



UNIVERSITY OF COLOMBO
SRI LANKA
ANNUAL RESEARCH SYMPOSIUM 2017



Research for Development: Challenges and Opportunities

PROCEEDINGS

15 November 2017

PROCEEDINGS
ANNUAL RESEARCH SYMPOSIUM 2017
UNIVERSITY OF COLOMBO, SRI LANKA

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UNIVERSITY OF COLOMBO, SRI LANKA

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'Buddhi Sarvathra Bhrajate'
Wisdom Enlightens

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*A center of excellence of global presence in research, teaching, learning and engagement
in the knowledge society*

OUR MISSION

*To be a benchmark setter in creating, disseminating, and applying multi-disciplinary
knowledge in the global presence, producing high quality human competencies for
innovation, independent thinking, and entrepreneurship within a collaborative work
environment while upholding national values*

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CONTENTS

Message from the Vice-Chancellor, University of Colombo	1
Message from the Chairperson, Symposium Committee	3
Introduction to the Chief Guest	5
Introduction to the Keynote Speaker	6
Address by the Keynote Speaker	7

FACULTY SESSIONS

Faculty of Arts	9
Message from the Dean, Faculty of Arts	10
Programme	11
Introduction to the Keynote speaker	12
Keynote Abstract	13
List of Abstracts	15
Abstracts	21
Faculty of Education	85
Message from the Dean, Faculty of Education	86
Programme	87
Introduction to the Keynote speaker	88
Keynote Abstract	89
List of Abstracts	90
Abstracts	93

Faculty of Graduate Studies	119
Message from the Dean, Faculty of Graduate Studies	120
Programme	121
Introduction to the Keynote speaker	122
List of Abstracts	123
Abstracts	129
Faculty of Law	171
Message from the Dean, Faculty of Law	172
Programme	173
Introduction to the Keynote speaker	174
Keynote Abstract	175
List of Abstracts	176
Abstracts	179
Faculty of Management and Finance	199
Message from the Dean, Faculty of Management and Finance	200
Faculty of Medicine	201
Message from the Dean, Faculty of Medicine	202
Programme	203
Introduction to the Keynote speaker	204
Keynote Abstract	205
List of Abstracts	206
Abstracts	209

Faculty of Science	229
Message from the Dean, Faculty of Science	230
List of Abstracts	231
Abstracts	237
Faculty of Technology	275
Message from Dean, Faculty of Technology	276
Introduction to the Keynote speaker	277
Keynote Abstract	278
List of Abstracts	279
Abstracts	280
Sri Palee Campus	285
Message from the Rector, Sri Palee Campus	286
List of Abstracts	287
Abstracts	288

**MESSAGE FROM THE VICE-CHANCELLOR,
UNIVERSITY OF COLOMBO**

Senior Professor Lakshman Dissanayake



It gives me great pleasure to write this message for the 2017 Annual Research Symposium of the University of Colombo. This year's theme, "Research for Development: Challenges and Opportunities", more than ever underscores the University's commitment to keeping a critical edge to its research culture. That the interrogation and renewal of knowledge is one of the drivers of development is virtually a commonplace. Yet the importance of educational institutions actively attending to this task is sometimes overlooked. All too often, the responsibility of enhancing the opportunities and addressing the challenges to doing critical research weighs heavily on the individual academic. This year's theme emphasises the institutional responsibility of the university in this undertaking. It is in keeping with this aim that the University of Colombo has established the Centre for Research to nurture cutting-edge research and facilitate its publication.

Academics from the University of Colombo have played an important role in keeping alive a sharp critique of the economic, social, political and ethical aspects of development. This year is no exception. A total of 240 abstracts were submitted for the Annual Research Symposium from the Sri Palee campus and from 8 Faculties. Each Faculty brings its specific focus to bear on development issues, showcasing strengths such as multidisciplinary perspectives, original investigations, and innovative methodologies. Our expectation is that this contribution will extend beyond the Symposium into the public discourse and into policymaking. The development discourse in Sri Lanka has been a highly contested domain. The high value attached to redefining development as a matter of national interest arose from one kind of iteration, which was that of 'moving on' to the next (and ostensibly long deferred) stage of the country's evolution. The competing understandings and interests of successive regimes, civil society, and other stakeholders continue to keep open a debate around the politics of the development discourse.

It is a privilege to welcome the Faculty Keynote speakers, each of whom is a well-established scholar in Sri Lanka or overseas. This year's Symposium also includes a number of overseas research collaborations between academics and postgraduate students from the University of Colombo and academics and independent researchers from Canada, Australia, the USA, Sweden, Saudi Arabia, Nigeria, and India.

I extend my congratulations and best wishes to the speakers and presenters, and wish everyone a fruitful period of research and networking.

**MESSAGE FROM THE CHAIRPERSON,
ANNUAL RESEARCH SYMPOSIUM 2017**

Dr. Pavithra Kailasapathy



It gives me great pleasure to welcome all of you, on behalf of the Organising Committee, to the Annual Research Symposium 2017. The Annual Research Symposium of the University of Colombo, which started in 2008, is in its tenth year. This year, the technical sessions are being held under the overarching theme, “Research for Development: Challenges and Opportunities”. This year, we have included 240 Abstracts from all Faculties, except Nursing, and Management and Finance, in the Proceedings. As the Faculty of Management and Finance is organising an International Conference, a separate book on the proceedings will be published. I am happy to note that, this year, one of our newest Faculties, the Faculty of Technology, will hold technical sessions as well. The abstracts included in this proceeding were submitted by the University of Colombo academics and postgraduate students and accepted after peer review.

On behalf of the University of Colombo, I would like to thank the Honourable Chief Justice, Mr. Priyasath Dep PC, for gracing the occasion as the Chief Guest. In addition, I would like to thank Professor Amilra de Silva of Queen’s University, Belfast, UK, for accepting our invitation to deliver the Keynote address.

I would like to take this opportunity to thank the Vice-Chancellor, Senior Professor Lakshman Dissanayake for his guidance and support in organizing this event. I also thank the Inauguration Committee, the Editorial Committee, the Food and Beverages Committee, the Media Committee, and Ms. Tharushika Pathirana and the staff of the Academic and Publications Branch for their efforts to make this event possible. Without your assistance, this could not have become a reality.

INTRODUCTION TO THE CHIEF GUEST

Chief Justice Priyasath G. Dep

45th Chief Justice

Supreme Court of Sri Lanka



Justice Priyasath Dep was appointed as the 45th Chief Justice on 2 March 2017. His Lordship was born on 12 October 1953 and was educated at St. Joseph's College, Colombo. He has a Bachelor of Development Studies, a Master of Arts in International Relations, and a Postgraduate Diploma in Forensic Sciences from the University of Colombo, as well as a Postgraduate Diploma in International Law from the ISS, The Hague, Netherlands.

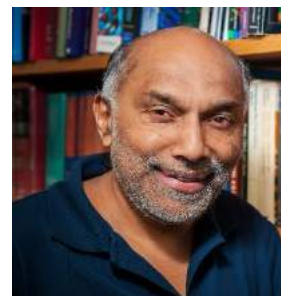
Justice Priyasath Dep was enrolled as an Attorney-at-Law of the Supreme Court of Sri Lanka in October 1976. His Lordship joined the Attorney General's Department as a State Counsel in January 1978, and was promoted to the post of Senior State Counsel in February 1989. Justice Dep was appointed as a Deputy Solicitor General in February 1996 and as the Additional Solicitor General in October 1991. Justice Dep was appointed as a President's Counsel in April 2000, and as the Solicitor General in April 2007. As the Solicitor General, Justice Dep was in charge of the Civil Division and supervised Fundamental Rights Applications, Civil Appeals and subjects such as Public International Law, Bills, Rule Matters and Extradition. Justice Dep has represented the Government of Sri Lanka in bilateral and multilateral negotiations pertaining to extradition and mutual legal assistance in criminal matters.

Justice Priyasath Dep served the Attorney General's Department for more than 33 years and had the distinction of being the head of both civil and criminal divisions. His Lordship was the acting Attorney General on many occasions. Justice Dep was appointed as a Judge of the Supreme Court of Sri Lanka on 13 June 2011, which is the highest and the final superior court of record in Sri Lanka. Justice Dep is a member of the Judicial Service Commission, a member of the Board of Management of the Sri Lanka Judges' Institute, and a member of the Incorporated Council of Legal Education. His Lordship is the most senior judge in the Supreme Court of Sri Lanka and was the acting Chief Justice on numerous occasions. Justice Priyasath Dep is the 45th Chief Justice of the Democratic Socialist Republic of Sri Lanka

INTRODUCTION TO THE KEYNOTE SPEAKER

Professor A. P. de Silva

Queen's University of Belfast, Northern Ireland



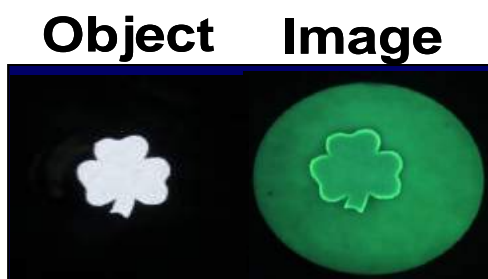
Sri Lankan-born A. P. de Silva works at the Queen's University of Belfast, Northern Ireland. With his co-workers, he introduced molecular logic as an experimental field and established the generality of the luminescent PET (photoinduced electron transfer) sensor/switch principle. He was consultant for the chemistry module of the market-leading OPTI® point-of-care blood gas/electrolyte analyzer currently sold by Optimedical Inc. The sales of the chemistry module have been 140 M USD so far. The corresponding veterinary version has made 400 M USD. He was elected to the Royal Irish Academy in 2002. He received the Royal Society of Chemistry Sensors award in 2008 and the 1st international award for Molecular Sensors and Molecular Logic Gates in 2012. His book, *Molecular Logic-based Computation*, written in 2013, has also been available in Chinese and in Japanese since 2014.

KEYNOTE ABSTRACT

Sensing and Logic Research at Colombo and Belfast: A tale of two once-troubled cities

Professor A. P. de Silva
Queen's University of Belfast, Northern Ireland

One of the main principles underlying fluorescent sensors is based on PET (photoinduced electron transfer),¹ according to which a switching 'on' of fluorescence in response to chemical analytes can be designed. Since its generalization in Colombo, Sri Lanka, it has now grown to involve 360 laboratories around the world. Some of these sensor systems are serving in critical care units in hospitals and in ambulances, performing blood diagnostics. These form the basis of a half-billion-dollar industry.² Other sensors visualize intracellular players. Yet others map species distributions in nanometric spaces near membranes.³ These spaces are too small for the tiniest silicon-based wireless devices to enter. Our introduction of molecular logic gates^{4,5} from Belfast, Northern Ireland, allows us to build more complex sensors and micro-object identification systems.⁶ More complex logic operations and even human-scale computations, e.g. edge detection of objects⁷ and outline drawing⁸ (Figure), are now achieved by molecular systems. 540 laboratories have contributed to this field so far. A short video is available at www.youtube.com/watch?v=sLGnZDP5Ecg



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FACULTY OF ARTS



The Role of Humanities and Social Sciences in Research for Development

21 - 22 November 2017

**MESSAGE FROM THE DEAN,
FACULTY OF ARTS**

Professor Athula Ranasinghe



It is with great pleasure that I pen this message for the proceedings book of the 2017 University of Colombo Annual Research Symposium on behalf of the Faculty of Arts. This year, the theme of the Faculty Symposium is “The Role of Humanities and Social Sciences in Research for Development”, in keeping with the overall University theme. Through the different eras of development discourse, the social sciences and humanities have played a crucial role in situating development in the realities of particular social, cultural, economic, and political contexts. Therefore, this year’s theme is of particular relevance and value to us.

Sixty-four abstracts were selected for presentation at this year’s Faculty of Arts Symposium. A common thread among them is their critical engagement with the concept and processes of development. In this context, I thank the Keynote Speaker, Professor Amrit Sen from Visva-Bharati, Santiniketan, for accepting our invitation to address us on the directions taken by research for development.

I thank the Vice-Chancellor of the University of Colombo for his continued support towards all academic endeavours at the Faculty of Arts. Thanks are due to the team efforts of the former Director of Studies of the Faculty of Arts and Conference Convenor; the Organising Committee; the Editorial Committee; the Review Committee; the staff of the Dean’s Office; the staff of the Vice-Chancellor’s office; and the Computer Unit. I would also like to acknowledge the contribution of the University of Colombo, the Faculty Development Fund of the Faculty of Arts, the Centre for Contemporary Indian Studies, and the Department Development Funds of the Faculty for sponsoring the Faculty of Arts Symposium.

I offer my congratulations to the contributors. It is their interest and enthusiasm that allow the Annual Research Symposium to bring together Faculty members and other academics to interact across disciplinary boundaries in a healthy exchange of ideas.

FACULTY OF ARTS

PROGRAMME

21-22 November 2017

- | | |
|------------|--|
| 8.00 a.m. | Registration |
| 8.50 a.m. | National Anthem and lighting of the oil lamp |
| 9.00 a.m. | Video presentation |
| 9.10 a.m. | Welcome Address by Professor Athula Ranasinghe
Dean, Faculty of Arts |
| 9.20 a.m. | Address by Senior Professor Lakshman Dissanayake
Vice-Chancellor, University of Colombo |
| 9.30 a.m. | Keynote Address: “Whither Research for Development?”
Professor Amrit Sen, Visva-Bharati, Santiniketan |
| 10.15 a.m. | Vote of Thanks by Dr Iresha Lakshman |
| 10.25 a.m. | Tea |

**INTRODUCTION TO THE KEYNOTE
SPEAKER**



Professor Amrit Sen

Department of English, Visva-Bharati, Santiniketan, India

Interested in Eighteenth-century Studies, Travel Writing, Tagore Studies and the History of Science, Professor Sen has won the outstanding research award for his doctoral dissertation, *The Narcissistic Mode: Metafiction as a Strategy in Moll Flanders, Tom Jones and Tristram Shandy*, published by Worldview in 2007. He has been awarded the UGC, India Research Award for his project titled “The Self and the world in Tagore’s Travel Writings”.

His major publications include *The Narcissistic Mode: Moll Flanders, Tom Jones and Tristram Shandy* (Worldview, 2007); *Rathindranath Tagore: The Unsung Hero* (Co-edited with Tapati Mukhopadhyay, Visva-Bharati, 2013); *Rabindranath Tagore and His Circle* (Co-edited with Tapati Mukhopadhyay, Visva-Bharati, 2015); *Sharing the Dream: The Remarkable Women of Santiniketan* (Visva-Bharati, 2016); *Confluence of Minds: The Rabindranath Tagore and Patrick Geddes Reader on Education and the Environment* (Co-edited with Tapati Mukhopadhyay and Bashabi Fraser, Visva-Bharati, 2017); *The Scottish Enlightenment and the Bengal Renaissance: The Continuum of Ideas* (Co-edited with Tapati Mukhopadhyay and Bashabi Fraser, Visva-Bharati, 2017); and *The Bengali Chemist: Acharya Prafulla Chandra Ray and Postcoloniality* (Karigar, 2017).

He has travelled extensively as Project Coordinator for the UK-India Education and Research Initiative (UKIERI) award to Edinburgh, Scotland; as invited speaker to the University of Oxford; and to Tongji University, Shanghai, China. He has also delivered the Tagore Memorial Lecture at the Rabindranath Tagore Institute in Mauritius.

KEYNOTE ABSTRACT

“Whither Research for Development?”

Professor Amrit Sen
Department of English
Visva-Bharati, Santiniketan, India

This paper interrogates the mainstream concept of measuring development by economic growth by examining two alternative models – development as freedom (Amartya Sen) and development as measured by the happiness index. Within this framework it interrogates the role of research in the humanities and social sciences. The first part of the paper looks at the synthesis of research in the humanities and social sciences along with performative practices in the ideas of Rabindranath Tagore as practiced in Visva-Bharati in an era of early global interaction. Using a relatively unknown essay by Tagore titled “Can Science be Humanized?”, I explore how Tagore approached new complexities and challenges to reinforce the role of exchange and happiness within research and pedagogic practices in Santiniketan. Taking the cue from Tagore, the paper then posits happiness and equality as potent questions for research in issues as diverse as democracy, environment, women’s rights, and the problems of digital media in the contemporary posthuman condition. Given the paucity of funding in the humanities and social science, paradoxically in an age of anger, what are the urgencies of raising meaningful questions in research? How does this research then enter into our pedagogic and everyday praxis?

FACULTY OF ARTS

List of Abstracts

1. 'Just kidding': Student perspectives on the use of pedagogical humour 20
S.A. Abayasekara
2. Use of Information and Communication Technology to teach English 21
vocabulary: A study conducted in primary schools of the Western
Province
T.A.C.J.S. Bandara and S. Pathirathna
3. Left-behind women's behaviour regarding contraceptive use: A case 22
study of selected Grama Niladari Divisions in the Kandy District
K. Boyagoda
4. Ethnic reconciliation after the civil war in Sri Lanka: Can pursuing 23
accountability for war crimes reconcile divided ethnic groups?
S. Chandran
5. Assessing the degradation of mangrove ecosystems in the Puttalam 24
Lagoon
M.D.K.L. Gunathilaka and C.M.K.N.K. Chandrasekara
6. A preliminary study of snake bites in Kurunegala, Anuradhapura, and 25
Galle Districts
U.T.G. Perera, H.M.T.P. Ekanayake and C.M.K.N.K. Chandrasekara
7. Language as supervernaculars: A case study on language and online 26
gaming
D.G.N.T. de Silva

8.	Workers, worshippers, and the servant of the temple: Up-country Tamil religiosity at Sri Pāda/Shivanoli Pādam <i>P. de Silva</i>	27
9.	Peasant resistance and the colonial encounter in Sri Lanka in the Seventeenth and Eighteenth centuries <i>N.R. Dewasiri</i>	28
10.	Environmental cooperation in South Asia: India and Nepal trans-boundary air pollution <i>P.L.S. Dias</i>	29
11.	The expectation of life without disability in Sri Lanka <i>L. Dissanayake</i>	30
12.	Use of legitimate power by Algeria, Egypt, and Syria against the Arab Spring <i>P.K. Dodangodage</i>	31
13.	Does foreign aid contribute to economic development? Evidence from micro data <i>P. Dunusinghe</i>	32
14.	A sociological study of the Five Hundred Houses Project in Mihindusenpura <i>A. Fernando</i>	33
15.	The prodigious need for Sustainable Development 25 years after Agenda 21: Determinants of CO ₂ emission in a cross section of countries (2002-2013) <i>A.N. Fernando</i>	34
16.	The impact of exchange rate volatility on Sri Lanka's export growth <i>S. J. Francis and M. Ganeshamoorthy</i>	35

17. International production networks and Sri Lankan exports: Where do we stand? 36
M. Ganeshamoorthy
18. Moor culture in independent Ceylon: The Moors Islamic Cultural Home (MICH) in the 1940s 37
F.F. Haniffa
19. Smoking as a risk factor for Non-Communicable Diseases: A study on over-40s male smokers from the Colombo District 38
A.P.H.S. Jayarathne
20. The applicability of a Buddhist environmental approach to drafting environmental legislation to address contemporary development issues 39
N. Jayasena and P. Amarasinghe
21. Assessment of surface water pollution using physico-chemical parameters in Lunawa Lagoon, Sri Lanka 40
J.N.D. Jayathunga, G.R.A.G. Kumari and R.U.K. Piyadasa
22. An assessment of the Saemaul Undong programme to enhance living standards of the people in rural areas with reference to Wahawa Grama Niladari Division in Rambukkana 41
F.N. Joseph
23. Identifying the relationship between land fragmentation and agricultural productivity: A study with reference to vegetable land of the Wakandawala North Grama Niladari Division in the Weeraketiya D.S. Division in the Hambanthota District 42
D.M. Karunadasa
24. Impact of socio-demographic factors on the decorative consumption of wristwatches among employees in Colombo 43
C. Karunanayake and T.L. Gunaruwan

25. Ethnic differences in university students' knowledge of HIV/AIDS and sexually transmitted infections 44
H.V.V.M.P. Karunaratne
26. Understanding access to potable water in resettled areas: A case study of the Karachi Divisional Secretariat Division, Kilinochchi 45
P. Kirishanthan
27. "Underserved" or "Undeserved"? A study on the identity formation of the 'slum' and 'shanty' dwellers in Colombo 46
A. Korala
28. Humanising development: Bringing home homeless humans and dogs to the development discourse in Sri Lanka 47
K.K. Kumara
29. Technical efficiency in the production of economic knowledge in state universities in Sri Lanka: A nonparametric perspective on multiple outputs and the role of students 48
N. Kurukulasooriya and A. Ranasinghe
30. Health-seeking behaviour of patients diagnosed with Chronic Kidney Disease with uncertain etiology: Complementary system for health service delivery 49
J.H.C. Liyanage
31. Knowledge, attitudes, and behaviour related to Non-Communicable Disease prevention: An intervention-based study in the Padukka MOH area 50
J.H.C. Liyanage and M. Higuchi

