for the colorimetric detection of trivalent chromic ions using 4-mercaptobenzoic acid (4-MBA) functionalized silver nanoparticles (AgNPs) is introduced. AgNPs were synthesized by the chemical reduction method and they were surface functionalized with 4-MBA under optimum experimental conditions. Bare and 4-MBA modified AgNPs were characterized using UV-Vis spectroscopy, dynamic light scattering measurements and scanning electron microscopy (SEM). 4-MBA contains a thiol group which displays high affinity for Ag surfaces and a carboxyl group which can interact with the surrounding, or in this case, to act as a sensor for  $\text{Cr}^{3+}$  ions since it forms a very stable complex with  $\text{Cr}^{3+}$  ions, when compared with other metal ions. The presence of  $\text{Cr}^{3+}$  ions induces the aggregation of 4-MBA functionalized AgNPs as they get linked together by “carboxylate- $\text{Cr}^{3+}$ -carboxylate” coordinative coupling, resulting in a colour change from yellow to deep orange. This  $\text{Cr}^{3+}$  induced aggregation was first monitored by the naked eye and then it was further verified by UV-Vis spectroscopy and SEM. This novel detection system could be successfully applied to determine  $\text{Cr}^{3+}$  ions in real water samples in heavy metal analysis.

**Keywords:** Chromic ions, 4-mercaptobenzoic acid, silver nanoparticles, UV-Vis spectroscopy

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## ENHANCEMENT OF PERFORMANCE OF DYE SENSITIZED SOLAR CELLS USING ANTHOCYANIN DYES WITH L-ASCORBIC ACID

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The natural pigments extracted from Jamson (*Carissa carandas*) fruit and petals of Erabadu (*Erythrina fusca*) flowers which are enriched with anthocyanins were used as sensitizers in dye sensitized solar cells (DSSCs). This study was mainly focused on studying the performance of dye sensitized solar cells in the presence of L-Ascorbic Acid with anthocyanin dyes. Working electrodes of dye sensitized solar cells based on TiO<sub>2</sub> were constructed by introducing ascorbic acid to the dye sensitizer by following three different methods. In the first method, sensitizer was coated on the TiO<sub>2</sub> surface by using a solution containing above dyes and ascorbic acid. In the second method, TiO<sub>2</sub> films were dip coated with dye molecules and then treated with the ascorbic acid. In the last method, TiO<sub>2</sub> electrodes were first treated with ascorbic acid and then dip coated with the dye molecules.

The highest photovoltaic efficiency was obtained from the solar cells with photoanodes coated using the mixture of ascorbic acid in Erabadu dye solution, which was 1.19 %. Devices fabricated with the TiO<sub>2</sub> electrodes, which were first coated with the dye from Erabadu and then dipped in ascorbic acid solution delivered 1.04% efficiency with 8.4 mA cm<sup>-2</sup> photocurrent density.

The solar cells fabricated with TiO<sub>2</sub> photoanode immersed in a mixture of ascorbic acid and dye obtained from Jamson showed only 0.762 % of efficiency. The efficiency of the cell coated only with the dye from Jamson showed a lower efficiency of 0.38 %. The dye extraction from Jamson already contains ascorbic acid which gives the sour taste to the fruit. Therefore, one of the reasons for lower efficiency in DSSCs sensitized by the mixture of ascorbic acid and dye extracted from Jamson could be attributed to the higher concentration of the ascorbic acid in the dye solution.

The enhancement in the efficiency of DSSCs using anthocyanin dyes with ascorbic acid could be mainly due to the following reasons. One is the suppression of recombination due to dye quenching by ascorbic acid surrounding the anthocyanin dye molecules. The other reason is ascorbic acid when chelate with TiO<sub>2</sub> turns to yellow in colour which itself absorbs light in the UV region to generate a photocurrent. Therefore, further studies are essential to fully understand the performance of the cell in terms of the effect of ascorbic acid concentration and the soaking time of the photoanode in the dye solution consisting of ascorbic acid.



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Keywords: Dye sensitized solar cells, Ascorbic acid, Anthocyanin, Photovoltaic efficiency

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