32.	Socio-economic differentials in disability among older people in Sri Lanka <i>R.L.R. Malsha</i>	51
33.	Determinants of employment participation of urban migrant women in the Kalutara District <i>D.P.K. Manel and S. Perera</i>	52
34.	The role of external debt in economic growth in Sri Lanka <i>U. Moramudali and N. Wickremeratne</i>	53
35.	History curricula for national reconciliation: An analysis of history textbooks in secondary schools in Sri Lanka <i>N.I. Nanayakkara</i>	54
36.	Spatial distribution of diseases related to the 2016 flood in Kaduwela and Kolonnawa Divisional Secretariat Divisions <i>S.M.A.T. de S. Nandaseela, L. Manawadu and D. Chathumami</i>	55
37.	Normative behaviour in regional affairs: A conceptual study on the 'ASEAN Way' <i>S.C. Padmakumara and K.L.S. Jayarathne</i>	56
38.	Taking participatory governance from needs to rights <i>P. Peiris</i>	57
39.	Can graduates increase earnings by acquiring multiple qualifications? <i>T.A.M. Pushpakumara and A. Ranasinghe</i>	58
40.	Impact of human capital investment on labour market outcomes: The Sri Lankan experience <i>A. Ranasinghe</i>	59

41.	Needs of family members of people with mental health problems <i>R.M.A. Rathnayake</i>	60
42.	Flood modelling and flood risk analysis based on the Kelani River using GIS and HEC-RAS <i>V.P.I.S. Wijeratne, L. Manawadu and M.A.D. Samanmali</i>	61
43.	Inter-district rate of out migration and district migration efficiencies in Sri Lanka <i>S. Samarakoon</i>	62
44.	The role of a social worker in community development in a disaster context: Narratives from flood victims in Kolonnawa <i>H.U.S. Samaraweera</i>	63
45.	An analysis of the magnitude of extreme rainfall events in Colombo from 2014 to 2016 <i>R.M.S.S. Sanjeevani, L. Manawadu, K. Punniyarajah and N. Chinthaka</i>	64
46.	Social impact of human trafficking on migrants and their left-behind families in Sri Lanka <i>V.P.N. Senadhi</i>	65
47.	Politics of development beneficiaries versus victims: A case study of the Moragahakanda Irrigation Project <i>M. Senanayake</i>	66
48.	“Remove the lens’’: An analysis of positioning identity and community security development of the Hill-Country Tamil people in Sri Lanka <i>J.U.W. Senevirathne</i>	67
49.	The representation of the mother/land in Shakespeare <i>S. Seneviratne</i>	68

50.	Regaining GSP+ in the wake of Brexit <i>Y.B.K. Seneviratne and K.C. Wijayabahu</i>	69
51.	Ulterior goal of reconciliation in Sri Lanka: A study of the reconciliation process during the Rajapaksa regime <i>N.C.R. Silva</i>	70
52.	Health risks associated with use of polluted water in the Mullaitivu District: A case study of the Maritime Pattu Divisional Secretariat Division <i>V. Sivarajah and F. Ruzaik</i>	71
53.	Physical and psychological health related issues among the post-menopausal women in urban settlement communities in Colombo <i>S.A.Y.N. Subasinghe and E.L.S.J. Perera</i>	72
54.	The role of community radio in community empowerment <i>C.S. Thangaraja</i>	73
55.	Prison overcrowding as a challenge to economic rehabilitation of prisoners <i>W.A.S. Thilanka</i>	74
56.	Sri Lanka's illegal migration: A detriment to development <i>M.S. Wanasinghe-Pasqual and P. Jayawardena</i>	75
57.	Status of long-term care of aged people in elders' homes in Sri Lanka <i>M.K. Weeratunga</i>	76
58.	Application of Balanced Scorecard to the apparel industry: The performance of XX Pvt. Ltd. <i>S. Weerawansa and C. Bandara</i>	77

59.	Impact of the information society on the contemporary Sri Lankan family: A sociological study of Facebook users in Sri Lanka <i>J. Wellawatta</i>	78
60.	Determinants of foreign debt in lower-middle-income countries <i>N. Wickremeratne</i>	79
61.	An analysis of the historiography of R. A. L. H. Gunawardana <i>E.I. Wijayarathna</i>	80
62.	Factors contributing to starting fertility behaviour among different ethnic groups: A case study of the Colombo District <i>D.M.S.G. Wijerathna</i>	81
63.	Challenges faced by university students in following the Sinhala language as a subject <i>W.M.K. Wijesundara, K.W.N.C. Fernando and C. Abeyrathne</i>	82
64.	Digital overuse and the future of children <i>W.M.K. Wijesundara, D.M.C. Senevirathne, N.N. Ruwanpura and K.W.N.C. Fernando</i>	83

‘Just kidding’: Student perspectives on the use of pedagogical humour

S.A. Abayasekara

Department of English, University of Colombo, Sri Lanka

Humour is considered as involving the communication of multiple incongruous meanings that in some manner evoke amusement. Regarding pedagogy, research has identified significant differences in humour use depending on teaching experience, where experienced professors utilise humour with more frequency and relevance than novice teaching assistants. Thus, examining student perspectives on humour use in terms of seniority and accompanying factors such as age, experience, and expertise would aid Higher Education development, especially in a country like Sri Lanka where education is regarded as a fairly formal, hierarchical process. Extending Instructional Humour Processing Theory, this study investigated student views on pedagogical humour in relation to the lecturer’s age, seniority, experience, and expertise. A sample of 53 students from the Department of English, University of Colombo, answered a questionnaire regarding their attitudes towards the use of humour in courses followed at all Departments of the Faculty of Arts. Confirming the research hypotheses, while many students (n=25:47%), regardless of sociocultural background, viewed senior faculty as more adept at using humour in teaching than juniors, they were more comfortable reciprocating humour (n=17:32%) when the lecturer was relatively junior and closer to them in age. However, students additionally regarded the lecturer’s personality, familiarity with the lecturer, class size and dynamics, and their own seniority in the system, as affecting their perceptions. While all respondents unreservedly endorsed the use of positive pedagogical humour, negative humour in terms of derisive jokes targeted at particular individuals/ groups, irrelevant humour, and prolonged humour to the point of distraction, were criticised. The study offers recommendations for junior faculty to learn strategic employment of instructional humour from senior colleagues, and for senior faculty to improve the effectiveness of their own classroom humour. Such steps would put a powerful pedagogical tool to good use, contributing towards enhancing the tertiary educational experience for teacher and learner alike.

Keywords: *humour, pedagogy, students, seniority*

Use of Information and Communication Technology to teach English vocabulary: A study conducted in primary schools of the Western Province

T.A.C.J.S. Bandara¹, S. Pathirathna²

¹*Department of Sinhala, University of Colombo, Sri Lanka*

²*School of Computing, Northshore College of Business and Technology, Sri Lanka*

Sri Lanka has a proud heritage of free education from primary to tertiary levels and a youth literacy rate of 98%, a feat of which any middle-income country can be proud. The Sri Lankan government has taken steps to integrate ICT education into the school education curriculum since the year 2006. With a mission to drive ICT literacy in Sri Lanka forward, 4500 schools have been provided with ICT infrastructure for student-centred ICT learning. Teachers at local schools have been given a comprehensive training in all aspects of using ICT tools in the classroom. In addition to the initial training provided by the Ministry of Education, government-school-based ICT teachers are also being provided with continuous assistance in developing a pedagogical approach to ICT training through the Intel Teach Programme. This study investigated how ICT facilitates teaching of English vocabulary: the ways teachers use ICT in teaching English vocabulary and the problems that hinder teachers from using ICT in teaching English vocabulary. The design of the study was a survey; the area of the study was the Western Province with 1250 primary teachers selected as the sample. Three research questions guided the study, with a 24-item questionnaire used to collect the data. Mean scores were used to analyse the data. The findings revealed that though teachers supported the use of ICT for English vocabulary development, teachers do not use ICT in teaching English vocabulary. They identified problems that hinder their use of ICT in classroom instruction, including poor finances to procure computers and other relevant equipment; slow and frustrating network connectivity; unreliable power supply; limited access to computer facilities; and lack of computer skills among teachers and pupils.

Keywords: *education, English, ICT, teachers, vocabulary*

**Left-behind women's behaviour regarding contraceptive use:
A case study of selected Grama Niladari Divisions in the Kandy District**

K. Boyagoda

Department of Demography, University of Colombo, Sri Lanka

Sri Lanka has shown a trend of male dominance in international labour migration in recent years. A large proportion of these males are married and leave their wives behind when they migrate for a contract period. Migration results in many behavioural and role changes among left-behind women, but research usually highlights the more visible socio-economic changes, such as women taking on household financial management and the resulting empowerment. Though migration also results in less visible changes, for example, in sexual relations and contraceptive use, which is important for reproductive wellbeing, these have not been adequately addressed in Sri Lankan research. To address this gap, this study examines contraceptive use among left-behind wives. The study is based on primary data collected in 2015 from 79 purposively selected left-behind women of reproductive age through a questionnaire as well as through in-depth interviews with 15 of these women in selected Grama Niladari Divisions in the Kandy District. Quantitative data were analysed through bi-variate analysis while content analysis was used for qualitative data. Results revealed that other than sterilized women, all used contraceptives only during spousal visits. A contraceptive method shift was observed after migration; approximately 80% shifted to condom use (mainly from) injectables and pills. The method switch was due to condoms being the most practical: they posed no health issues for women, and spousal visits were unplanned and short. Condoms were used only for pregnancy prevention though they offer protection from STIs, which is a risk faced by many left-behind wives. Around 65% of the women reported concern regarding their husbands' STI risk, but none discussed condom use as a protective method. Since condom use is high and it is a STI protection mechanism, whether used intentionally or not, and there is a lack of spousal dialogue on reproductive risk behaviours, it is important to make high quality condoms available and easily accessible in the interests of the reproductive wellbeing of left-behind women.

Keywords: *migration, left-behind women, STI, Sri Lanka, contraceptives*

**Ethnic reconciliation after the civil war in Sri Lanka:
Can pursuing accountability for war crimes reconcile divided ethnic groups?**

S. Chandran

Department of Political Science & Public Policy, University of Colombo, Sri Lanka

Reconciliation after a conflict carries positive connotations that suggest an end to antagonism, a graceful acceptance of disappointment or defeat, and a healing and repair of ties of friendships. This is the current necessity for Sri Lanka since the major causes and effects of the prolonged conflict and civil war have provoked negative attitudes among the different ethnic groups. Especially during the last months of the civil war in Sri Lanka, very serious allegations of war crimes and crimes against humanity were made against both parties involved in the final battle by both the United Nations panel of experts and the Lessons Leant and Reconciliation Commission. At the conclusion of the civil war, demands for accountability of the wrongdoers and justice for the victims were high. Though the LTTE was also found to be an offender of alleged war crimes and grave violations of Human Rights, the international community put increased pressure only on the government to ensure accountability. Such moves on the part of the international community have created rifts between ethnic communities and aroused public resentment. This erodes the consensus that needs to be built in the process of reconciliation. The allegations against the government's armed forces, who are honoured by the Sinhalese for their sacrifices to defeat the LTTE, are deepening the level of anger and humiliation borne by many Sinhalese. This situation will not pave the way to ethnic reconciliation in post-civil war Sri Lanka. In this context, the paper attempts to highlight what transpired during the battle's final phases and identify the role of the diaspora and the international community. More specifically, it examines how their efforts can trigger negative reactions among the majority Sinhalese and hinder the ongoing ethnic reconciliation process in Sri Lanka. The paper is based on primary and secondary sources of data, and the analysis is based on the three Fs: Facts, Feelings, and Forecasts.

Keywords: *war crimes, accountability, reconciliation, ethnic groups*

Assessing the degradation of mangrove ecosystems in the Puttalam Lagoon

M.D.K.L. Gunathilaka¹, C.M.K.N.K. Chandrasekara²

¹*Department of Zoology, University of Colombo, Sri Lanka*

²*Department of Geography, University of Colombo, Sri Lanka*

DPSIR is an abbreviation for Driving forces, Pressures, State, Impact, and Responses. The framework is appropriate for describing the relationship between the origins and consequences of environmental problems, their dynamics, and linked causes and effects. The Puttalam Lagoon, located in the North Western Province in Sri Lanka, was selected as the study area. The objectives of the study were to identify the mangrove species diversity and assess the degradation of mangrove diversity. A field survey, interviews and a literature survey were used as data collection methods for the study. A total of 25 quadrant samples consisting of 5m X 5m area were selected for the mangrove vegetation survey. A total of 100 individuals living on the periphery of the lagoon were interviewed. The analysis was carried out based on the DPSIR framework. The Statistical and Inverse Distance Weighted (IDW) interpolation technique in ArcGIS mapping technique has been used for the analysis of data. A total of 15 mangrove species types belonging to 13 genera and nine families were enumerated. Among them, eight species represented true mangroves and seven species represented mangrove associates. The results revealed that there is degradation of the mangrove diversity of the Puttalam Lagoon due to both human and physical reasons. The results of the survey revealed that the drivers of the degradation were aquaculture, fishing, population in-migration, transportation, industry, land use, and climate. The pressures exerted by the driving forces were expansion of human settlements and agricultural areas; destruction of mangrove species; exploitation of mangrove ecosystems; unsuitable restoration methods; gas emission; and increase of the chemical content of water resources. The state of the ecosystem of the study area is highly impacted by these pressures. The critical impacts were identified as fragmentation and loss of mangrove habitats; decreasing diversity of mangroves; increasing abundance of mangrove species; and coastal erosion.

Keywords: *DPSIR, degradation, mangrove diversity, Puttalam Lagoon*

A preliminary study of snake bites in Kurunegala, Anuradhapura, and Galle Districts

U.T.G. Perera¹, H.M.T.P. Ekanayake², C.M.K.N.K. Chandrasekara²

¹*Amerasian Private Limited, Colombo, Sri Lanka*

²*Department of Geography, University of Colombo, Sri Lanka*

South Asia is identified as one of the most vulnerable regions for snake bites in the world. All countries in this region report a significant number of snake bites annually. Sri Lanka is also heavily affected by snake bites. Data from Sri Lanka's Ministry of Health indicates that poisoning is a main cause of death from snake bites for the period 2006-2015. The main objective of this study is to identify the temporal and demographic differences of individuals with snake bites in the Kurunegala, Anuradhapura and Galle districts. These three districts report high snake bite records in Sri Lanka. Recorded data on snake bites collected from government hospitals in Kurunegala, Anuradhapura, and Galle Districts were selected for the study. MS Excel 2013 and the Statistical Package for Social Sciences were used for data analysis. Percentages and graphs were used to present the information. A total of 1,29,330 patients have been discharged from hospitals after treatment and a total of 287 deaths have been recorded from all three districts during the selected period. The highest number of discharged individuals (55,972) has been reported from hospitals in the Kurunegala District during the study period. It represents 43% of the total recorded live discharges. The highest number of deaths (139) has also been recorded in the Kurunegala District. It represents 48% of the total reported deaths. The Anuradhapura District shows the second highest live discharges and deaths. The Galle District presents the lowest numbers of live discharges and deaths. The results revealed that the vulnerable age group for snake bites is 17 – 49 years in all three districts. This age group included the highest number of live discharged individuals during the period. The recorded live discharges from the hospitals in the Kurunegala District demonstrate a significant decline during the selected period.

Keywords: *snake bites, Kurunegala District, Anuradhapura District, Galle District*

Language as supervernaculars: A case study on language and online gaming

D.G.N.T. de Silva

Department of Sociology, University of Colombo, Sri Lanka

Supervernaculars emerge as semiotic codes which form a sociolinguistic system as a result of the processes of globalization in a technologically-driven world. This very creation of supervernaculars challenges the traditional notion of speech community of early sociolinguists, where language functioned within a particular territory, adhering to the norms and rules of a given community. With the emergence of supervernaculars, the concept of speech community is challenged with the formation of de-territorialized and trans-idiomatic communities on the virtual platform. The current study engages in an analysis of the language used in online gaming to emphasize the ways in which language functions as a supervernacular on a virtual platform. The paper provides multiple case studies which illustrate how the English language functions as a Supervernacular. In doing so, it presents a form of English that actually occurs in use, which deviates from the imagined standard of English. A purposive sampling method was used for data collection, and the data was analysed using thematic analysis. Cyber ethnography has been employed as the primary method of data collection. Findings suggest that, on the virtual platform, supergroups are created through the sharing of linguistic resources irrespective of cultural, social, and geographical backgrounds. In addition, world Englishes, rather than the imagined standard of English, function as supervernaculars, thus highlighting the role of dialects of languages. This leads to the formation of super speech communities in segments of the virtual platform, such as in the instance of online gaming, where individuals across the globe, irrespective of boundaries, use the global language of English as a supervernacular for communication and social interaction.

Keywords: *supervernaculars, speech communities, globalization, online gaming*

**Workers, worshippers, and the servant of the temple:
Up-country Tamil religiosity at Sri Pāda/ Shivanoli Pādam**

P. de Silva

Department of Sociology, University of Colombo, Sri Lanka

The presence of Up-country Tamil Hindu persons as worshippers at the sacred footprint (Sri Pāda) is quite recent when compared to other ethno-religious groups in the country. The majority of pilgrims going to Sri Pāda are Sinhala Buddhists, and the second largest group are Hindu Tamils from the tea estates in the area around the temple. But unlike in the past, Hindu, Muslim, and Catholic groups do not play any significant ritual role at the temple. As far as Up-country Tamils' religiosity is concerned, the central religious festival that they perform annually is centered on the female goddess Mariyamman. By celebrating Mariyamman, Up-country Tamils highlight their distinct identification with the island and their cultural differences from not only other ethnic groups in Sri Lanka but also diasporic Tamil Hindu communities. This is because the cult of Mariyamman is quite a unique feature of Up-country Tamil religiosity when compared to other Hindu practices in the country. However, Up-country Tamils are not confined to their own religious world, and the performance of their rituals can be extended to major multi-religious sacred sites like Kataragama, Munneswaram, and Sri Pāda. This paper elaborates how they have connected with the Buddhist-dominated Sri Pāda as worshippers and become the servants of the Sri Pāda temple while being estates workers. This paper will also explain the politics of carving out a ritual space by performing a special ritual at the Sri Pada temple and how such a ritual of Up-country Tamils highlights their cultural differences from numerous others, including Sinhals and other Tamil Hindu communities.

Keywords: *Up-country Tamils, religiosity, ethnicity*

Peasant resistance and the colonial encounter in Sri Lanka in the Seventeenth and Eighteenth centuries

N.R. Dewasiri

Department of History, University of Colombo, Sri Lanka

The nature of the European colonial encounter, the ways in which indigenous people responded to the colonial presence, and the specific nature of the polity that emerged out of the colonial domination are still debated by scholars. This paper seeks to address these issues by looking at the peasant revolts in Southern Sri Lanka in the context of the Portuguese and the Dutch interventions. The research problem concerns the question of how to understand these revolts or peasant uprisings as the dominant mode of explanation envelops them in the general narrative of anti-colonial struggles. The method is critical reading of contemporary and near-contemporary records, both published and archived, and of the modern scholarly discourses of the anti-colonial struggles. The conceptual framework is mainly drawn from the works of Irfan Habib, Ranajith Guha and others. The 1616 revolt was reportedly led by Nikapitiye Bandara and Kuruvita Rala, who were outsiders to the traditional ruling elite. Their ability to mobilize peasants was enhanced by the weakened hegemonic links between the Portuguese and the peasantry. Riots in the Dutch territory in the early eighteenth century were caused by measures taken by the Dutch to raise the level of surplus extraction. These revolts signalled the break-up of the traditional system of authority. These revolts were alarming, not only for the colonial powers but also, at times, for the indigenous ruling elite as well. The Dutch were able to devise new forms of governmentalisation in order to re-hegemonise the peasantry, which was a sine qua non for the maximization of the extraction of the surplus of the peasant.

Keywords: *colonial domination, Dutch rule in Sri Lanka, Portuguese rule in Sri Lanka, peasant, surplus extraction*

Environmental cooperation in South Asia: India and Nepal trans-boundary air pollution

P.L.S. Dias

Department of International Relations, University of Colombo, Sri Lanka

The region of South Asia, inhabited by one fifth of the world population, is faced with the common problems of underdevelopment, poverty, population pressure, and environmental degradation. Environmental problems have made life almost unmanageable for a considerable proportion of the population. Air pollution, a significant environmental problem, is damaging the region's natural resources. India and Nepal are prominent contributors to trans-boundary air pollution in the region due to industrialization, population growth, and weak implementation of air pollution policies. This paper explores the puzzle of why South Asian countries such as India and Nepal do not cooperate for the environment, compared to Europe's successful regulatory regime, even though both regions have borne similar conditions in terms of atmospheric problems. Regional cooperation must take place in South Asia through an examination of the factors that shape the environmental foreign policy of the sovereign states. The acid rain of Europe has been investigated through the lens of the epistemic community approach and the interest-based approach. The investigation has resulted in a successful regional cooperation in Europe. The main objective of this paper is to identify a successful environmental cooperation method in South Asia to address the trans-boundary air pollution problem in India and Nepal. Due to the existence of a knowledge-based community perspective, some self-interested states have difficulties in defining their interests and development goals and preferences. It finds that a lack of a domestic and regional consensus on the shared ecological vulnerability to trans-boundary acid deposition and the high economic costs involved in reducing toxic emissions have contributed to the slow development of environmental cooperation in South Asia.

Keywords: *environmental cooperation, trans-boundary air pollution, foreign policy, sovereignty*

The expectation of life without disability in Sri Lanka

L. Dissanayake

Department of Demography, University of Colombo, Sri Lanka

This paper calculates the Expectation of Life without Disability for Sri Lanka. No one has ever attempted to calculate health expectancies up to now for Sri Lanka, and, hence, this paper will be the first of its kind and can be regarded as a great contribution to the field of Sri Lankan demography. Life expectancy is composed of lengths of time spent in different states of health until death. These lengths of time in different states of health are health expectancies and they combine information on both mortality and morbidity. Although this aspect is new to Sri Lanka, the concept of health expectancies as health indicators was proposed in 1964 and the first example was published in a report of the US Department of Health Education and Welfare. The present paper contains estimates of 'Disability-Free Life Expectancy' calculated using a method devised by Sullivan and is applicable to any state of health definition. Sullivan health expectancy reflects the current health of a real population adjusted for mortality levels and is independent of age structure. Health expectancy calculated by Sullivan's method is the number of remaining years, at a particular age, which an individual can expect to live in a healthy state (however health may be defined). It was observed that women in 2012 at age 65 could be expected to live a further 17.8 years of which 9.3 years (52.4%) would be spent without disability, disability being defined as restrictions in daily activities due to longstanding illness(es), condition(s) or handicap(s). In the case of men who were at age 65 in 2012, they could be expected to live 14.7 years of which 8.8 years (60%) would be spent without disability. The analysis suggests that men live a greater proportion of their lives without disability than do women. The data used were the age-specific prevalence (proportions) of the population in healthy and unhealthy states (often obtained from cross-sectional surveys), and age-specific mortality information taken from a period life table. Sullivan health expectancy is not very sensitive to the size of the age groups; thus, an abridged life table was used.

Keywords: *health expectancy, Sullivan Method, Sri Lanka, life table, disability-free life*

Use of legitimate power by Algeria, Egypt, and Syria against the Arab Spring

P.K. Dodangodage

Department of International Relations, University of Colombo, Sri Lanka

The Arab Spring is a series of anti-government protests spread across the Middle East and the North African (MENA) region since 2011. It is a widespread concept that Arab Spring is a ‘failed revolution. This study hypothesizes that the failure of the Arab Spring revolution was due to the legitimate monopoly of the use of power against citizens by the state. Background information related to a pre- and post-Arab-Spring situation in Algeria, Egypt, and Syria was collected from published literature and analysed in detail with the use of theories of International Relations such as social deprivation theory, frustration and aggression theory, and the theory of modern states, to understand how each state uses the legitimate monopoly of the power vested in them to control uprisings. This analysis revealed that the regime in Algeria used a mixture of soft and hard power to defeat the uprising. Egypt used the power vested in it against the uprisings; however, it was unsuccessful and the military became the real power, seizing the opportunity of the power vacuum in the country. The use of power by the Syrian regime against the uprisings dragged the country into a civil war that saw numerous international interventions. This analysis clearly shows that the aspirations of the people who initiated the uprisings were not fulfilled. Of the three countries, Algeria continues the same regime that existed prior to the uprising; Egypt has fallen into a new autocratic rule led by a civilian style military backed by the government; and Syria is engaged in a disastrous civil war that affects global security and stability as well. Based on this study, it can be concluded that the people’s revolution was defeated by the rulers of Algeria, Egypt, and Syria using the legitimate monopoly of the use of force by the government.

Keywords: *Arab Spring, aggression theory, frustration theory, legitimate power*

Does foreign aid contribute to economic development? Evidence from micro data

P. Dunusinghe

Department of Economics, University of Colombo, Sri Lanka

The relationship between foreign aid and economic development has been investigated extensively with the use of cross-country macro data, but the findings have remained inconclusive. The literature points to a number of problems with cross-country studies, such as a lack of reliable and comparable data. Using micro-data, this study revisits the above relationship in a context of Sri Lanka depending markedly on foreign aid to pursue economic development. Specifically, it examines the impact of a foreign aid funded development project. This particular project has been in operation for over eight years in selected DS Divisions in the Kandy, Kegalle, Nuwara Eliya, and Monaragala Districts, and has assisted beneficiaries through a number of interventions such as tea and rubber outgrowing, entrepreneurship development, and social capital formation. In its analysis, this study triangulated evidence from different sources, namely a household survey, in-depth and key-informant discussions—covering both beneficiary and non-beneficiary households—and project monitoring and evaluation records. In particular, the study employed a quasi-experimental design based on the Propensity Score Matching approach. Results indicate that the average household per capita consumption and income, for both beneficiary and non-beneficiary households, had significantly improved during the project period 2008-2016. More importantly, per capita consumption and income of the project beneficiary households had increased much faster than that of the non-beneficiary households. In addition, beneficiary households had significantly improved their housing conditions, household assets, and access to basic facilities when compared with non-beneficiary households. Moreover, results indicate differential impacts across different districts and intervention types. Nevertheless, evidence suggests that the project had failed to achieve its intended development objectives to their maximum level. In other words, the project failed to achieve the rate of return expected at the beginning of the project, thereby highlighting the existence of sub-optimal utilization of foreign funds.

Keywords: *development project, foreign aid, impact evaluation, Sri Lanka*

A sociological study of the Five Hundred Houses Project in Mihindusenpura

A. Fernando

Department of Sociology, University of Colombo, Sri Lanka

Urban development is emerging as a key priority in Sri Lanka. However, the social costs of development are often ignored in the construction of highways, flyovers, condominiums, and other large scale development projects. Human beings, families, and communities are embroiled in the process of development. The overall objective of this study is to ascertain the impact of development-induced displacement in Mihindusenpura, Dematagoda, in the Colombo Municipal Council area. The specific research objectives are to explore the quality of life of the community pre- and post-resettlement; the expectations and fears of the urban community; and the social impact of resettlement in condominiums. The cross sectional study design focussed on the experiences of the sample population during 2013-2017. The study population was the Mihindusenpura 500 Houses project, of which 100 households were selected (50 houses from each condominium). The initial sampling method was simple random sampling; this had to be altered when selected household respondents could not be contacted at home. Data was collected from September 2015 to March 2017. The methods were a household survey administered through a semi-structured questionnaire; twenty case studies conducted with selected respondents; recording of observations and interactions with the community; and interviews with community leaders. The findings of the study identified factors that play a role in the lives of the community such as dangers of unplanned development; change in social status and upward social mobility; breakdown in community networks and social isolation; and the impact on social institutions and the resulting insecurity within the community. The study concludes that while urban development projects are designed to be beneficial to people, the lack of a people-centred focus in urban development, the prevalence of aggressive planning tactics, and the lack of strong housing policies create greater vulnerability and result in the impoverishment of the targeted communities.

Keywords: *urban development, people-centred*

**The prodigious need for Sustainable Development 25 years after Agenda 21:
Determinants of CO₂ emission in a cross section of countries (2002-2013)**

A.N. Fernando

Department of Economics, University of Colombo, Sri Lanka

This study investigates the determinants of Carbon-dioxide emissions (CO₂) for 140 countries, using a dynamic cross-sectional annual data model for the period 2002 to 2013 inclusive. The main findings are that trade openness, growth of per capita GDP, industrialization, and urbanization have positive effects on CO₂ emissions. Energy intensity level of primary energy consumption proxied for energy consumption level of the country is found to have a negative impact on CO₂ emissions, although insignificant, while alternative sources such as renewable resources are identified as significantly reducing CO₂ emissions. The limited availability of data has given rise to a few limitations in the analysis, but the study is still able to propose several policy suggestions for the contemporary global issue of the carbon footprint. The study has clearly identified some important implications and prospects for developed countries, as it finds that there is a significant difference between the determinants of CO₂ emissions in developed countries from those that are still developing. The study revisits several agreements, such as Agenda 21 (Rio Summit, 1992) and the Kyoto Protocol (2002)—global agendas designed to address the problem of climate change and the need for sustainable development—and draws on them to propose policy interventions targeting developing countries in particular. The study thereby aims at deriving tailor-made propositions for both developed and developing countries.

Keywords: *CO₂ emission, climate change, Sustainable Development, urbanization, sustainomics*

The impact of exchange rate volatility on Sri Lanka's export growth

S. J. Francis¹, M. Ganeshamoorthy²

¹*Hector Kobbekaduwa Agrarian Research and Training Institute, Sri Lanka*

²*Department of Economics, University of Colombo, Sri Lanka*

Exchange rate volatility affects export competitiveness and, thereby, has an impact on export growth. Economies that embark on export-led economic growth endeavour to maintain a competitive exchange rate policy as an important measure of macroeconomic management. Many studies have investigated the impact of exchange rate volatility on export growth. Yet, only a few have found a significant relationship between these variables. This paper investigates the same issue in the context of Sri Lanka. It focuses on the causal effects of the short- and long-run relationship between exchange rate movements and export growth in Sri Lanka. It employs quarterly data spanning the first quarter of 2000 to the fourth quarter of 2015. It incorporates the following variables: real exports, real imports, real Gross Domestic Product (GDP), and price indices extracted directly from data sources such as the Central Bank, the World Bank and the IMF, with only real exchange rate volatility and Real Exchange Rate (RER) as derived data series. All data figures are expressed in Rupees millions, unless otherwise stated. A time series analysis was performed on exchange rate volatility and Sri Lanka's Export Growth, involving Augmented Dickey Fuller (ADF) unit root test, Johansen Co-integration test, Vector Error Correction (VEC) modelling and Granger casualty tests. The study finds that there is a unique co-integrating vector linking real exports, relative export prices and real exchange rate volatility both in the short- and long-run. Further, the findings show that the volatility of the real exchange rate has a significant impact on exports destined to Sri Lanka's main export markets, which are the USA and the UK, both in the short- and long-run. Overall, the findings of the study confirm the notion that Sri Lanka's export trading activities could be expanded by maintaining a stable competitive Real Exchange Rate.

Keywords: *Exchange Rate, volatility, exports, co-integration, vector error correction*

International production networks and Sri Lankan exports: Where do we stand?

M. Ganeshamoorthy

Department of Economics, University of Colombo, Sri Lanka

International production networks have become an increasingly important part of international production and trade in recent times, especially in East Asia. An international production network refers to inter- and intra-firm relationships through which a lead firm organizes the entire range of its business activities, from research and development (R&D), product definition and design, to supply of inputs, manufacturing (or production of a service), distribution, and support services. The objective of this paper is to identify the current status of the integration of Sri Lankan firms into the international production networks and to explore the potential to strengthen this integration further. This study draws on data on trade in parts and components from Sri Lanka's trade statistics from the United Nations trade data reporting system for the period of 2000 to 2016. Additional data and information on export trade and industrial exports are drawn from the Export Development Board, Department of Commerce, Sri Lanka Customs, and the Central Bank of Sri Lanka. Export product categories and the share of parts and components are reviewed in terms of their export destination, and the main firms exporting them are identified and classified. A time series analysis was performed on the product categories and the industrial links of exporting firms in order to identify the expansion of Sri Lankan exports to international production networks. The analysis of data reveals that a number of Sri Lankan firms, especially from the apparel and services industry, have already been able to make links with international production networks. Products such as apparel, ICT, and Business Process Management activities have been linked with international production networks, and there exists greater potential for expansion of this trend to other activities as well.

Keywords: *production networks, parts and components, inter- and intra-industry trade*

**Moor culture in independent Ceylon:
the Moors Islamic Cultural Home (MICH) in the 1940s**

F.F. Haniffa

Department of Sociology, University of Colombo, Sri Lanka

Sri Lankan Muslim leaders and social movements have constantly negotiated their connection to the global Muslim Umma with their place as a minority within the Sri Lankan polity. While Sri Lankan Muslim leaders have always taken pride in their connection to the global Muslim community, the manner in which such a community was imagined and the mode of engagement with such a community has shifted. It has varied in keeping both with national politics and changes in the larger Muslim world. This paper will address the creation of the Moor's Islamic Cultural Home (MICH) as indexing a particular form of Muslimness that suited the manner in which the Sri Lankan polity was being imagined while anticipating independence. The founders wanted the institution to celebrate the glories of a global Muslim heritage, and drew connections to the intellectual centres of Alhambra, Baghdad, and Cordova, as well as to the scholarly, artistic, and spiritual prowess of Avicenna, Averroes, Al Ghazzali, and Rumi. Locally, they were concerned with asserting the particularity of a section of the Muslim community by naming themselves "Moors". Additionally, they asserted Muslim specificity through establishing their own cultural institution but also represented Muslims as partaking of the same modernity to which the country as a whole was aspiring. However, the founders committed to ensuring that the state was involved and recognized Muslims' (Moors') contribution to the country's economy and social life. The paper will also argue that in asserting Muslims' Sri Lankaness, the institutions' founders were rendering Muslims recognizable as partaking in middle and upper class 'sociality' through engaging in 'recreation' and entertainment in the atmosphere of an exclusive 'club'. They were engaged—together with other communities building similar institutions—in the formation of 'cosmopolitan' elite post-colonial subjectivities.

Keywords: *Muslims, Islam, identity, nationhood, cosmopolitanism*

**Smoking as a risk factor for Non-Communicable Diseases:
A study on over-40s male smokers from the Colombo District**

A.P.H.S. Jayarathne

Department of Demography, University of Colombo, Sri Lanka

Non-Communicable Diseases (NCDs) can be observed as a leading cause of mortality in Sri Lanka. Smoking, physical inactivity, harmful use of alcohol, and unhealthy diets increase the risk of dying from NCDs according to the World Health Organization (2015). Smoking can be identified as one of the main behavioural risk factors that cause NCDs. The main objective of this study is to investigate the patterns and trends of smoking among men over 40 years of age in Sri Lanka because smoking is a risk factor for men with NCDs. The study used interviewer-administered questionnaires, in-depth interviews, and publications of the Department of Census and Statistics as primary and secondary data sources. The target population was 128 men in the study area of the Colombo District, who are over 40 years of age and suffer from any kind of NCD. The study reveals the prevalence, frequency, and patterns of smoking among this population. The mean age of starting to smoke was found to be 25 years of age. The study revealed that a majority of the respondents are non-smokers. A considerable number of respondents abstained from smoking after being diagnosed with an NCD and on their doctor's recommendation. Respondents who were smokers had limited the number of cigarettes smoked per day. A higher percentage of smokers' smoke with office colleagues, while some have become victims of passive smoking. This study identifies that to minimize mortality due to NCDs, smoking has to be controlled. Men should be encouraged to abstain, and awareness should be raised to that end. Attention should also be paid to reducing in-office smoking which is connected to work stress.

Keywords: *Non-Communicable Diseases, smoking, lifestyle risk factor*

The applicability of a Buddhist environmental approach to drafting environmental legislation to address contemporary development issues

N. Jayasena¹, P. Amarasinghe²

¹*Department of Sinhala, University of Colombo, Sri Lanka*

²*Department of Economics, University of Colombo, Sri Lanka*

This paper takes an unorthodox approach to examine conventional environmental legislation and explore how Buddhist ethics on environmental conservation could be incorporated to solve contemporary development issues. Fundamentally, this paper illustrates the strength of the Buddhist notion of the environment and demonstrates the inter-disciplinary nature of Buddhism and law as a possible method for environmental conservation. Two research hypotheses are considered: 1. Legal interventions made by the state are not adequate to solve issues in disaster risk management; 2. Buddhist philosophy is based on observed laws of nature which galvanize the relationship between human beings and the environment. The paper takes an inter-disciplinary approach to study the interconnectedness of Buddhism and law. However, it does not overlook the salient differences of the two disciplines in their approach to the environment. For example, the law attempts to deter people from violating environmental rules. However, Buddhism mainly focuses on the punishment that comes from nature itself if it is violated, while reiterating the need of spiritual development to conserve the environment. In order to achieve the research objective of determining a nexus between Buddhism and law to support environmental protection, primary data has been collected from original Buddhist discourses in the Tripitaka and from environmental legislation. Apart from the primary sources, this paper traces many secondary sources from both legal and Buddhist literature. The study concludes by demonstrating how the use of Buddhist environmental ethics can generate a new mechanism which could lead to a sustainable solution to address the burning environmental problems faced by today's society.

Keywords: *Buddhist epistemology, development issues, environmental legislations, new mechanism*

Assessment of surface water pollution using physico-chemical parameters in Lunawa Lagoon, Sri Lanka

J.N.D. Jayathunga¹, G.R.A.G. Kumari¹, R.U.K. Piyadasa²

¹*Department of Geography, University of Colombo, Sri Lanka*

²*Department of Environmental Technology, University of Colombo, Sri Lanka*

The objective of this study is to evaluate the surface water quality of the Lunawa Lagoon in terms of physio-chemical parameters. The water quality was surveyed from October 2015 to March 2016 by using eight different sample points. A total of six water quality parameters, namely, water temperature, pH, Electrical Conductivity (EC), Dissolve Oxygen (DO), Salinity, and Turbidity, were measured in-situ, while laboratory analysis included five chemical parameters namely, nitrate, phosphate, Total Dissolve Solids (TDS), Biological chemical oxygen demand (BOD), and Chemical oxygen demand (COD). To identify natural and human impacts, the study deployed a questionnaire survey using 50 samples in accordance with the random stratified sampling method; spatial variation was analysed using Invers Distance Interpolation (IDW). Arc GIS 10.1 was performed to prepare spatial distribution maps. Temporal variation was analysed and correlation calculated using MS Excel 2013. The study revealed that the pH level ranged between 7.1 and 7.7. Water temperature had an average of 29.4°C to 29.6°C. DO average level was 1.4mg/l to 3.2mg/l across the sites, and the turbidity range was 27.4 to 7.3NTU. The salinity average range was 10.4ppm to 28.4ppm. The nitrate concentration was high in the southern part and the phosphate concentration was high in the northern part of the lagoon. The BOD and COD averages in the lagoon were 281.81mg/l and 44.81mg/l respectively. There were high negative correlations between pH and rainfall ($r = -0.81$), EC / rainfall ($r = -0.83$) and high positive correlation between turbidity and rainfall ($r = 0.99$), dissolve oxygen / rainfall ($r = 0.92$). According to the Water Quality Index in the lagoon, this water is not suitable for drinking, bathing, aquatic, and agricultural purposes.

Keywords: *correlation, GIS, interpolation, Lunawa Lagoon, Water Quality Index*

An assessment of the Saemaul Undong programme to enhance living standards of the people in rural areas with reference to Wahawa Grama Niladari Division in Rambukkana

F.N. Joseph

Department of Geography, University of Colombo, Sri Lanka

In developing countries, community-based integrated rural development programmes have been used as a special strategy to enhance the economic and social standards of rural people over the past few decades. Saemaul Undong was such a rural development programme introduced by the government of Korea and implemented in Sri Lanka through the KOICA in 2012. The main objective of this study was to find out how community-based rural development programmes contribute to economic development in rural communities. Wahawa GN Division in the Rambukkana Divisional Secretariat Division was purposively selected as the study area. A purposive sample of 23 potter households was selected from a total of 395 households. Structured questionnaires and four focus group discussions were used to collect primary data on income, infrastructure, availability of employment, and attitudinal changes. Semi-structured interviews were conducted with officials and coordinators of this programme. The analysis drew on descriptive statistical techniques and content analysis. According to the research findings, it can be concluded that, as a result of high daily productivity, potters earned a higher income compared to the beginning of the programme in 2012. When this programme began, 72% of the village potters had no housing. After beginning the programme, they were able to construct their own houses using materials such as cement and tin for roofs given by the KOICA. Furthermore, 84% have got electric potter wheels and 60% have gone to Korea to learn new techniques. Moreover, they have introduced five varieties of new clay products to the market by using knowledge gained from workshops. The content analysis shows that the programme resulted in positive attitudinal changes about their livelihood amongst the people. As a result of the programme, the pottery industry in the area has been augmented. Therefore, it can be concluded that community-based rural development programmes contribute to overcoming poverty among rural people in developing countries.

Keywords: *Saemaul Undong, integrated, rural development programme, living standards*

Identifying the relationship between land fragmentation and agricultural productivity: A study with reference to vegetable land of the Wakandawala North Grama Niladari Division in the Weeraketiya D.S. Division, Hambanthota District

D.M. Karunadasa

Department of Geography, University of Colombo, Sri Lanka

Vegetables are a necessary food item in the diet systems of most Sri Lankan people. Vegetables provide proteins, vitamins, and other nutrients that are required by the human body. In Sri Lanka, per capita vegetable consumption is 52Kg per year. Vegetables in Sri Lanka are classified under two categories: Up-country vegetables and Low-country vegetables. Hambanthota is the main district which cultivates low-country vegetables. The objective of this study is to examine the relationship between land size and the yield of vegetable farmers in the selected geographic location. The implications of this relationship are discussed in the paper. The study uses primary and secondary data. A questionnaire survey was used for primary data collection. One hundred vegetable farmers were included in the sample of 200 vegetable-growing families in Wakandawala North GN Division in the Weeraketiya DSD. The simple random sampling method was used to select the farmers. Information such as land preparation methods, crop varieties, and size of land were collected through field observations. Secondary data were collected from the Weeraketiya DS Office and the Agricultural Service Office, Weeraketiya. Statistical and mathematical methods were used in analysing the data. The main characteristic of the vegetable lands of the Hambantota District is that cultivated plots are very small. In the research area, more than 90% of farmers have land plots of less than 0.25 acres. The following characteristics are identified in the area: most farmers do not have proper land ownership; farmers cannot use heavy machinery for farm activities and, thus, follow labour intensive methods for vegetable cultivation; and finally, the vegetable market has uncertain conditions. The implications of these characteristics are discussed in the paper.

Keywords: *agricultural land, plot size, yield*

Impact of socio-demographic factors on the decorative consumption of wristwatches among employees in Colombo

C. Karunanayake, T.L. Gunaruwan

Department of Economics, University of Colombo, Sri Lanka

The modern day person is involved in vicarious consumption patterns in order to showcase wealth, enhance prestige, and attract others' attention through conspicuousness, exclusiveness, and emulation. We live in a society where consuming expensive goods is accepted as a mark of superior status. Yet, too little scholarly attention has been devoted to this obtrusive consumer desire in Sri Lanka and elsewhere in the world. In light of this, the purpose of this study is to explore what the authors denote as 'decorative consumption' and to examine the impact of socio-demographic factors on such consumption in terms of conspicuousness, snobbism, and conformism. This paper reports the outcomes of an exploratory survey conducted with 250 employees working within the Colombo city limits, to examine the concept of decorative consumption with regard to different ages, genders, sectors, religions, and income categories. The data gathered were analysed using SPSS (Version 20.0). The results highlighted that the socio-demographic factor 'sector' has a strong impact on the decorative consumption of wristwatches among employees working in Colombo as it is prone towards decorativeness in all three dimensions: conspicuousness, snobbism, and conformism. The results also revealed that 'age' and 'religion' could impact decorative consumption of wristwatches in the dimensions of conspicuousness and snobbism, whereas 'monthly income' is prone to influence decorative consumption in the dimensions of conspicuousness and conformism. The noteworthy outcomes that men appear to be more snobbish than women, and employees within the lowest income cohort are equally conspicuous and conformist as those in the richest income cohort, warrant further research to identify their causal factors.

Keywords: *decorative consumption, wristwatches, socio-demographic factors, conspicuousness, snobbism, conformism*

Ethnic differences in university students' knowledge of HIV/AIDS and sexually transmitted infections

H.V.V.M.P. Karunarathne

Department of Demography, University of Colombo, Sri Lanka

At present, HIV/AIDS and Sexually Transmitted Infections (STIs) have created a serious public health issue. Youth aged 15 - 24 years are the most vulnerable to infection, the main reason being their lack of knowledge. Youth can be categorized into different sub-groups by ethnicity, religion, education, and gender. Some of these categories may face an increased risk of contracting HIV/AIDS and STIs. University students comprise a sub-group that is somewhat neglected by researchers on the assumption that they are more knowledgeable because of their academic status. However, they are not a homogeneous group; although they may share an educational level, factors such as ethnicity and religion can influence their knowledge. At present, there is a lack of evidence on the ethnic differentials of knowledge on HIV/AIDS and STIs among university students. Therefore, this study focuses on the ethnic differences among university students' knowledge of HIV/AIDS and STIs. The study, conducted in 2016, selected 210 respondents from the Faculties of Arts, Management, Science, Medicine, and Law in the University of Colombo. Equal numbers were selected with respect to gender and ethnicity (Sinhala, Tamil, and Moor) by using the purposive sampling method. Data were collected by a self-administered questionnaire. Findings indicate that respondents' mean age was 23.5 years. A higher proportions of students came from urban areas. Sinhalese students' knowledge about AIDS was higher than that of Moor students, while Tamil students reported the lowest levels of knowledge. Nearly one fifth of Tamil students had never heard of STIs. Moor students had a better awareness of where STD tests are conducted than the other two groups. The findings suggest that it is important to organize seminars, workshops, and guest lectures to provide adequate knowledge on HIV/AIDS and STIs to university students. It is further suggested that the University introduce reproductive health counselling centres and also make HIV/AIDS and STI related materials available in libraries.

Keywords: *ethnic differences, knowledge, HIV/AIDS, sexually transmitted infections, university students, youth*

**Understanding access to potable water in resettled areas:
A case study of the Karachi Divisional Secretariat Division, Kilinochchi**

P. Kirishanthan

Department of Geography, University of Colombo, Sri Lanka

Increasing challenges to access potable water have created numerous problems in highly-populated societies. Societies returning to normalcy after the war face unique challenges in this regard. This study explores the challenges faced by the resettled community in accessing potable water for daily consumption in the Karachi Divisional Secretariat area in the Kilinochchi District. The selected area faces a number of challenges to access potable water. The main objective of this study is to study the challenges faced by the resettled households by looking at their potable water consumption patterns after resettlement. Both random and purposive sampling methods were employed to select both the study area (Grama Niladhari Divisions - GND) and the households as sampling units. Of the inhabitants, 106 households were selected from five GNDs. These GNDs were selected as they are the most affected due to a potable water shortage in the area. Questionnaires and structured interviews were used to collect data. Data were analysed using sample statistical methods such as mean and percentage. The findings show that 74% of the households obtain water from dug wells and 26% from tube wells for daily water consumption excluding drinking water. Seventy-six percent of the households depend on the water supply of the National Water Supply and Drainage Board through bowsers for potable water, while others use wells and tube wells. In the dry season, in the absence of drinking water, people have to travel nearly a kilometre to fetch water or buy from sellers. Women hold the key responsibility to collect water. The results of the study clearly show that people in the study area face challenges in accessing potable water. It is, therefore, recommended that providing potable pipe-borne water to every household would be preferable to the existing system.

Keywords: *potable water, resettlement, water shortage*

“Underserved” or “Undeserved”? A study on the identity formation of the ‘slum’ and ‘shanty’ dwellers in Colombo

A. Korala

Department of Political Science & Public Policy, University of Colombo, Sri Lanka

In the urbanization of the city of Colombo, ‘slums’ and ‘shanties’ have attracted the attention of state authorities since the British colonial period. Pre- and post-Independence town planning proposals and urban development plans have identified ‘slum’ and ‘shanty’ dwellers as people who face material and physical problems related to sanitation, transportation etc., and the authorities have initiated many projects to solve these problems. Nevertheless, the identity ascribed to them by society as socially unacceptable, still prevails. This study aims to assess the identity formation of ‘slum’ and ‘shanty’ dwellers within policy frameworks and society, in terms of being embedded in the urban development discourse. The paper has three research questions: (a) How has the state constructed the identity of the ‘slum’ and ‘shanty’ dwellers within urban development planning? (b) How has society constructed the identity of the ‘slum’ and ‘shanty’ dwellers? (c) Why have the state’s policy initiatives to upgrade the living conditions of the ‘slum’ and ‘shanty’ dwellers failed to change their socially constructed identity? The desk research was conducted and Laclau’s and Mouffe’s Discourse Theory was used to analyse both the primary and secondary sources. Policy papers, Government Acts, policy briefs, and secondary sources, as well as reports by non-governmental organizations and journal articles on the ‘slum’ and ‘shanty’ development projects were used to identify and examine how the two different types of identities have been attributed to ‘slum’ and ‘shanty’ dwellers by the state and by society. The research contends that a contradiction between the two different identities formed by the state and by society regarding the ‘slum’ and ‘shanty’ dwellers has complicated their identity within society. It also argues that the more ‘liberal’ terms used to designate ‘slum’ and ‘shanty’ dwellers have only been limited to policy papers and have not penetrated into society through the projects initiated by these particular policy proposals.

Keywords: *slum, shanty, identity, discourse theory, development policy*

Humanising development: Bringing home homeless humans and dogs to the development discourse in Sri Lanka

K.K. Kumara

Department of Sociology, University of Colombo, Sri Lanka

The discourse of development has been humanised in its meaning by research in humanities and the social sciences, with the addition of equity and welfare and human well-being to its original exclusive focus on material wealth and income. Amartya Sen introduced the ‘Capability Approach’ to the UNDP’s Development Index, adding health and education as indicators to income, leading to the Human Development Approach. The Capability Approach focuses on quality of life of, and opportunities for people to live as equals in society. Here ‘development’ is understood as expanding capability to live a good life. Martha Nussbaum has theorized that ten capabilities are central to living a good human life: Life, Bodily Health, Bodily Integrity, Senses, Imagination, and Thought, Emotions, Practical Reason, Affiliation, Other Species, Play, Control over One’s Environment. The capability, “the Other Species,” refers to nature and the meaning of human relationships with plants, animals, and the natural world, and is defended based on prevailing human values. This paper examines values found in Sri Lankan society that support “the Other Species Capability,” specifically the basic affinity between humans and the rest of the sentient world found in Buddhism and the Buddhist conscience and the compassion born out of it. It will examine how the development discourse in Sri Lanka has excluded its homeless humans and dogs, thus emaciating our understanding of development. The study is theoretical and is based on secondary literature. It takes into consideration the Megapolis development project and the attempts made to remove community dogs from the premises of two universities as case studies. The public debate surrounding these cases indicate that Sri Lankan values that support Nussbaum’s “Other Species Capability” act as a corrective to the dominant notion of development. Among such values are compassion, belief in rebirth and merit, and the modern notion of love.

Keywords: *humanising development, capability approach, other species, Buddhist values*

Technical efficiency in the production of economic knowledge in state universities in Sri Lanka: A nonparametric perspective on multiple outputs and the role of students

N. Kurukulasooriya¹, A. Ranasinghe²

¹*Department of Economics, University of Ruhuna, Sri Lanka*

²*Department of Economics, University of Colombo, Sri Lanka*

The performance of Sri Lankan state universities has come under scrutiny due to the need for accountability for the consolidated funds being invested. Following criticism of the teaching-learning process for its quality and standards, social science disciplines have undergone significant changes. Assessing undergraduate performance is vital in many respects. The objective of this study is to investigate the performance of undergraduates in Economics degree programmes. Economics knowledge is critical in higher education, contributing to the outcomes of future employees, entrepreneurs, and voters. Primary data was collected from a sample of 1002 undergraduates from Special Degree programmes in Economics in state universities. Joint production function was estimated and evaluated using second-stage DEA analysis. Economics Attitude Sophistication (EAS) and Attitude Towards Economics (ATE) have been introduced additionally to Grade Point Average (GPA) in the production function. Empirical findings reveal that economics students are not technically efficient. Minimum mean efficiency varies from 65% to 85%, so further improvement of outputs between a range of 15% to 35% is possible. Output targets were set for each output. Output target of EAS varies from three percent to 11%. It is three percent to 12% for ATE and two percent to nine percent for GPA. Statistically significant efficiency variations were observed among different universities. Lower performers were identified in each degree programme. Entry qualification for Special Degree, the effect of peers, English language proficiency, AL Z-score, average attendance, and grade obtained for Economics at AL examination, significantly influence learning efficiency. Policy strategies must focus on further improvement of interactive teaching-learning methods while introducing undergraduate teaching assistantships. The University Grants Commission (UGC) can consider its student distribution policy to share the benefit of peer effect. The undergraduate evaluation process can also be considered for revision.

Keywords: *data envelopment analysis, economics knowledge, multiple outputs, state universities, technical efficiency*

Health-seeking behaviour of patients diagnosed with Chronic Kidney Disease with uncertain etiology: Complementary system for health service delivery

J.H.C. Liyanage

Department of Sociology, University of Colombo, Sri Lanka

Chronic Kidney Disease with uncertain etiology (CKDu) has been a hazard in the North Central Province and surrounding areas since the late 1990s and early 2000s. Scientists from diverse disciplines have been attempting to identify the etiology of CKDu but have not reached concrete conclusions. The objective of this paper is to explore the health-seeking behaviour of CKDu patients and their illness-management strategies at different stages of disease progression. An ethnographic study was conducted in Madhawachchiya and Padaviya DS Divisions. The study sample included 90 patients, caretakers, community leaders, and healthcare providers. Illness narratives were collected using a phenomenological perspective. In-depth interviews, focus group discussions, key-informant interviews, and observations were used for data collection. Ninety percent of patients were diagnosed with CKDu when they sought treatment for different disorders. Only 10% were diagnosed using screening programmes. Health-seeking behaviour was scrutinized and was seen as a process of illness response from a social behaviour perspective. Two interrelated trends have been emerging. Patients have initiated their treatment process by attending CKDu clinics. Simultaneously, a trend of exploring multiple therapeutic options as complementary to biomedicine, where social networks play a key role in sharing relevant information, was observed. Various healers are mushrooming in response to the growing demand. Fifty percent of patients utilize *Ayurvedic* treatment when the disease progresses. Narratives reveal that *Ayurvedic* treatment has an ability to manage ill-health and improve the functional capacity of patients. No remarkable disparities based on gender identity were found. The context demands a complementary and integrated approach towards health service delivery. Policy must be altered to make better use of alternative therapies to biomedicine in addressing health hazards.

Keywords: *CKDu, uncertainty, integration, complementary*

Knowledge, attitudes, and behaviour related to Non-Communicable Disease prevention: An intervention-based study in the Padukka MOH area

J.H.C. Liyanage¹, M. Higuchi²

¹*Department of Sociology, University of Colombo, Sri Lanka*

²*National College of Nursing, Tokyo, Japan*

Analyses of age-standardized data for 1991-2001 show that mortality due to chronic non-communicable diseases (NCDs) was 20-30% higher in Sri Lanka than in many developed countries, accounting for 71% of all deaths. There has been a shift in disease patterns from Mother and Child Health issues and infectious diseases to NCDs, which account for nearly 90% of Sri Lanka's disease burden. Diverse programmes have been implemented to raise awareness on NCDs. However, these interventions lack behaviour modification strategies to address lifestyle diseases. The objective of this paper is to explore knowledge on NCDs, attitudes about NCDs, and behaviour related to NCDs in a selected community, while identifying appropriate preventive strategies. The analysis is based on an action-oriented research in a Public Health Midwife (PHM) area in the Padukka Medical Officer of Health area. Intervention and qualitative deductive approaches were used in this study. Collaborative interventions were implemented by adopting a bottom-up approach. Participation was voluntary. The PHM was assigned to conduct a monthly health checkup and maintain individual records. Records were reviewed once every three months while empowering and motivating each individual to modify his/her risk-behavioural practices. Fifty in-depth interviews were conducted to review the experience of the participants. Ninety-two percent of the participants were women. Of the sample, 52.4% in the 20-30 age category and 56.2% in the 50-60 age category were pre-obese. Findings reveal that the majority of the participants have sufficient knowledge about NCDs and attempt to modify risk food consumption practices while integrating exercise into their everyday life. Changing some cultural practices remains a challenge. Empowering individuals for self-health management is essential and it requires culture-sensitive, context-specific lifestyle modification strategies. The primary healthcare delivery structure has a greater capacity to incorporate NCD prevention strategies.

Keywords: *lifestyle, behaviour, prevention, empowerment*

Socio-economic differentials in disability among older people in Sri Lanka

R.L.R. Malsha

Department of Demography, Faculty of Arts, University of Colombo

Research in ageing and disability has shown that people of lower socio-economic status experience more difficulties as they grow older than do those of higher socio-economic status. However, in Sri Lanka, it is rare to find investigations into disability in old age carried out by such differentials. This study examines socio-economic status and disability among older people in Sri Lanka, using secondary data from the Population and Housing Census, 2012, around six domains of disability such as seeing, hearing, walking, cognition, self-care and communication. The results indicate that females report a higher proportion of disabilities than their male counterparts. Though Sri Lankan females experience a higher life expectancy (79 years) than males (72 years), females tend to live longer with difficulties as they grow older, which can have a significant impact on their health and well-being. The results also revealed that disability persists among middle-old and the oldest-old groups. The majority of the oldest-old people experience disability in walking (44.6%), seeing (38.7%), hearing (33.1%), and cognition (25.7%). The highest proportion of females with disabilities (62%) has been reported from the urban sector, while the highest proportion of males with disabilities (43.6%) has been reported from the estate sector. Among demographic and socio-economic factors, age, gender, employment participation, marital status, and level of education show a significant relationship with the disability status of older people in Sri Lanka. These findings suggest that policies and programmes need to focus on improving health infrastructure and geriatric health care facilities to support older people who have difficulties.

Keywords: *older population, ageing, disability, differentials in difficulty*

Determinants of employment participation of urban migrant women in the Kalutara District

D.P.K. Manel, S. Perera

Department of Demography, University of Colombo, Sri Lanka

More women than men migrate internally in Sri Lanka, the majority of female migrants migrating to the urban areas of the Western Province either due to the availability of female-oriented job opportunities in industrial, commercial, and service sectors, or for marriage- and family-related reasons. However, there is a lack of research on employment participation and its determinants with respect to women who have migrated. This paper investigates the status of migrant women's employment participation and its determinants, taking the Kalutara District as a case study. Migrant households were selected from 3 Urban Council areas using the simple random sampling method. The sample size was 582 urban migrant women (aged 18-59). Data were gathered through an interviewer administered questionnaire from April to June, 2014. The results related to the demographic and socio-economic determinants of the employment participation of women were presented based on descriptive and logistic regression analyses. Results based on descriptive analysis revealed that the mean age of migrant women was 36.4 years and that only about 30% of migrant women were employed. More than half of migrant women of the sample (59.0%) were Sinhalese, while Tamils and Moors were 7.0 % and 34.0 % respectively. Employment participation was higher among Sinhalese and Tamil migrant women (35% each) compared to Moors (21.4%). More than half of the women had an educational level of G.C.E. O/L or below and more educated women (G.C.E. A/L and above) were employed compared to those with a lower level of education. More than half of the unemployed women would like to engage in home-based self-employment. The logistic regression results revealed that marital status, level of education, household size, ethnicity, and household dependency status were significant predictors of employment participation of urban migrant women. These findings suggest that policies and programmes should focus on skill development and facilitate self-employment activities to improve the employability of urban migrant women.

Keywords: *women's employment, urban migrant women, migrants' employability*

The role of external debt in economic growth in Sri Lanka

U. Moramudali¹, N. Wickremeratne²

¹*Ministry of Finance and Mass Media, Sri Lanka*

²*Department of Economics, University of Colombo, Sri Lanka*

Economists have observed in recent times that Sri Lanka's external sector has become very vulnerable to the Balance of Payment crises due to soaring external debt stock along with the rise of external debt servicing. Given such a backdrop, this paper investigates the impact of external debt on Sri Lanka's Gross Domestic Product. The study adopts the Autoregressive Distributed Lag (ARDL) econometric model to estimate the impact of Gross Domestic Capital Formation, Gross Domestic Savings and external debt on GDP. Estimates indicate that a 10% increase of Gross Domestic Capital Formation resulted in 3.6% increase of GDP, while a 10% increase of Gross Domestic Savings resulted in a 1.3% growth in GDP. However, as per the estimates, a 10% increase in external debt stock resulted in reducing GDP by 1.7%. The regression estimate results are supported by the literature. A number of studies conducted to identify the relationship between external debt and economic growth in developing countries suggest that an increase of external debt affects GDP adversely. This study attributes the negative relationship between external debt and GDP growth to the massive external debt servicing payments, resulting in foreign reserve outflows which causes a contracting of public investment. It is observed that raising money by issuing Sovereign Bonds (categorized as commercial borrowings) has a significant impact on increasing external debt servicing payments because interest in such commercial borrowings is high. Government finance figures show that, as the debt servicing cost rises, capital expenditure of the government has fallen, reducing investment in the economy.

Keywords: *external debt, economic growth, debt servicing, revenue, commercial borrowings*

History curricula for national reconciliation: An analysis of history textbooks in secondary schools in Sri Lanka

N.I. Nanayakkara

Department of History, University of Colombo, Sri Lanka

The concept of national reconciliation has become a key concern in post-war Sri Lanka. The government of Sri Lanka has been trying to build a nation within a framework of multi-culturalism during and after the war. As a long-term policy, the education system plays a vital role in building social cohesion. The first report of the National Education Commission has established the achievement of a functioning sense of national cohesion, national integrity, and national unity (Report of the NEC, 1992). Nevertheless, the history textbooks in Sri Lanka, containing historical narratives which shape and mould the historical consciousness of the Sinhala and Tamil communities, pose a fundamental challenge to the process of national reconciliation. Much research done overseas (on the history textbooks in Rwanda, Israel, and so on) has proven how history textbooks can highlight social, cultural, and ethnic diversity and promote mutual respect and tolerance among different ethnic groups. This study examines the contribution of history textbooks to reconciliation by analysing the historical narratives in them. The aim of the study is to develop a theoretical discussion on the gap between national reconciliation and history textbooks in Sri Lanka. The research method is mainly qualitative data collection through library research. A content analysis was used for Sinhala-medium history textbooks from grade six to grade eleven. The analysis of the textbooks with the use of the theoretical concepts of historical significance, memorialization, and racial hierarchy show that the historical narratives in the textbooks are full of omissions. These textbooks provide Sinhala-centric narratives which have omitted the Tamils and Muslims in the country. The textbooks are highly ideologised, and they portray the Sinhala kings as heroes defeating the Tamils. To construct a sober dialogue between the Sinhalese and Tamils, it is essential to transform narratives based on a single point of view to alternative views, such as a shared history or joint history.

Keywords: *national reconciliation, history text books, historiography, historical significance, shared history*

Spatial distribution of diseases related to the 2016 flood in the Kaduwela and Kolonnawa Divisional Secretariat Divisions

S. M. A. T. de S. Nandaseela¹, L. Manawadu¹, D. Chathumami²

¹*Department of Geography, University of Colombo, Sri Lanka*

²*Department of Zoology and Environment Sciences, University of Colombo, Sri Lanka*

Climate change has intensified the occurrence of extreme weather events all over the world. Frequent and intensified floods are one of the main resulting scenarios that can be seen in many parts of tropical countries. Sri Lanka has also been prone to high-intensity floods during the past few years. Due to the destructive energy of floods, the health implications arising from them vary from physical injuries to long-term psychological effects. Floods can spread disease pathogens, vectors, and airborne allergens, greatly increasing the vulnerability of a country to epidemics. The main objective of this study is to examine the relationship between the spatial distributions of diseases and floods. The Medical Officer of Health areas of Kaduwela and Kolonnawa Divisional Secretariat Divisions (DSD) were selected for the study and primary and secondary data were collected. Weekly records of diseases for Public Health Inspector (PHI) areas were collected and primary data were collected through a questionnaire survey. Overlay analysis, measures of central tendency, and measures of dispersion along with regression were used as methods of data analysis. Maps and charts were used as visualization techniques. According to the data recorded, dengue cases show an increase during the South West Monsoon period in general and the number of cases is comparatively high after floods in both the Kaduwela and Kolonnawa DSDs. The highest number of recorded cases is from the Kolonnawa PHI area, which is 44 cases per week. In the Kaduwela DSD, the highest number of recorded cases is from Hokandara, which is 30 cases with an overall average of 20 cases per PHI area. In conclusion, it is clear that there is a relationship between diseases and floods, especially in relation to dengue, leptospirosis, and skin inflammations (although there are no secondary records for skin inflammations).

Keywords: *flood, health, spatial distribution of diseases*

**Normative behavior in regional affairs:
A conceptual study on the ‘ASEAN Way’**

S. C. Padmakumara¹, K. L. S. Jayarathne²

¹*Department of International Relations, University of Colombo, Sri Lanka*

²*Bandaranaike Centre for International Studies, Colombo, Sri Lanka*

Scholars who study regional affairs have mostly focused on both materially- and ideationally-oriented analyses while concentrating primarily on their institutional dimensions. Existing literature on a wide range of examples from regional organizations and their institutional practices suggests that normative engagements have become increasingly important for regional affairs. Somehow, little attention has been paid to systematically analysing distinct and patterned normative practices that have been embedded in regional organizations. Therefore, it is important to explore such normative practices adopted by regional entities through a contextual and systematic academic inquiry. This involves investigating how regions regulate the behavior of their members by adopting normative frameworks and what patterns and distinct features are identifiable from such practices. In this context, the ‘ASEAN Way’ attributed to the Association for Southeast Asian Nations (ASEAN) offers useful insights to understand how regions have been distinctively shaped and regulated by normative frameworks. Specifically, the ‘ASEAN Way’ is a unique style of conducting regional affairs and it can be broadly understood as a code of conduct for states to interact with each other and make decisions based on consultations and consensus. In other words, the ‘ASEAN Way’ is a normative process of conducting interactions through which the existing political tension, mistrust, and historical confrontations among ASEAN members are strategically overlooked by informal and flexible institutional procedures. Therefore, this paper argues that the ‘ASEAN Way’ can be treated as a distinct model of conducting regional affairs and has important implications for other regional organizations to enhance their normative practices.

Keywords: *ASEAN, ‘ASEAN Way’, normative framework, consensus building*

Taking participatory governance from needs to rights

P. Peiris

Department of Political Science & Public Policy, University of Colombo, Sri Lanka

Theory indicates that local government functions as a site where people on the periphery engage in decision-making and thereby take part in resource distribution in the community, thus allowing for a greater degree of democratic participation and equal citizenship. However, citizens' participation at the local government level is extremely poor in Sri Lanka, despite it being the institution closest to the community. In this context, this paper aims to examine (a) why citizens show almost no interest in participating in local government, (b) whether there are other forms of participation at the local government level that are not captured by conventional approaches to democratic participatory governance, and (c) the impact made by the nature of current participation in local government on local democracy. This paper is based on field work carried out in Trincomalee, Panama, and Bandarawela, as part of an evaluation of a donor-funded programme to increase citizens' participation in local government. Key-informant interviews, focus group discussions, and a survey have been used for data collection. The findings suggest that it is not only politicians but also the communities that they serve that seek to establish state-society relationships on the basis of the needs of citizens rather than their rights, thus creating a patron-client relationship instead of the expected state-citizen engagement. Under clientelistic politics, certain groups within the community enjoy greater access to state resources and more opportunities to make their voice heard than do others. Those marginalized constitute a minority in the village and their voices are not heard irrespective of who is in power, thus leaving democratic engagement as the only way to make their voices heard.

Keywords: *democratization, state-society relationship, local government, political participation, patronage politics, development*

Can graduates increase earnings by acquiring multiple qualifications?

T.A.M. Pushpakumara, A. Ranasinghe
Department of Economics, University of Colombo, Sri Lanka

According to the Graduates Career Outcome Survey (GCOS) 2011, which was conducted by the Department of Manpower and Employment, Sri Lankan graduates acquire multiple qualifications to upgrade their position in the labour market. A significant number of graduates have followed certificate courses and professional courses other than the degree programme. Hence the objective of this paper is to identify whether acquiring multiple qualifications is an effective strategy for graduates to increase their earnings. To achieve the above objective, a log earnings function was estimated using a national representative data set, GCOS 2011. Graduates' earnings mainly depend on the type of degree, results, medium of studies, and professional qualifications. The earnings of graduates with First Class Honours is 26% higher than that of others. English-medium graduates earn 22% more than Sinhala- or Tamil-medium graduates. Graduates who have professional qualifications earn 18% more than others. The findings show that a graduate with professional qualifications has a better position in the labour market. There is no return for certificate courses such as English or Tamil language, computing, or management. As findings show that graduate earnings mainly depend on university education, students should prioritize their university education. In the present university system, undergraduates have opportunities to improve their soft skills such as language competence and computer literacy free of charge. Hence, undergraduates should fully utilise the resources available within the university system without engaging in external courses while at university.

Keywords: *multiple qualifications, graduate earnings*

Impact of human capital investment on labour market outcomes: The Sri Lankan experience

A. Ranasinghe

Department of Economics, University of Colombo, Sri Lanka

Theoretically, a positive relationship is expected between human capital investment and labour market outcomes. It is anticipated that a greater possession of human capital will increase Labour Force Participation (LFP) and Employment probability (E). Using the Quarterly Labour Force Survey Data for 2004, this study examines the relationship between two types of human capital investments (formal education and vocational training) on LFP decisions and the classification of the labour force between Employment (E) and Unemployment (U). Vocational training data for all eligible aged people have not been collected after this year. The empirical findings of this study support the hypothesis that both the LFP decision and Employment probability increase with formal education. This is interpreted in terms of increased opportunity of not working with increased volume of human capital. The time cost of persons possessing a greater volume of human capital is higher. However, the employment probability is negatively related with formal education and the effect of vocational training on employment is negative but statistically insignificant. This is interpreted in terms of increasing job expectations and higher reservation wage with increasing human capital investment. People with a higher volume of human capital have higher job expectations, and, therefore, they stay unemployed voluntarily until they find a desirable job. The LFP decision and Employment probability are found to be correlated with gender, ethnicity, and location. LFPR and employment probability are higher among males and respondents of the plantation sector. Vocational training helps in reducing the LFPR and employment gaps by gender, ethnicity, and location.

Keywords: *labour force participation, employability, vocational training, human capital, Sri Lanka labour market*

Needs of family members of people with mental health problems

R. M. A. Rathnayake

Department of Psychiatry, University of Colombo, Sri Lanka

Families are social units functioning as a system with interrelated supportive parts performing functions to help with maintenance, continuation, and integration with society. The family functions as a locus for organizing the way to fulfil many wants and needs of individuals. In the case of people with mental health problems (PMHP) in Sri Lanka, 80-90% live with their families. According to growing evidence and opinion, the family should be included in the treatment package of PMHP. The objective of this study is to explore the needs of family members (FMs) with PMHP because family distress and burden can be reduced by supporting the fulfilment of their needs. A combination of quantitative and qualitative research techniques was applied to collect data. A questionnaire was administered to each family based on the random sampling method. Eighty-four questionnaires were collected. In-depth interviews were conducted with 15 families selected through a purposive sampling method. The Statistical Package for Social Sciences (SPSS) and a thematic analysis approach were applied to analyse the data. Family needs were identified as basic survival needs; autonomy in the family; physical security; economic security; protective housing; appropriate health care; significant primary and social relationships; the need to be educated and aware; mutual support of close relatives; formal support; the need for a respite; and spiritual needs. More attention should be paid to family needs in the care of PMHP in Sri Lanka. Identifying the support needs of families is an important element of developing family support programmes for the future care of PMHP. This study provides important insights for mental health professionals and policy makers about the care of people with mental health problems in Sri Lanka.

Keywords: *family, needs, mental health problems*

Flood modelling and flood risk analysis based on the Kelani River using GIS and HEC-RAS

V. P. I. S. Wijeratne, L. Manawadu, M. A. D. Samanmali
Department of Geography, University of Colombo, Sri Lanka

Floods are one of the most destructive forms of natural hazards in both local and global contexts, resulting in loss of life and damage to property. Flooding is the most frequent and damaging natural hazard in Sri Lanka, which makes it imperative to study it more closely. The present study aims to identify the flood inundation, modelling, and vulnerability of different periods of the Kelani River in the area of Kaduwela and Kolonnawa in the Colombo District. The study required two main types of data sets: hydrological data for river analysis and spatial data for GIS operations. Furthermore, physical and social data were collected to identify the flood vulnerability of this area. The study used both primary and secondary data such as stream network/ culvert/ bridge/ precipitation data, flood inundation data, stream flow, flood level, terrain data (1: 10,000), population data, building layer, land use, and flood hazard data. Data were subject to spatial and statistical analysis using ArcGIS 10.1, HEC-RAS and MS excel. The Gumbel distribution was used to analyse flood frequency and the vulnerability index was used to calculate the social and physical vulnerability of the area. This study reveals that the flood inundation area in 1889 was 28.15 sq.km and in 2016 it was about 27.03 sq.km. According to the flood model, the flood inundation area can be identified as 26.67 sq. km in 2016 and the model validation was done using the actual measured flood inundation area in 2016. According to the analysis of the social and physical vulnerability index, Sedawatta, Meethotamulla, Wadulla, and Kotikawatta can be identified as the most vulnerable Grama Niladari Divisions in the Kaduwela Divisional Secretariat Division. The high distribution of low-income houses and the impermeability of surfaces have affected the high vulnerability of this area. Necessary action should be taken to minimise the flood risk in this area.

Keywords: *flood modelling, HEC-GeoRAS, Kelani River, flood vulnerability*

Inter-district rate of out migration and district migration efficiencies in Sri Lanka

I.S. Samarakoon

Department of Demography, University of Colombo, Sri Lanka

Migration is one of the main components that has an effect on the changing demographics of a population. Migration in general has been defined as the crossing of a spatial boundary by one or more persons involving a permanent or semi-permanent change of residence. Migration is considered an important factor in disciplines such as geography, sociology, economics, and demography. Often, research on internal migration has received little attention due to difficulties in obtaining the required data to compute the measures on migration. The objective of the paper is to identify inter-district out migration rates and to identify the district migration efficiencies in Sri Lanka. The secondary data used for the computations of this study are from Sri Lanka Statistical Information Services (LankaSIS) of the Department of Census and Statistics. The migration efficiency ratio is used to measure the migration efficiency and it is defined as the ratio of the net number of moves of individuals between areas to the gross number of moves that take place. Results reveal that in 2012, out of the 25 districts, the 11 highest out migration streams are directed towards Colombo while the other out migration streams are directed towards Gampaha, Jaffna, Kandy, Puttalam, Kilinochchi, Ampara, Anuradhapura, and Badulla. When the lowest out migration streams are considered, the majority are directed towards Kilinochchi and Monaragala. The highest migration efficiencies are reported in Jaffna, Gampaha, and Matara respectively, whereas the lowest migration efficiencies are reported for Mullativu, Matale, and Trincomalee Districts respectively. Findings on inter-district out migration patterns and migration efficiency ratios suggest that districts such as Gampaha, Jaffna, and Matara require attention when addressing migrants' needs with regard to health, education, and employment.

Keywords: *out migration, internal migration, migration efficiency*

**The role of a social worker in community development in a disaster context:
Narratives from flood victims in Kolonnawa**

H.U.S. Samaraweera

Department of Sociology, University of Colombo, Sri Lanka

Community development is an important but often neglected and invisible area in post-disaster contexts in contemporary Sri Lanka. The role of the social worker in the community is vital in the larger picture of disaster management and disaster risk reduction. Given this background, the main operationalized research problem of the study was to explore the role of the social worker in community development during natural disasters. The specific objectives were: to examine the role of the non-affected community towards the affected community during reactive and recovery phases; to identify the steps taken at community level by the affected community; and to investigate the steps that could have been taken at the community level by the affected community. The research questions addressed the following regarding post-disaster contexts: the roles of the social worker, the affected community, and the non-affected community; the ways in which the affected community could come together for a collective goal; and other untapped options for rebuilding the affected community. The selected research field was Kolonnawa, which was severely affected during the 2016 floods. Data and information were collected from 15 heavily affected households in Egoda Kolonnawa and Megoda Kolonnawa, selected through the convenience sampling method. Using a qualitative approach, the study drew on 30 narratives from the inhabitants, which represent diverse gender and age backgrounds. These narratives were processed with the use of the narrative analysis method. The main argument was that victims acted more at an individual level than at a community level during reactive and recovery phases. One of the reasons for the lack of community feeling and collaboration towards community development in the post-disaster context was the dependency mentality of victims. In other words, the 'community feeling' has been replaced by a dependency mentality which needs to be appropriately addressed through a social work perspective.

Keywords: *social work, flood victims, community development, dependency mentality*

An analysis of the magnitude of extreme rainfall events in Colombo from 2014 to 2016

R.M.S.S. Sanjeevani¹, L. Manawadu², K. Punniyarajah², N. Chinthaka²

¹*Department of Transport & Logistics Management, University of Moratuwa, Sri Lanka*

²*Department of Geography, University of Colombo, Sri Lanka*

One of the major trends accompanying a potential change in global climate is the increase of extreme weather events. Changes in extreme weather events have significant impacts and are among the most serious challenges to society. Currently, extreme flood events have become a major problem in Colombo. Therefore, it is critically important to study extreme rainfall events in Colombo. The main objective of this study is to scrutinize extreme rainfall events and determine their magnitude of extremity in Colombo. Frequency and intensity of rainfall extremes will be determined using some of the indices defined by the World Meteorological Organization. Daily rainfall data from 2014 to 2016 for Colombo, collected from the Irrigation Department, Sri Lanka, is used in this study. This study identifies that both lengthier consecutive wet periods and lengthier consecutive dry periods are apparent in 2016. Accordingly, 15 occurrences (days) of heavy rainfall days ($\geq 10\text{mm}$) are recorded during May 2016, which coincide with the disastrous flood that occurred in Colombo. An unexpected maximum 1-day rainfall (220mm) is recorded during May and this extreme event has occurred as one of the events among a consecutive 21-day period extending from 8 to 28 May, 2016, accompanied by a 685.79 mm rainfall. More extreme events are recorded in 2016 compared to the other years, while most of the extremes of those years are recorded from September to December. The study recommends observing long-term trends of extreme rainfall events in Colombo and investigating the associated accelerating factors of these extremes. This study offers insights into the methods used in analysing the magnitude of extremes, which can be used to prevent associated floods and can be developed in order to forecast future trends, thus contributing towards devising mitigation and adaptation strategies for decreasing the impacts of extreme rainfall events.

Keywords: *extremes, frequency, intensity, magnitude, extreme indices*

Social impact of human trafficking on migrants and their left-behind families in Sri Lanka

V.P.N. Senadhi

Department of Demography, University of Colombo, Sri Lanka

Human trafficking is a global problem affecting most countries, including Sri Lanka. Today, the activity of trafficking is equated to a form of modern-day slavery and involves particularly egregious breaches of fundamental Human Rights. The process of trafficking which impacts the trafficked also creates many problems for their left-behind families. This study examines the social problems faced by the trafficked as well as their left-behind families. The study is mainly based on primary data collected from left-behind family members of trafficked persons, selected using the purposive sampling method. They were interviewed at the Repatriation Section of the Ministry of External Affairs (MEA), Sri Lanka, when they came to lodge complaints about their relatives who were trafficked. Both quantitative and qualitative data were collected using a questionnaire survey and in-depth interviews. The study included 115 survey respondents and 65 in-depth interviewees, and also used secondary data from different sources. The study reveals that during the recruitment stage of trafficking, traffickers use deception, coercion, abduction, intimidation etc. against the trafficked. These traffickers are identified as members of the family, neighbours, agency persons and friends. This experience has challenged the social relationships of the trafficked with society. Some of those trafficked become easy targets due to poverty. Some are deceived into marriage and love affairs and elope with traffickers or accomplices, creating disruption in families. At the destination, the trafficked endure labour and sexual exploitation. When a trafficked woman gets pregnant and/or works in prostitution due to exploitation, the left-behind families are stigmatized. This experience in turn makes family members violent and aggressive towards each other and the community that stigmatizes them, impacting family and community relationships. Therefore, the study shows that family inter-relationships and social relationships are challenged by human trafficking.

Keywords: *international migration, human trafficking, social impact*

**Politics of development beneficiaries versus victims:
A case study of the Moragahakanda Irrigation Project**

M. Senanayake

Department of Political Science & Public Policy, University of Colombo, Sri Lanka

In Sri Lanka, development projects and their aims cannot be understood in isolation from politics. The rationale of a project, as well as its process and outcomes, are products of the clientelistic politics practised in the country since independence. In that context, this paper examines why there has been a considerable level of resistance from the public to the Moragahakanda development project, despite it being a well-planned, timely, and important project. This study adopted pluralistic research methodology and used both primary and secondary data for the analysis. However, this paper is mainly based on primary data collected from the project sites of Moragahakanda, Thorapitiya, Maoya resettlement villages in the Wellevela Grama Niladari Division (GND). This project is one of the last components of the Mahaweli Development Programme that was designed as a 30-year project. The main objective of the project is to provide irrigation facilities to the existing water scarce farmlands (82,000 ha) and also to open up new land (5000 ha) for agricultural development in the Northern, North Central, Eastern, and North Western Provinces. In addition, generating and supplying 25MW of hydro-power to the national grid, increasing inland fish production, provision of portable and industrial water requirements, eco-tourism, and effective flood control are also among the objectives of the project. However, the field data show that there are a lot of mismatches between the objectives of the project and the actual outcomes. Among them are the issues between beneficiaries and victims; weaknesses of the resettlement plan; strong bureaucracy; suppression of real issues with the intention of continuing the project; re-settlers' attachment to their original lands; change of voter bases; economic and social issues based on a water crisis; conflict over limited resources; and relations between the original inhabitants and the re-settled. These aspects will be discussed in the paper.

Keywords: *development, beneficiaries, politics, resettlement, bureaucracy*

“Remove the lens’’: An analysis of positioning identity and community security development of the Hill-Country Tamil people in Sri Lanka

J.U.W. Senevirathne

Department of International Relations, University of Colombo, Sri Lanka

The debate on the identity of the Hill-Country Tamil (HCT)/ Up-Country Tamil (UCT) people has created a dilemma over their identity. The Hill-Country Tamil people’s identity has become a complex issue because of self- and other- definitions of their identity. The Up-Country Tamil people are referred to as Estate Tamils or Indian Tamils because of their job and colonial legacy. Based on Positioning Identity, persons outside the social group create a gap of actual needs of the Hill-Country Tamil people (first order positioning and second order positioning). This gap is challenged in this study to gain an understanding of the basic human needs of the Hill-Country Tamil people within a policy plan of state and non-state actors. To ensure inclusivity, and to be able to compare and contrast, Tamil people of the Hill-Country are sampled based on age, gender, and social status. Using Positioning Theory and the concept of Personal Security, triangulated data from in-depth interviews, observations, and primary and secondary sources are analysed to understand the actual basic human needs and the gap of positioning data of the Hill-Country Tamil people. The research findings are formulated on the importance of identifying basic human needs of Hill-Country Tamil people to fulfil their needs through their own interests and concerns rather than as seen from an external point of view. Understanding their self-identity and human needs as expressed by them will reduce the gap of the positioning level and support policy making in post-conflict peace-building. Further, it will lead to the safeguarding of the community security of the Hill-Country Tamil people. The findings of this study provide a lot of opportunities for development processes in Sri Lanka to generate mechanisms and tools that can address real community needs.

Keywords: *Hill-County Tamils, identity, Positioning Theory, community security, development*

The representation of the mother/land in Shakespeare

S. Seneviratne

Department of English, University of Colombo, Sri Lanka

The symbol of the motherland has often been used to legitimise nationalist discourses in South Asia, and the female body is complexly implicated in this symbol. This paper will attempt to contribute to the research on the embodiment of the motherland, by exploring how selected Shakespearean texts (especially the history plays of the second tetralogy) interrogate the relationship between the female body, the land, and the nation, and outlining what this may mean for us today. The Renaissance witnessed revisions to traditional perceptions of the relationship between women and the nation, and the paper will argue that in Shakespeare, the embodied, ‘engendered’ motherland is not solely an essentialist icon used to represent nationalist discourse, but a complex symbol which serves competing narratives. The discourse of nationhood in the texts is correspondingly problematized as it draws on the ambivalences of the geo-corporeal motherland. The paper will submit that the Shakespearean texts suggest the need for us to reconsider how the symbol of the motherland functions in nationalist discourse, and provide a starting point for us to rethink the ways we perceive women’s bodies and their relationship to the nation in South Asia today. The paper will explore the Shakespearean texts using an eco-feminist perspective, since the motherland symbol is predicated upon the symbolic continuities between the female body and the land, two of the most important sites upon which the ‘nation’ is produced. It will draw on eco-critical work by scholars such as Laura Tommaso and Jennifer Munroe. It will supplement the discussion of Shakespeare by considering contemporaneous sources that address similar issues, including speeches delivered by Elizabeth I, and relevant verses from the Bible.

Keywords: *motherland, women, bodies, nation, Shakespeare*

Regaining GSP+ in the wake of Brexit

Y.B.K. Seneviratne, K.C. Wijayabahu

Department of International Relations, University of Colombo, Sri Lanka

The withdrawal of the GSP+ trade concession from Sri Lanka by the European Union (EU) is worthy of analysis. From 2009 to 2017 January, the GSP+ issue was in the spotlight. The EU manages economic diplomacy in a manner that leads to a complex interdependency with states such as Sri Lanka. The objective of this study is to investigate the dilemma of a complex interdependency in a possible Brexit situation and its implications for the Sri Lankan economy. Following Yin's case study analysis methodology, the paper focusses on the GSP+ trade concession. The EU is Sri Lanka's largest export market, and the most prominent attraction is its GSP+ scheme, where developing economies can access European markets with zero duties. This GSP+ concession leads to a dependency on the EU markets which can carry both negative and positive implications. After 2005, when Sri Lanka enjoyed the GSP+ facility, there was a notable increase in exports. This gradual increase took a downturn and export shares declined in the post-2009 context. What is crucial to explore is how worthwhile GSP+ is for Sri Lanka with the dawn of Brexit. If Sri Lanka is to reap GSP+ benefits as before, it should negotiate with the UK for a possible trade agreement because it is possible that the benefits of regaining the GSP+ can be diluted with Brexit. However, until the UK officially leaves the EU, Sri Lanka can reap the benefits of free market access. This time of uncertainty should be regarded as a breathing space and not a comfort zone. The economy of a developing state is vulnerable to drastic changes in the international system. Therefore, it is necessary to determine proactively what fruitful benefits can be reaped by such a state out of a complex interdependency.

Keywords: *economic diplomacy, IPE, European Union, GSP+, EU fish ban*

**Ulterior goal of reconciliation in Sri Lanka:
A study of the reconciliation process during the Rajapaksa regime**

N.C.R. Silva

Department of Political Science & Public Policy, University of Colombo, Sri Lanka

Eight years after the end of the war, Sri Lanka is still struggling to establish a sustainable and viable peace. With the end of the war in 2009, the government of Sri Lanka and the international community emphasized that reconciliation should be the top priority of the country. Against this background, this study explores why reconciliation failed during the Rajapaksa regime. It attempts to address the following issue: Why did reconciliation attempts fail in Sri Lanka during the period 2009-2015, despite the existence of conditions in their favour? The study employs a mixed method to gather data, including a survey and in-depth interviews. The survey was conducted in the districts of Mannar, Vavuniya, Mullaitivu, and Trincomalee with a total sample of 200 persons. Additionally, 30 in-depth interviews were carried out with policy makers, politicians, academics, journalists, civil society activists, and researchers. According to the findings, there were a number of challenges that the Rajapaksa regime faced that resulted in their failure in terms of reconciliation: 1) Lack of unanimity amongst the actors within the government regarding post-war reconciliation; 2) The confrontational agenda between the government, civil society organizations, and the international community; 3) Ambiguity maintained with regard to policies on reconciliation and peace-building; 4) Contradictory beliefs among key policy makers in the reconciliation process; and 6) A great deal of ignorance among the general public. The Sri Lankan experience shows that post-war transition is more complex and difficult in a situation of war that ended in a unilateral victory, compared to a conflict that ends with a negotiated peace settlement. The military victory of the Rajapaksa regime, their victory mind-set, and the total decimation of the LTTE, have created a new condition in the country.

Keywords: *reconciliation, regime, civil war, peace*

Health risks associated with use of polluted water in the Mullaitivu District: A case study of the Maritime Pattu Divisional Secretariat Division

V. Sivarajah¹, F. Ruzaik²

¹*Independent Researcher*

²*Department of Geography, University of Colombo, Sri Lanka*

The Maritime Pattu Divisional Secretariat Division (DSD) faces a major issue of water contamination and scarcity of pure drinking water, creating various health risks for its dwellers. The objective of this study is to identify the health risks encountered by the dwellers due to use of contaminated water. Primary data were collected through a questionnaire survey, with the selection of six model villages based on purposive sampling techniques. Ninety questionnaires and 36 ordinary water samples, selected on the basis of random sampling, were used as primary data. The water samples were tested on 9 water quality parameters to identify electrical conductivity (EC), pH, nitrogen, turbidity, fluoride, phosphorous, and zinc. The findings are presented using a GIS application. Results revealed that the most recorded values of EC, salinity, pH, total dissolved solids (TDS), nitrogen, phosphorus, and turbidity were 1304 $\mu\text{s}/\text{cm}$, 1254 ppm, 8.6 mg/L, 848 ppm, 7.9 ppm, 3.8 ppm and 35.7 NTU respectively. The high concentration of the above elements found in this DSD are higher than the Sri Lankan Standard Institute's desirable limit. The findings of this study also indicate that the dwellers face a variety of health issues: 27% skin diseases/skin rashes; 13% dysentery; 12% tiredness; 4% kidney stones; 4% eye-related issues; 12% allergies, kidney failure, goitre and sleeping disorders; and 4% diarrhoea, dengue, malaria, and pneumonia. The northern part of the DSD shows a higher degree of water pollution and the occurrence of related health risks is higher compared to the southern part, since most of the dwellers there engage in fishing activities. Therefore, this study recommends formulating new irrigation projects, cleaning existing water bodies of the area, and strictly implementing existing water, land, and irrigation related laws and acts. Further, the cooperation of governmental and non-governmental organizations and the general public is vital to maintain the quality of water in the area.

Keywords: *contamination, pH value, electrical conductivity, health risk, water quality*

Physical and psychological health related issues among post-menopausal women in urban settlement communities in Colombo

S. A. Y. N. Subasinghe, E. L. S. J. Perera

Department of Demography, University of Colombo, Sri Lanka

Women's health concerns extend over the life cycle and are not limited to a particular stage or age of their lives. The literature on women's health problems has mostly focused on women in their reproductive age (15-49 years). There is a dearth of research on post-menopausal health-related experiences of women, especially in the context of increasing female life expectancy (79 years) in Sri Lanka. Since the physical and psychological health status of elderly women affects their quality of life, assessing the effect of post-menopausal health-related vulnerability is vital to understand their wellbeing. This paper examines physical and psychological health-related issues among post-menopausal women, focusing on three areas: (a) post-menopausal symptoms that they had experienced; (b) physical and psychological health issues; and (c) their coping mechanisms and health-seeking behaviour. The study uses quantitative data gathered through a questionnaire. A random sample of 400 post-menopausal women (aged 50-64 years) was selected from urban settlement communities in Colombo. The findings were analysed using descriptive statistics and chi-square analyses. The results reveal that the mean age at menopause is 49 years. Common menopausal symptoms experienced by women were dizziness (67.3%), night sweats (50%), and tiredness (58%). Common Non-Communicable Diseases that they had experienced during the menopausal stage were diabetes (46%), high blood pressure (40%), high cholesterol (35%), and osteoporosis (30%). The psychological issues faced by menopausal women were reflected in symptoms such as sleeping disorders (60%), anxiety (61%), distress (17%), loss of memory (61%), and an unwillingness to have sexual intercourse. About 63% of women had not taken any treatment or sought medical advice to overcome their health issues. Women's health-seeking behaviours were significantly related to their socio-economic characteristics. The findings point to the need to address menopausal-aged women when planning for health care needs and delivery mechanisms for older women.

Keywords: *post-menopausal women, physical and psychological health, urban settlement communities*

The role of community radio in community empowerment

C. S. Thangaraja

Journalism Unit, University of Colombo, Sri Lanka

Communication for Development (C4D) is a far-reaching concept that is discussed universally. It recognizes the role that communication can play in empowering people to make decisions that affect their lives. C4D is a poor and marginalized people-centred approach which works well within development and upholds and expands people's own development essentials, perceptions, and intentions. Radio is the prime electronic medium in Sri Lanka and goes beyond the barriers of illiteracy and isolation. It is the most inexpensive electronic medium to transmit and receive information. Community radio represents an expansion of broadcasting media and is used as the tool of voiceless people. Community radio aims to serve and benefit the community while empowering it. This study explores how community radio empowers people in our society by communicating information that is directly linked to development. The study identifies both the role of community radio in development and the effects of community radio on people's awareness of development, and examines the obstacles faced by community radio providers in the context of contemporary profit-oriented FM radio stations. The study analysed the content of media messages covering the theme of development and conducted a field survey using questionnaires and interviews with the audience to obtain data. Content analysis was used as the main research methodology. The study evaluated the influence of such media messages on the audience's attitudes and perceptions in terms of empowerment and the process of development. It argues that community radio is an essential part of the process of development in Sri Lanka, and highlights the need for more attention to be paid to develop community radio appropriately.

Keywords: *community radio, development, empowerment*

Prison overcrowding as a challenge to the economic rehabilitation of prisoners

W.A.S. Thilanka

Department of Sociology, University of Colombo, Sri Lanka

The main objective of this study is to examine the impact of prison overcrowding on the economic rehabilitation of prisoners. To successfully rehabilitate and integrate prisoners into society, rehabilitation should be able to place ex-prisoners in a standard livelihood, minimizing recidivism and reconviction. However, the rates of recidivism and reconviction have not reduced, making the success of rehabilitation questionable. Therefore, this study examines the challenges associated with prison overcrowding that impact economic rehabilitation. The Magazine Prison was selected as the field of study as it is the prison headquarters that categorises convicted prisoners on admission and transfers them to relevant prisons. Purposive sampling was done to focus on recidivists who received vocational training during the first imprisonment. Qualitative data were collected from the sample and statistics were collected from secondary sources available in the Prisons Department. In-depth interviews and non-participant observation were also used to collect data. The data suggest that the quality of vocational training and access to training are low for a number of inmates. Further, since it has been difficult to categorise prisoners according to their offences, all are locked up together in a limited number of cells. As a result, soft core criminals have become more hardened criminals, nullifying the utility of vocational training in reducing recidivism. Also, the high male inmate population has resulted in gender stereotyping in vocational training. Additionally, prison officers are not trained adequately to deliver vocational training effectively to a large crowd. A lack of financial resources for the overcrowded prison population and outdated programmes minimise the effectiveness of vocational training. Social attitude is secondary but is still a major issue and discourages ex-prisoners from trusting rehabilitation. Finally, the most required but least planned aspect, which is the after-care process, has made the issue more critical. The study makes recommendations to policy makers, the Department of Prisons and its officers, and to society, to accept and support rehabilitated prisoners.

Keywords: *effectiveness, recidivism, reconviction, rehabilitation, vocational training*

Sri Lanka's illegal migration: A detriment to development

M.S. Wanasinghe-Pasqual, P. Jayawardena

Department of International Relations, University of Colombo, Sri Lanka

Sri Lanka has been placed in the Tier 2 Watch List as a source country for illegal migration and human trafficking (IM&HT) following infamous cases and reported failures to prosecute those responsible. Illegality occurs from the outset in IM&HT to countries like Australia. Once at destination, illegal immigrants highlight allegations of war crimes and Human Rights violations to justify their request for asylum. This negatively impacts the image and development of Sri Lanka. This study investigates the role of diaspora in relation to IM&HT to Australia and how this detrimentally impacts Sri Lanka. This paper argues that, in spite of a substantial number of studies on Sri Lanka's IM&HT, the lacuna in the literature is the involvement of diaspora as a part of and a stimulating factor for IM&HT. Interviews with the Sri Lanka Navy and Police highlighted how the diaspora become part of IM&HT criminality by establishing links with traffickers to pay money on behalf of the migrants, sometimes as much as Rs.1 million per person to reach Australian soil. The methodology consists of triangulation of data: interviews with the Police, with the Navy and with those who paid but failed to reach Australia, in addition to observations and content analysis of news, records, and reports. The data highlight the need for further extensive research on this subject. Although diaspora participation in IM&HT is a reality, there is a dearth of research on this subject in Sri Lanka. The research findings of this study illustrate that the diaspora contributes negatively by damaging the image of Sri Lanka, hindering the influx of remittances, encouraging lawlessness within Sri Lanka, helping the 'Sea-Tigers' to thrive, and assisting in the brain drain. They create barriers between people and law officials, and between embassy officials and the diaspora, in effect working against Sri Lanka's overall development. However, if addressed correctly, diaspora involvement can be actively harnessed for the development of Sri Lanka.

Keywords: *diaspora, migrants, illegal migration, human trafficking*

Status of long-term care of aged people in elders' homes in Sri Lanka

M.K. Weeratunga

Department of Demography, University of Colombo, Sri Lanka

As Sri Lanka's population is ageing rapidly, an increasing number of older people will gradually enter the 80-and-above age category. Although the family care of elderly people is regarded as a culturally accepted way of caring for elders, currently there is an emerging demand for institutional care for elders. Unlike in the family setting, the institutionalized elderly have greater difficulties in performing their daily activities. This study examines the status of long-term care of aged people in elders' homes with regard to cognitive and physical impairment as observed through health records and self-health reporting. The study is based on the information collected from eight elders' homes covering three districts—Colombo, Gampaha and Kalutara. The study adopted a mixed method approach with the use of a semi-structured survey of 150 elderly people who need long-term care, as well as six in-depth interviews and three focus-group discussions. Functional disability is seen commonly in older adults. Physical impairment is associated with underlying medical conditions as well as with external factors such as social and financial support and the environment. Investigation into cognitive impairment revealed that it is higher among the older adults who barely receive required mental support. Approximately three percent of the sampled elderly had a mental disability. A lower rate of mental disability is due to the fact that the majority of the elderly people surveyed are still below the age of 75. Major issues encountered by institutionalized elders include lack of basic facilities, shortage of workers, and unhygienic conditions, as well as a lack of, or no support received from their families.

Keywords: *long-term care, healthy ageing, impairment status, adult homes, health problems*

Application of Balanced Scorecard to the apparel industry: The performance of XX Pvt. Ltd.

S. Weerawansa¹, C. Bandara²

¹*Department of Economics, University of Colombo, Sri Lanka*

²*Imperial Institute of Higher Education, Colombo, Sri Lanka*

Sri Lanka's apparel industry is significant to the country in terms of economic growth, employment creation, and foreign exchange earnings. Apparel exports had a value of over USD 4.6 billion for 2016, while generating over one million jobs, both directly and indirectly. The aim of this research was to study a leading apparel export conglomerate in Sri Lanka, at which five of the seven plants are incurring financial losses, to analyse the reasons for the losses. It evaluated three plants that are underperforming. The management attributes the financial loss to low labour productivity, but this single variable may not explain the loss in its entirety. Balanced Scorecard (BSC) was applied as a model, and the major aspects of an organization such as customers, internal business, financial perspectives, and growth perspectives were rated by the researchers through a questionnaire. The overall efficiency is conceptualized as the dependent variable and the four above-mentioned perspectives as independent variables. The research objective was to identify the overall efficiency level and to identify the three most influential factors relating to overall performance. The study revealed the absence of line continuity and skill matrixes as key factors that have a negative effect on the efficiency of the plants. Although the average profit making efficiency level in the industry is 70%, all three plants at XX Pvt. Ltd. have maintained only 40% to 55% efficiency. The efficiency of the machine operators could be improved by deploying them to handle the same style. Changing styles that run in the lines has a negative effect on efficiency. The other important factor which has a direct impact on efficiency is employees' skill matrix. Replacement of machine operators should be done with employees who are equally skilled in order to maintain the efficiency level, but a failure of the HR department of XX Pvt. Ltd. to follow such a procedure has caused a drop in the efficiency level.

Keywords: *Balanced Scorecard, employee performance, internal business perspective, overall efficiency, financial perspective*

**Impact of the information society on the contemporary Sri Lankan family:
A sociological study of Facebook users in Sri Lanka**

J. Wellawatta

Department of Sociology, University of Colombo, Sri Lanka

The post-industrial society, also known as the information society, is a stage of development that is seeing an accelerated level of social and economic development of the world. It is a society in which scientific knowledge and information play a vital role in the service sector economy. The impact of the post-industrial society is now felt in developing countries following the unprecedented development of Information Technology. This unavoidable influence may create negative consequences for the human and social landscapes of these countries. This study aims at identifying the extent of the impact of Facebook on contemporary family relationships in Sri Lanka. A sample of 1000 users of Facebook in Sri Lanka was selected randomly for this study. Questionnaires and interviews were used for data collection using a Google App disseminated through Facebook. Of the selected sample, 742 responded and were considered the full sample of the study. One hundred of these respondents were randomly selected for interviews, and 32 agreed to be interviewed. The study revealed that 56.9% of Facebook users were females and that the highest percentage (43.1%) were those between the ages of 15-29 years. Some of the findings of the study indicate that Sri Lankan women no longer conform to cultural expectations and that Facebook provides a space for men and women to subvert existing social practices. The 'cyber love affairs' revealed in this study are a result of such a practice and can be described as romantic partnerships, e-motional relationships or internet friendships. While such relationships would generally have a sexual aspect, these internet love affairs have no real sexual aspect, instead involving highly romantic and erotic feelings that are restricted to being expressed through Facebook chats, Skype calls etc.

Keywords: *information society, postmodern society, Facebook, cyber love affairs, Sri Lankan family*

Determinants of foreign debt in lower-middle-income countries

N. Wickremeratne

Department of Economics, University of Colombo, Sri Lanka

Foreign indebtedness has always been an issue of debate for policy makers. Research shows that foreign loans are supportive to developing countries suffering from scarce capital stocks. More importantly, lower-middle-income countries have identified that their debt burden remains high as a percentage of their Gross Domestic Product and that a significant portion of their debt burden consists of external debt. On the other hand, the high debt burden, lagging growth, resource outflows, and the middle-income trap have caused these countries to further rely on foreign borrowing as an easy way out. Given this backdrop, this paper attempts to investigate the determinants of foreign debt among 52 lower-middle-income countries between the years 1991 to 2015. The methodology adopted in this study is a cross-sectional Ordinary Least Squares estimator to derive statistical inferences. In this model, external debt was taken as the dependent variable while Central Government debt, Per Capita Income, trade openness, Terms of Trade, Foreign Direct Investments, total reserves, inflation, and educational enrolment were employed as independent variables. The findings suggest that Central Government debt, Per Capita Income, trade openness, total reserves, and inflation are the major determinants of foreign debt among lower-middle-income countries, while Terms of Trade, Foreign Direct Investments, primary educational enrolment and secondary educational enrolment variables do not significantly influence foreign debt among the lower-middle-income countries in the world.

Keywords: *external debt, lower-middle-income countries, Ordinary Least Squares*

An analysis of the historiography of R. A. L. H. Gunawardana

E. I. Wijayarathna

Department of History, University of Colombo, Sri Lanka

This study explores the philosophical and theoretical background of R. A. L. H. Gunawardana's historical writing. Although Sri Lanka claims to have a long tradition of recording history, the approach to history writing changed significantly with the influence of the European colonization of Ceylon from the 16th century. The first generation of historians includes Paul E. Peiris, E. W. Adikaram, Colvin R. de Silva, G. C. Mendis and so on. One question to consider is whether it was the influence of a Neo-Marxist tradition that made second generation historians such as Gunawardana adopt a new historiography by moving away from traditional historiography. The objective of the study is to examine the theory and perspective of history writing that influenced the historiography of R. A. L. H. Gunawardana. R. A. L. H. Gunawardana, who engaged in research at London University, was influenced by the Theravadi Oriental French School started by Andre Bareau. He was also influenced by the philosophical traditions nourished by Karl Marx and Hegel, as well as the critical historical tradition which includes Neibuhr and Ranke. Gunawardana belongs to a generation of professional historians who contributed to developing the discipline of history by experimenting with various sources and modes of historiography of Ceylon during the 1960s and 1970s. He emphasises the existence of the historian as a person in the perspective he or she takes. The way Gunawardana deals with sources, inter-relationships between historical events, historians and their perspective, theory of current events, and philosophy of history, are of particular interest to this study. To date, there has not been a serious attempt to analyse the social, political, and educational background of 20th century historiography in Sri Lanka and R. A. L. H. Gunawardana's historical discipline. This paper addresses that gap by studying the background that influenced Gunawardana's perspective.

Keywords: *Neo-Marxism, critical historiography, sources, history*

Factors contributing to starting fertility behaviour among different ethnic groups: A case study of the Colombo District

D. M. S. G. Wijerathna

Department of Demography, University of Colombo, Sri Lanka

Fertility behaviour changes through time and differs due to many factors such as demography, society and culture, and the economy. The current trend in developing countries is that most women start childbearing at an early age. Ethnicity and religion are significant factors that explain different fertility behaviours among different population groups in diverse contexts. In Sri Lanka, too, there is a marked variation in fertility levels among different ethnic groups. Among the three main fertility behaviours (starting, spacing, stopping), starting fertility is considered the most important. This study focuses on identifying the demographic and socio-economic factors that affect starting fertility behaviour among different ethnic groups in Sri Lanka. The study is based on secondary data obtained from the Sri Lanka Demographic and Health Survey (SLDHS) conducted in 2006/2007. The study selected a sub-sample of 1674 currently married women from the Colombo District comprising the three main ethnic groups, Sinhala, Tamil, and Moor. The women were selected on the basis that they should have at least one child. A simple linear regression model was used to examine the factors contributing to starting fertility behaviour, and age at first birth was used as the dependent variable to measure starting behaviour. Findings revealed that there is no difference in age at first birth among the three different ethnic groups. However, factors influencing starting behaviour differs by ethnicity. The current age of the woman is the most significant variable for all ethnic groups. When starting fertility behaviour is analysed for the ethnic groups separately, it indicates that the spouse's and the woman's years of schooling, the woman's and the spouse's labour force participation, and the use of contraceptives are significant factors for Sinhalese women; the spouse's years of schooling is the most significant factor for Tamil women; and the spouse's education, occupation, and use of contraceptives affect starting fertility behaviour for Moor women.

Keywords: *fertility, starting of fertility behaviour, ethnicity, age at first birth*

Challenges faced by university students in following the Sinhala language as a subject

W.M.K. Wijesundara, K.W.N.C. Fernando, Chathurika Abeyrathne
Department of Sinhala, University of Colombo, Sri Lanka

Language is closely related to the socio-cultural and political life of a community. However, not every student has the privilege of learning the language properly. When a language is taught, the four skills of reading, speaking, writing, and listening should be improved. However, school textbooks are mostly restricted to improving reading and writing skills. In such a context, university students face various challenges when choosing the Sinhala language as a subject. The purpose of this study is to identify the challenges faced by university students when learning Sinhala. Its main objective is to explore the issues and choices faced by students selected to follow the Arts stream. Its methodology involves using both quantitative and qualitative data to gather and analyse information. The main research instruments used are a structured questionnaire and an interview. Fifteen students from the Department of Sinhala who study the Sinhala language for their Bachelor of Arts Degree were selected as the sample. Both quantitative and qualitative methods of analysis were used. The findings show that though they have many language problems, university students have good opportunities to address these challenges when learning Sinhala at the university. The findings also indicate the need to further investigate this issue across the country in order to gain a deeper understanding of the challenges faced by university undergraduates in learning Sinhala.

Keywords: *challenges, Sinhala language, four skills, undergraduate education*

Digital overuse and the future of children

W. M. K. Wijesundara, D. M. C. Senevirathne, N. N. Ruwanpura,
K. W. N. C. Fernando

Department of Sinhala, University of Colombo, Sri Lanka

A mere twenty years ago, children used to play outside all day, riding bicycles, playing sports, and building forts. They created their own forms of play that did not require costly equipment or parental supervision. Their sensory world was simple and based on nature. But 21st century children now rely on technology for the major part of their play. It is now rare to see a child who is not using a mobile phone or a tablet. Children are more likely to confidently use a mobile phone, a tablet, or any other digital device before they are able to read, write, or even ride a bicycle. Children are losing touch with vital life skills due to the overuse of digital devices. The objective of this study is to explore the effects of digital technology on childhood. The study also intends to examine how digital technology has effects on children's behavioural patterns. This study focused on a sample set of children aged 2 ½ - 12 years from the day care centre at the University of Colombo. The study was based on quantitative and qualitative data gathered from selected parents of children placed in the day care centre. Data were obtained from 20 parents using a survey questionnaire. Of them, six parents were randomly selected for interviewing. In addition to the sample, two key informants, including a subject expert on digital technology and a specialist in child psychology, were interviewed. Data from the questionnaires and interviews were analysed to explore the effect of digital overuse on children, in terms of how it affects them mentally, physically, and socially. Finally, the study reported several mental, physical, and social problems affecting children because of their addiction to or overuse of the internet.

Keywords: *technology effects, childhood, digital devices, behavioural patterns*

FACULTY OF EDUCATION



Research for Development: Challenges and Opportunities

22 November 2017

**MESSAGE FROM THE DEAN,
FACULTY OF EDUCATION**

Professor Manjula Vithanapathirana



I am pleased to present this message to the proceedings of the 2017 Annual Research Symposium of the University of Colombo. This year, in congruence with the University of Colombo theme, the Faculty of Education decided to focus on improving the quality of teacher education research. Thus, the academic staff and the research students have shown great enthusiasm to disseminate their research.

The Faculty of Education has earned a reputation as the first Faculty of Education to be established in Sri Lanka in the early 1970s. The mission of the Faculty is to develop the capacity of teachers, educators and researchers by equipping them with the necessary knowledge, skills and attitudes to serve the system of education to their full potential.

We are privileged to have as our Keynote speaker this year, Dr. G.B. Gunawardena, an eminent education specialist who has held many high positions in Sri Lanka and overseas. He is the Vice Chairman of the National Education Commission (NEC), and was also a former Director General of the National Institute of Education (NIE). I wish to express my gratitude to Dr. G. B. Gunawardena for accepting our invitation.

I congratulate the Symposium committee of the Faculty of Education for working hard to make this event a success. I wish to thank the reviewers who worked tirelessly to keep to our schedules. I also wish to thank the Chairperson and the Committee members of the University of Colombo Symposium for their support.

I offer my congratulations to all presenters and hope a majority of these deliberations will be further developed as full papers to be published in high quality journals.

FACULTY OF EDUCATION

PROGRAMME

22 November 2017

8.30 am	Registration & tea
9.30 am	National Anthem & lighting of oil lamp
9.40 am	Welcome Address Professor Manjula Vithanapathirana Dean, Faculty of Education, University of Colombo
9.45 am	Address by the Chief Guest Senior Professor Lakshman Dissanayake Vice-Chancellor, University of Colombo
10.00 am	Keynote Address: “Transforming Teacher Education in Sri Lanka: The Challenge of Change” Dr. G. B. Gunawardena Vice Chairman, National Education Commission
10.40 am	Vote of Thanks, Ms. S. Yogarane
11.00 am	Research presentation Session I
12.30 pm	Lunch and start of Sessions

**INTRODUCTION TO THE KEYNOTE
SPEAKER**

Dr. G. B. Gunawardena

Vice Chairman, National Education Commission



Dr. G B Gunawardena is an eminent personality with over 50 years of service to the education sector. He commenced his long career in education as a Teacher and was appointed as a Teacher Educator in the early 1960s. He was the Principal of the Katukunda Teachers College in 1974, and later joined the Ministry of Education and served the Staff College for Edu

ational Administration. He was the Director of the Department of Teacher Education at the inception of the National Institute of Education (NIE). He was the founder Director of the Department of Educational Research of the NIE where the culture of educational policy research was developed in the Sri Lankan Educational system under his leadership. As the Director of the Department of Educational Research he was able to steer many innovations, such as Action Research in Education; C W W Kannangara Memorial Oration; Study of Educational Reforms; Policy Paper series; Sri Lankan Journal of Educational Research; Study on the Economics of Education; Wastage in Education; National Seminars on Current Issues etc. In 1990 he assumed a position as a faculty member at the University of the West Indies and the University of Brunei. He was appointed Director General of the NIE in 2000 and served till 2004. He also served as National Coordinator of the Coalition for Educational Development of the Commonwealth Education Fund. In 2008 Dr. Gunawardena was appointed as Vice Chairman of the National Education Commission and completed a term of office.

He has written policy papers on teacher education which are currently used as reference material. He has served as a consultant to UNICEF, UNESCO, Harvard Institute of International Development, NIER Tokyo, Ministry of Planning and Finance, Sri Lanka, and several other local and international institutions, including being the Policy Advisor in Education for the Government of Sindh, Pakistan

Dr. Gunawardena was reappointed as the Vice Chairman of the National Education Commission in 2017.

Transforming Teacher Education in Sri Lanka: The Challenge of Change

Dr. G.B. Gunawardena

Vice Chairman, National Education Commission

A radical reconceptualization of the process of the professional preparation of teachers has become an urgent need in the current context of teacher behavior in Sri Lanka. Issues related to selection, deployment, teacher performance, quality of service, and social efficiency have led to a crisis in confidence in teacher education programmes offered by Teachers' Colleges, Colleges of Education and Universities. Further, the crisis is aggravated by the militant approach adopted by teachers to win demands, breaking with all traditions and values associated with their profession. One major issue related to the failure to provide quality education to all is attributed to the "worker" behaviour resulting from market forces and the erosion of dignity and decorum associated with the teaching profession.

Changes taking place within education, such as curricular reforms, decentralized and school based management, social accountability, assessment and evaluation of students call for a new constructive role from teachers. The social context of the teaching and learning environment is subject to a number of external forces such as globalization, political pressures, rapid technological advancement as well as internal forces such as teacher unionism, child rights, parent choice and inclusive education.

Emphasis on equity, efficiency, effectiveness and relevance in school education makes new demands on teachers. The above factors and demands call for a shift in initial and continuous programmes of teacher preparation, from mastering a body of knowledge derived from an objectivist epistemology and supported by technical rationality in "training" and "education" programmes to constructivist "development" oriented programmes ensuring knowledge skills and dispositions to provide effective instruction to students through a field based clinical approach, providing individual and collaborative experimentation and opportunity for reflection and shared experiences through a knowledge base which does not reject theory altogether.

This paper will discuss the dimension of the context for revamping teacher education and the challenge of change to initiate programmes for teacher development to improve quality in Sri Lanka's school education.

FACULTY OF EDUCATION

List of Abstracts

1. Contribution of school development committees to school-based management 93
T.W.V. Indigahawala
2. A study on the followership role of Sri Lankan graduate school teachers following the Postgraduate Diploma in Education 94
C.P.W Malepathirana
3. Equity in education: Teacher perceptions 95
Jeevani Herath
4. Influential factors in selecting a Bachelor's Degree from private higher educational institutes in Sri Lanka: A study based on perspectives of lecturers and graduates of international degree programmes 96
K.A.V. Abeygunawardena and L.N.P. Wedikandage
5. Use of first language in facilitating second language writing development 97
M. Perera
6. Remedial plan aimed at students' development of practical skills in dancing: An action research study 98
R. K. A. Rathnayake and L. N. P. Wedikandage
7. Attitudes of stakeholders towards the education of plantation children in the Ratnapura district 99
S.H.D.R.Y. Samaranayake and L.N.P. Wedikandage

8.	An investigation of problems related to writing in English as a second language <i>I.H.S. Fernando and M. Perera</i>	100
9.	Developing communicative competence of bilingual Bachelor of Education undergraduates using ‘subject content’: An action research <i>E.S. Neranjani</i>	101
10.	Identifying the areas for capacity development of Sri Lankan government school principals <i>D.I. Wettasinghe and L.N.P. Wedikandage</i>	102
11.	Recommended competency levels in Drama and Theatre for senior secondary students <i>M.M.J.S. Amarasri and A. Jayawardhana</i>	103
12.	Difficulties faced by G.C.E. Advanced Level students following the A/L stream of Technology studies <i>R.A.B.U.I. Perera</i>	104
13.	Importance of visual arts in primary education <i>T.S. Dayasagara and S. Senerath</i>	105
14.	The impact of counselling on the academic achievement of primary school children in Grades 3, 4 and 5 <i>P.K.S.S. Thilakarathna</i>	106
15.	Strategies to develop soft skills in Bachelor of Education undergraduate students <i>S.S. Dahanayake</i>	107
16.	User perceptions of pleasure reading facilities provided by the Main Library of the University of Colombo <i>K.K.N.L. Perera and S. D. Somaratna</i>	108

17. An exploration of issues pertaining to geometry at the G.C.E. (O/L) Examination 109
M.G.D.A. Siriwardena
18. A study on Physics teaching methods used by Grade 10 and 11 teachers in Sri Lankan government schools 110
N.V.D.P. Priyadarshani
19. In-service teachers' perspectives: The educational value of professional experiences 111
D.V.K.P. Seneviratne
20. Cognitive domain of Dyslexic students: A study based on multiple case study method 112
E. Randeniya
21. A study to identify the professional development needs of teachers 113
H.M.G.D. Herath and M. Perera
22. Aid to focus: A self-regulation programme for young adolescents 114
L.C.D. Wickramanayake and M. Perera
23. Adopting Motivated Strategies for Learning Questionnaire to assess self-regulated learning skills in university students 115
D. Vajira Manjarie De Silva and M. V. Vithanapathirana
24. Prosocial attitudes of students at the end of the compulsory education span: Development of a self-report scale for a status study prior to an intervention 116
H.G.S.K. Wimalasiri and M.V. Vithanapathirana
25. Symptoms of stress in adolescent students' due to home related problems: An exploration to facilitate designing an intervention 117
Rev. P. D. Sangamitta and M.V. Vithanapathirana

Contribution of school development committees to school-based management

T.W.V. Indigahawala

Department of Social Science Education, University of Colombo, Sri Lanka

A School Based Management (SBM) programme called “Programme for School Improvement” was introduced to Sri Lankan schools in 2006. This programme was aimed at improving quality of education through a more transparent decision-making process at school level. It was anticipated that empowering the school community will enable the school to be a productive institution. The School Development Committee (SDC) was identified as the key element in the school-level decision making process. The objective of this research was to study the contribution of SDC to the management processes and to assess its impact on school development. The study started with a literature review of SBM, including the development, concepts, features, the theoretical frameworks and models of SBM. To initiate the study with an exploratory survey, a sample of SDC members were selected from zonal education areas where the SBM programme started at the pilot phase. The data were collected through interviews, questionnaires, and observations, as well as EMIS database. The study found that the selection of SDC members was not transparent. The influence of the strongest stakeholders was revealed. While the SDC was the decision-making body for school development, its role was limited to decision making on financial matters. The contribution of the SDC to school based capacity development was found to be inadequate. Further, it was found that the committee lacks proper guidance and support from the zonal authorities in order to improve the school management system. Hence, it is recommended that the SDCs be further strengthened by providing regular training on school planning and management processes to all stakeholders at the zonal level.

Keywords: *School Based Management (SBM), Programme for School Improvement (PSI), School Development Committee (SDC), role.*

A study on the followership role of Sri Lankan graduate school teachers following the Postgraduate Diploma in Education

C.P.W Malepathirana

Department Social Science Education, University of Colombo, Sri Lanka

The study focuses on identifying the followership styles and their determinants of Sri Lankan graduate school teachers who follow the Post-Graduate Diploma in Education. Followership, regarded as a factor within the leadership equation, has not yet received sufficient attention in the field of education. By exploring the followership characteristics of school teachers, the study contributes to this limited body of research. The five research questions addressed by the study were: (i) What are the followership styles of graduate school teachers who follow the Post-Graduate Diploma in Education? (ii) How do their followership styles vary in terms of gender? (iii) How do their followership styles vary in terms of school type? (iv) How do their followership styles vary in terms of leadership positions held at school? (v) What are the followership style determinants of exemplary followers? Using Robert Kelly's (1988, 1992) followership classification model as a framework to understand the characteristics of different followership styles, a questionnaire survey (n=200) based on Kelley's (1992) Followership Questionnaire was administered to collect data regarding the followership styles and the determinants of the followership styles of respondents. The majority of Sri Lankan graduate school teachers who follow Post Graduate Diploma in Education are found to be exemplary followers with excellent followership characteristics of higher critical, independent thinking, activeness, self-motivation and cooperativeness. Gender and the leadership position in school revealed no significant relationship with the followership styles, whereas the type of school showed a significant relationship with the followership styles. Semi-structured interviews were conducted with eight teachers who reflected the exemplary followership style to investigate the followership style determinants of exemplary followers. The influence of the family, school and university education, as well as the influence of coworkers and the influence of the leaders were identified as the determinants of exemplary followership.

Keywords: *followership role, followership styles, exemplary followers*

Equity in education: Teacher perceptions

Jeevani Herath

Department of Social Science Education, University of Colombo, Sri Lanka

Equity in education may be a ‘hot’ topic, but securing a perfect level or at least a reasonable level of equity in schools appears to be a tedious endeavor. The literature shows that teachers are mostly under the impression that they are fair to students in their classrooms, irrespective of gender, socio-economic status or ethnic origin. Yet, it seems that, in reality, the prejudice each teacher holds appears to be undermining the expected level of fairness. This study aimed to understand how teacher perceptions of the abilities of students obstructs equity in education. The study focused on three objectives: (1) to examine whether teachers perceive that students’ educational abilities depend on gender, socio-economic status and ethnicity; (2) to identify whether the perceptions about students’ abilities differ according to the teacher’s gender; and (3) to examine whether there is a prevailing difference in perceptions of Sinhala medium and English medium teachers. A sample of 100 teachers was selected from the teachers who follow the Postgraduate Diploma in Education. A questionnaire was administered to Sinhala medium and English medium students, equally distributed amongst 25 male and 25 female students. Data were analyzed quantitatively and presented as percentages. The study shows that teachers perceive girls as having higher abilities only in languages and aesthetics, and boys as having higher abilities in mathematics and science. This proves to be a contradiction when G.C.E (O/L) results and NEREC national level data are considered, as girls outperform boys in all subjects. Another contradiction is teachers thinking that the children of middle income parents are academically better than those of the other strata. Yet, what is more important is the amount of money spent on education than the wealth a family possesses (NEREC, 2004). Finally, a majority of teachers share the perception that English medium students are academically better than Sinhala medium students, which is parallel to other research findings.

Keywords: *Equity in education, teacher perceptions, gender*

Influential factors in selecting a Bachelor's Degree from private higher educational institutes in Sri Lanka: A study based on perspectives of lecturers and graduates of international degree programmes

K.A.V. Abeygunawardena, L.N.P. Wedikandage
Department of Social Science Education, University of Colombo, Sri Lanka

This paper is a part of a larger study aimed at optimising students' choice in selecting a Bachelor's degree (BD) from international degree programmes (IDPs) offered in Sri Lanka. The national university intake in Sri Lanka has become progressively competitive over the years due to the limited number of opportunities available. Hence, only a small percentage of the student population eligible for a state-funded higher education is selected for admission to national universities. The majority of the students who fail to enter national universities and students who complete the Advanced Level examination in the British curriculum at international schools are presumed to continue their university level education (ULE) overseas. But those who cannot afford overseas education have been increasingly seeking alternative educational options in the domestic market. These challenges in ULE have caused an emergence of IDPs in Sri Lanka affiliated with private higher education institutes (PHEIs). Due to the flexibility and optionality in IDPs offered in Sri Lanka, the decision-making process in selecting IDPs has become complex and multifactorial, which is evident through research studies carried out by Sia (2011), Kusumawati, Yanamandram and Perera (2010), and Briggs (2006) on the importance of students' choice criteria. According to Neoclassical economics, students select the most suitable BD which maximizes their long-term happiness among the available BDs offered in several IDPs. This study aims at exploring the most significant factors influencing students' choice in selecting a BD from IDPs. Data were collected via focus group discussions with lecturers and graduates in randomly selected PHEIs. Through thematic analysis of data, university characteristics, source of information (messenger), programme evaluation, cost, marketing strategy, and infrastructure facilities were identified as the most significant factors influencing the decision-making process. These factors would be further verified using undergraduates in IDPs to identify their preference in selecting a BD, through developing a structured questionnaire in optimising students' choice.

Keywords: *University-level education, students' choices, Bachelor's Degree, international degree programmes*

Use of first language in facilitating second language writing development

M. Perera

Department of Humanities Education, University of Colombo, Sri Lanka

A collaborative action research study was conducted in 2014 in two grade 7 classes in a type 1C and a type 2 school in the Gampaha education zone. The main purpose of this collaboration was to utilize a product-based approach to improve the basic skills in writing of low performers. The findings of the pretest revealed that none of the students in the type 2 school could write a grammatically correct sentence, while only three students could do so in the Type 1C school. It also revealed that the student's first language (L1) appears to influence the student's thought processes in formulating the sentences. In the present study, the same pretest was administered to 900 students from type 2 and 1C schools in the Gampaha education zone. The analysis confirmed the findings of the previous study. This paper examines how students' first language can be utilized positively to develop their writing skills in the second language. The methodology used in this study was a collaborative action research. The collaborators were a university lecturer, three Regional English Support Centre (RESC) staff and sixteen teachers. The main purpose of this collaboration was to utilize a product-based approach and the students' knowledge of the L1 grammar to improve their writing skills in L2. The classes were selected from sixteen 1C and type 2 schools. A remedial programme was designed with the collaboration of the RESC staff and the teachers. Four sessions were initially planned and implemented to enable the students to write a simple sentence. A post test was administered to find out whether the students have improved in writing simple sentences. In addition, data collection involved interviewing the students and the teachers; conducting classroom observations, which was done by the RESC staff; and utilizing students' task sheets. The post test revealed an improvement in students' writing in both school types. Classroom observations, students' and teachers' feedback, and students' task sheet analysis confirmed that the intervention programme had been successful.

Keywords: *product based, influence of L1, pre-test/post test, RESC, collaborative action research*

**Remedial plan aimed at students' development of practical skills in dancing:
An action research study**

R.K.A. Rathnayake, L.N.P. Wedikandage

Department of Social Science Education, University of Colombo, Sri Lanka

This action research was based on broadening the strategies of critical thinking of the learning and teaching process related to the aesthetic subject, dancing. Stemming from Educational Reforms in 1972, the subject 'Aesthetics' was introduced as a compulsory subject. The current national vision of the subject Aesthetics (Dancing/Music/Art) is to sensitize students and the community through aesthetics to the Motherland, endowed with cultural pride, creativity, sensitivity, tolerance, patriotism and a sense of national identity (NIE). Dancing is one of the aesthetic subjects included in the grade 6-11 curriculum as a 2nd Basket Subject which students can select according to their preference. It is twofold, involving both practical aspects and theory. The common major problem that the teacher faces in the system is failure to achieve the targeted efficiency in all students. In this action research, the target group consisted of five grade 9 students who obtained low marks, 40 subject teachers, five parents, and five teacher instructors. The basic foundation of practical dancing, "Goda Saramba", was used to implement a progressive remedial programme in improving the efficiency of the target group. During the process, the target group was assessed by awarding marks based on Observations, Interviews and Questionnaires. SPSS software and simple statistical strategies were used to analyze the data qualitatively and quantitatively. During the implementation of the remedial programme and practical sessions, novel teaching techniques and methods were infused to increase student potential in a practical and simple setting.

Keywords: *Aesthetics, Dancing, practical Dancing, action research, remedial programming*

Attitudes of stakeholders towards the education of plantation children in the Ratnapura district

S.H.D.R.Y. Samaranayake, L.N.P. Wedikandage

Department of Social Science Education, University of Colombo, Sri Lanka

The resident workforce in the plantation sector is underprivileged, and their level of educational attainment is far behind that of others in the national educational system. The aim of this research is to gather existing knowledge and information on low educational attainment of plantation children in order to identify gaps in understanding and to make recommendation for areas that would benefit from further research. The study focused on the years of compulsory schooling in the junior secondary education system. The main elements of this study include documenting the current experience of schooling of plantation children and an assessment of the experience of teachers, parents and officers regarding the education in plantation schools. The sample area was confined to four zones in Ratnapura District. The sample of the study consisted of 300 Grade 8 and 9 students, 150 teachers, 48 principals from 48 provincial schools of 1AB, 1C and type 2 categories, 50 parents, and 3 officers from each zone. Primary data were collected using a questionnaire, interviews and focus group interviews, while secondary data were gathered through school documents such as log books, registers, attendance sheets, and mark sheets. Quantitative methods were used to summarize numeric data collected from questions from survey instrument. Qualitative methods, data synthesis and content analysis were used to analyze the non-numeric data obtained from open-ended questions on children's, parents', teachers' and school administrators' questionnaires. Interpretative methodologies were used to analyze the qualitative results of interviews with zonal education officials. The factors affecting the low attainment of plantation children were identified through the analysis.

Keywords: *stakeholders, plantation children, education, attainment, junior secondary grades*

An investigation of problems related to writing in English as a second language

I.H.S. Fernando, M. Perera

Department of Humanities Education, University of Colombo, Sri Lanka

Writing in English as a second language (ESL) has been identified as the most difficult skill for learners and achievement levels remain very low and unsatisfactory. The present study, which is a part of a larger study, was conducted to identify the difficulties faced by learners in writing in English as a second language and to find out the reasons for those difficulties. It also investigated the strategies that can be used to develop writing skills in ESL. The sample was drawn from a type 1C school and a type 2 school in the Colombo South Zone, which is a cross-section of the sample of the larger study. It adopted multiple data collection instruments, including document analysis, a questionnaire for teachers, a questionnaire for students, a test, and a focus group discussion with students. During phase one of the study, documents were analyzed and questionnaires were administered. During phase two, a test and a focus group discussion were conducted concurrently for an in-depth understanding of the problem. Data analysed both quantitatively and qualitatively revealed that the major difficulties students face in writing is their lack of knowledge of grammar, syntax and vocabulary. The main reasons identified for those difficulties were inadequate practice, lack of prior knowledge, and lack of training in the use of writing strategies by the learner. The most effective strategies in developing writing were identified as revising, feedback, pair work and group work, guided writing activities and word and picture clues. Therefore, the consideration of prior knowledge, the use of strategies, and adequate practice and feedback in the writing classroom can be considered as important for improving writing skills in English as a second language.

Keywords: *writing, English as a second language, prior knowledge, writing strategies*

Developing communicative competence of bilingual Bachelor of Education undergraduates using ‘subject content’: An action research

E.S. Neranjani

Department of Humanities Education, University of Colombo, Sri Lanka

This study aims to identify ways of developing the English language communicative competence of Bachelor of Education students of the Faculty of Education who studied the subject content in English. It is based on action research. The communication difficulties of the students were assessed by conducting interviews and classroom observations, using a checklist based on the Common European Framework, as well by taking field notes. Activities were prepared to develop the communication skills of the students by considering their feedback and by classroom observation. The data were analyzed qualitatively. The study found that many students had problems with pronunciation due to lack of exposure to English. Although students knew the grammatical rules, they could not use them correctly in communication due to lack of practice. Similarly, they had difficulties with using vocabulary appropriately in communication although they knew the meanings of the words. They also faced difficulties with conveying the meaning they intended to communicate and were not practised in using the correct structures in formulating questions. However, at the end of the intervention, they were able to self-correct most of their errors and conduct simple discussions related to the subject content. Further, they overcame their fear of using English and made presentations with confidence. Using subject content to develop the communication skills of undergraduates is successful because students are able to use the language in a practical and authentic situation, which motivates them to use the language meaningfully. Dialogues, group discussions, competitions, explanations, and presentations are effective in the development of communication skills.

Keywords: *communicative competence, English language proficiency, Bachelor of Education*

Identifying the areas for capacity development of Sri Lankan government school principals

D.I. Wettasinghe, L.N.P. Wedikandage

Department of Social Sciences Education, University of Colombo, Sri Lanka

Human resources are more important to an institution than any other resource. In a school, the principal plays the role of the chief manager supervising human resources. This makes it imperative to pay attention to the capacity development of principals. A proper professional development programme should be established in the system of Education to enhance the knowledge, skills and attitudes of the principal. Such a measure may ensure the delivery of a more systematic, effective and productive education service to the community. This study focuses on identifying the capacity development areas of Sri Lankan government school principals. The objectives of this study were to identify the nature of the existing capacity building procedure for Sri Lankan government school principals; find out how school principals are trained and the factors considered in designing the capacity development procedures in other countries; examine the appropriate professional skills that Sri Lankan government school principals should obtain; identify the necessary areas that should be strengthened in order to enhance the professional development of principals; and introduce a model for principals on capacity building. Data were collected through interviews, questionnaires, and documents with a specific focus on 60 principals in Hambantota district, 10 directors of education and 10 trainers (principals). This was survey research, and data were analyzed both quantitatively and qualitatively. The study identified capacity development areas for Sri Lankan government school principals and made suggestions for modifications.

Keywords: *capacity development, school principals*

Recommended competency levels in Drama and Theatre for senior secondary students

M.M.J.S. Amarasri, A. Jayawardhana

Department of Social Science Education, University of Colombo, Sri Lanka

Drama and theatre are considered as avenues for enhancing students' creativity. In a competency based educational system, there are numerous issues associated with analysing the achievement levels of students learning this subject. This study aims to identify the current achievement levels of students following this subject and analyse the reasons behind any disparities. A questionnaire was administered to teachers who teach the subject in different schools. The main line of inquiry was whether students obtained more marks for the theoretical part of the subject or for the practical part of it. Data analysis revealed that students in some schools obtained higher marks for the theoretical part and those in other schools scored higher for the practical part. There were also some schools where students scored equally in both aspects. Hence it is evident that there is a disparity in the competency levels of students' achievements in this subject. The paper identifies the reasons for these disparities and proposes ways of reducing them in the interests of supporting individuals to develop both practical and creative thinking and a sensitive intelligence.

Keywords: *competencies, achievements, Drama and Theatre*

Difficulties faced by G.C.E. Advanced Level students following the A/L stream of Technology studies

R.A.B.U.I. Perera

Department of Educational Psychology, University of Colombo, Sri Lanka

The government of Sri Lanka introduced the stream of technology studies to the G.C.E. Advanced Level under new educational reforms, with the prime intention of diverting knowledge-based education into career- and skill-based education. This stream has been implemented for nearly four years, and a discussion has now emerged around the achievement of expected outcomes. This study was conducted to identify the problems and difficulties faced by students who are following the G.C.E. A/L stream of technology studies. It was carried out as a survey, under the descriptive research design. A simple random sampling method was used to select the sample for the study. Data were collected by administering questionnaires to students and giving interview schedules to teachers, and analyzed quantitatively as well as qualitatively. The objectives of the study were to identify the ongoing process of the G.C.E. A/L stream of technology studies and the problems and difficulties faced by the students. The study found that the technology stream of study was more popular among students who entered to do A/Ls. This reduced the number of students in the Arts and Commerce streams of studies. Female students preferred Bio systems technology to Engineering technology. Students faced many difficulties in their studies, such as insufficient equipment for practical work, lack of relevant resources, lack of trained teachers to teach specific subjects, and a lack of adequate knowledge among teachers with regard to the use of modern equipment.

Keywords: *Technology stream of study, bio system technology, engineering technology*

Importance of visual arts in primary education

T.S. Dayasagara, S. Senerath

Department of Educational Psychology, University of Colombo, Sri Lanka

This study investigates the perception, knowledge, attitudes and role of primary teachers in visual arts in line with current efforts to promote visual arts both locally and globally. To achieve the above aim, a survey was conducted taking a random sample from among primary teachers in the Colombo Zone. Data were collected through a pilot-tested questionnaire consisting of a combination of questions gathering quantitative and qualitative data in three main sections: 1) teachers' background information; 2) teachers' awareness and attitudes of the subject; and 3) challenges and obstacles faced by teachers when implementing visual arts lessons in the primary classroom. The observations focused on instructional strategies adopted by teachers in teaching visual arts, as well as structured and unstructured interviews conducted with teachers to ascertain their awareness of the subject. Findings revealed that primary teachers' attitudes towards implementing visual arts in their classrooms were affected by factors such as, lack of pre-service and in-service training; inadequate knowledge of how to handle art materials; self-efficacy; minimal belief in their capacity; crowded curricula and classrooms; and standard exams such as Grade 5 Scholarship Examination. Research recommendations aim to effect an attitudinal change in primary class teachers in using visual arts along with improving their skills and enriching their experiences in visual arts, while offering pre-service and in-service training opportunities to enhance optimistic attitudes through workshops.

Keywords: *visual arts, primary education, primary teacher and student*

The impact of counselling on the academic achievement of primary school children in Grades 3, 4 and 5

P.K.S.S. Thilakarathna

Department of Educational Psychology, University of Colombo, Sri Lanka

There is a growing interest in counselling in Sri Lankan schools, driven by an increasing awareness of the role that schools can play in helping to promote emotional health by addressing mental health issues. Psychological and behavioural problems have a direct impact on the educational achievement of the child. Although secondary school students approach counselors when help is needed, primary level students usually do not approach counsellors for help. It is the class teacher who identifies their problems and refers them to the counsellor. Thus, the class teacher has to possess knowledge of counselling and psychology to some extent. The main objectives of this study were to examine how primary teachers identify children's problems and to explore the current practice in counselling with respect to primary children. The study was carried out as a case study. Data were gathered by questionnaires and interviews from teachers and from the relevant reports of the students. The findings of the study are that the majority of the teachers in primary classes do not pay attention to students' emotional and behavioral problems, and that most of the counselors were not qualified and did not have any professional qualifications in counseling.

Keywords: *counselling, academic achievement, primary students*

Strategies to develop soft skills in Bachelor of Education undergraduate students

S.S. Dahanayake

Department of Humanities Education, University of Colombo

Enhancing the soft skills of undergraduates in Sri Lanka has become vital for the future workforce. Universities in Sri Lanka have implemented programmes to develop the soft skills of undergraduates by using different approaches. The aim of this study, which is ongoing, is to identify strategies that can be used to develop the soft skills of the Bachelor of Education undergraduate students in the Faculty of Education. A hundred undergraduates and ten university lecturers from the Faculty of Education, University of Colombo, constitute the sample. Data derived from the questionnaires and interviews were analyzed under the following five themes: curriculum model for developing soft skills; rearranging and restructuring the B.ED. course; changing the instructional system; changing the assessment standards; and enhancing the co-curricular components. The three curriculum models identified were Standalone subject model, Embedded model, and combined Standalone and Embedded model. The majority of the lecturers were agreeable to the incorporation of soft skills in the curriculum through an Embedded model. The Faculty has changed the instructional system in the areas of Learning outcomes, Syllabus content, Instructional system, Soft Skills, and Assessment. Lecturers recommended the following teaching strategies as suitable to develop the soft skills of the students: role play, group discussions, presentations, brainstorming activities, effective questioning method, case studies, decision making activities, and reflective journals. Both students and lecturers viewed the following activities as suitable for incorporating soft skills through co-curricular component: uniform activities, sports activities, cultural activities, leadership activities, and debates. Reflecting on the two weeks of teaching experience in a school, the students stated that they had achieved the essential soft skills required of their profession by applying the above strategies in the school.

Keywords: *strategies, soft skills*

User perceptions of pleasure reading facilities provided by the Main Library of the University of Colombo

K.K.N.L. Perera¹, S.D. Somaratna²

¹*Main Library, University of Colombo, Sri Lanka.*

²*The Library, Faculty of Science, University of Colombo, Sri Lanka.*

Pleasure reading refers to free, voluntary and non-goal oriented reading which provides enjoyment or pleasure to the reader. It is different from reading related to the curriculum. The promotion of pleasure reading is not generally considered as a priority in most of academic libraries. However, recent studies offer strong proof that pleasure reading can have a significant and positive impact on the overall performance of academic library users. A leading academic library in Sri Lanka, the Main Library of the University of Colombo also holds this responsibility to a great extent. The objectives of this study were to identify the perceptions of pleasure readers (undergraduates) of the benefits gained through pleasure reading, and to identify the perceptions of pleasure readers of current facilities provided for pleasure reading by the Main library of the University of Colombo. The three commonly cited benefits of pleasure reading were that pleasure reading offers enjoyment (99%); pleasure reading offers escape from routine work (98%); and pleasure reading helps relaxation (96.2%). The two most significantly rated services related to pleasure reading were the availability of a suitable physical environment in the library for pleasure reading (85.1%) and the services of a helpful library staff to find pleasure reading materials (77.5%). The three lowest rated services were the ability to find pleasure reading materials easily (52.7%); the availability of adequate pleasure reading materials in the preferred language (59.3%); and the availability of adequate pleasure reading materials in the library (61.8%). A majority of undergraduate users believe that the promotion of pleasure reading must be a priority for a university library (97.1%). These findings can be used as justifications to allocate more budget, staff time, space and other resources to promote pleasure reading at the main library of the University of Colombo.

Keywords: *pleasure reading, academic libraries, user perceptions, pleasure reading facilities, benefits of pleasure reading*

An exploration of issues pertaining to geometry at the G.C.E. (O/L) Examination

M.G.D.A. Siriwardena

Department of Science and Technology Education, University of Colombo, Sri Lanka

Every year in Sri Lanka, a large number of students sit for the G.C.E (O/L) examination (393, 887 in 2015, according to reports of the Department of Examinations) which paves the way for their higher education. Ideally, a student sits for 10 subjects in this examination. It is mandatory to obtain passing grades for Mathematics and the first language (Sinhala or Tamil) in order to pass the exam. Unfortunately, more than 50% of the candidates fail to satisfy this requirement, most as a result of failing Mathematics. This hinders their chances of pursuing further education and obtaining formal employment. Therefore, it is imperative to take appropriate steps to overcome this problem as soon as possible. The main objective of this study is to investigate perceptions of geometry among teachers and students. The study focused on three main aspects: (1) investigating the strategies and techniques used in teaching geometry; (2) investigating student performance in geometry in past G.C.E (O/L) examinations; and (3) investigating the perceptions of and perspectives on geometry among students. Data were collected from a survey conducted by the Sri Jayawardenapura Educational Zone. The purposively selected sample consisted of 14 schools with 70 students and 28 teachers. A mixed method was used in this study to gather the required data, including questionnaires, diagnostic tests, and documentary reviews. Geometry lessons are passed on to students as systematic lectures, thus minimising opportunities to engage students' cognitive activity. It has become a challenge to retain students' interest in Geometry due to inadequacies in the teaching techniques. A total of only 50 marks or less was obtained for the diagnostic test by seventy-five percent of the total student population. There is a positive correlation between the cognition fields of general vision, fear, future thinking, self-reliance, and the teacher's role. The relationship between fear and students' achievement is the most powerful relationship among them. The findings are useful for those who design curricula as well as for teachers and parents.

Keywords: *G.C.E (O/L), Mathematics, perception of geometry*

A study on Physics teaching methods used by Grade 10 and 11 teachers in Sri Lankan government schools

N.V.D.P. Priyadarshani

Department of Science & Technology Education, University of Colombo, Sri Lanka

The G.C.E (O/L) is one of the main examinations in Sri Lanka. Science is a main and compulsory subject which student have to follow. According to the new syllabus, the subject Science is divided into three parts namely, Physics, Chemistry, and Biology. School textbooks clearly indicate all relevant theories and practical methods. Teaching methodologies are clearly indicated in the teaching guide but are not used effectively by teachers, as a result of which student achievements are not at acceptable levels. The main objectives of this research were to (a) examine the teaching methodologies recommended in grades 10 and 11 text books related to Physics; (b) examine how far the identified teaching methodologies are used by Physics teachers in grades 10 and 11; and (c) identify problems related to teaching methodologies in grade 10 & 11 Physics. The study focused on Grades 10 and 11 in government schools of the Sri Jayawardenapura Educational Zone and drew its sample from amongst students and teachers. It employed mixed method research. Data were collected with the use of discussions, questionnaires, and interviews. The grades 10 and 11 science textbooks contain 37.4% and 34.8% student-centred activities respectively. However, there is not enough time allocated for the Physics part in comparison with the other two parts. The teacher's capability in terms of organizing the lesson, as well as a lack of adequate resources for teaching Physics lead to a situation in which some of the student-centred activities are only used as a demonstration, while suitable teacher-centered teaching methods are deployed. Student interest in Physics is low, resulting in low marks at the examinations.

Keywords: *Science, Physics, teaching methodologies, Grades 10 and 11, government schools*

**In-service teachers' perspectives:
The educational value of professional experiences**

D.V.K. P. Seneviratne

Department of Science & Technology Education, University of Colombo, Sri Lanka

Revisiting the educational value of professional experiences from student teachers' perspectives is important. This correlational study investigated the educational value of the professional component of an in-service teacher education programme as perceived by the participants. Documentary reviews, questionnaires, observation check lists, and reflective post notes were used for data collection from a sample of two groups of practicing teachers (Sinhala medium and English medium) who have concurrently completed the Postgraduate Diploma in Education (PGDE) at the Faculty of Education, University of Colombo, in the academic year 2015/2016. A General Linear Model (GLM) Univariate analysis was used to find out the correlation. Fact finding revealed that in-service teachers of the Sinhala medium (4.81 ± 0.24) had a comparatively higher perception towards the educational value of eight professional components than that of the English medium group (4.77 ± 0.22). However, the mean difference in perception was not significant ($t = 0.51, p > 0.05$). Criterion-wise analysis in the act of teaching revealed that teachers of the Sinhala medium group (3.47 ± 0.34) had outperformed the English medium group (3.28 ± 0.30). However, the mean difference was not significant ($t = 0.071, p > 0.05$). The highest performing criterion was lesson development for the Sinhala medium group, while that of English medium group was the use of learning aids. Assessing for learning in the classroom was the least performing skill among the in-service teachers irrespective of the medium. The majority in the Sinhala medium group have attempted to be reflective after the completion of each lesson, but that was lacking among teachers in the English medium group. Further research in the area is required to improve the educational value of the professional components of the in-service teacher education programme.

Keywords: *in-service teachers, professional experiences, educational value, perception, performance*

Cognitive domain of Dyslexic students: a study based on multiple case study method

E. Randeniya

Department of Educational Psychology, University of Colombo, Sri Lanka

Children, as human beings, are entitled to an education, including children with Dyslexia. Accordingly, studies offering different perspectives on the education of Dyslexic students have been carried out in many countries. However, only a few research studies have been conducted in Sri Lanka. Therefore, the aim of this study is to investigate the cognitive abilities or disabilities of Dyslexic students under the themes of intelligence quotient, defense mechanism, memory functioning, attending skills, creativity, mathematical ability, and time management. The study deployed a qualitative research paradigm, adopting a multiple case study method and selecting a purposive sample of 10 Dyslexic students. In-depth interviews, observations, and medical reports of the Dyslexics were used as techniques of data collection. The generated data and information were analysed and interpreted thematically using a qualitative comparative analysis method. Findings revealed the intelligence quotient of Dyslexic students to be >70; the use of positive and negative defense mechanism to settle down in the learning environment; difficulties with memory (short term and long term) during educational process; attention difficulties; higher level of creativity; difficulties understanding concepts of mathematics at the relevant level; and difficulties with time management. Further research in the area is required in order to make teachers and parents aware of issues related to the functioning of the cognitive domain amongst Dyslexics and to use relevant intervention methods to address intellectual difficulties.

Keywords: *dyslexia, cognitive domain, multiple case study method, thematically*

A study to identify the professional development needs of teachers

H.M.G.D. Herath, M. Perera

Department of Humanities Education, University of Colombo

Teachers of English in government schools are appointed under three categories: Graduate, Trained, and Untrained (Sri Lanka Education Information 2013, Ministry of Education). Graduate and untrained teachers are given compulsory in-service training for their professional development, while the trained teachers are encouraged to follow degree courses. This investigation was conducted as a part of the major study, *Enhancing Professional Practice of Teachers through Reflection*, with the objectives of examining teachers' understanding of professionalism and the prevailing need and expected support in terms of professional development. A survey was conducted with a purposive sample of teachers of English in one education zone, and data were collected through a questionnaire. Data analysis revealed that the subjects expect more support from the In-service advisors and the Assistant Director of Education (English). The professional development needs that were identified highlighted the fact that subject knowledge and knowledge of teaching methodology were also mentioned under 'high level of need'. Maintaining a reflective journal, which is an essential component for a professional, was not a practice among the subjects of the sample, although it had been a part of their teacher training. Lack of professional support, especially due to the shortage of In-service advisors, was also identified as an important issue. Recommendations from this investigation are that teachers be made aware of the importance of maintaining reflective journals and engaging in action research as a part of their classroom practice, towards enhancing professionalism. The school-based teacher development programme should be strengthened with the aim of transferring into practice the theoretical knowledge that teachers gain at their teacher training. A further recommendation is that there should be a mechanism to identify the actual needs of the teachers before planning teacher training sessions.

Keywords: *professional development needs, teachers of English, reflective journal*

Aid to focus: A self- regulation programme for young adolescents

L.C.D. Wickramanayake, M. Perera

Department of Humanities Education, University of Colombo

Cultivation of the necessary mindset and knowledge of effective learning strategies are notable features for successful school performance, enabling students to focus better on their work. Studies confirm that the academic mindset can be fostered with the knowledge of a growth mindset which takes the position that intelligence is malleable and can be changed with effort. Know-how of effective learning strategies plays a salient role in increasing student performance in school. The objective is to design a programme to encourage students to form an academic mindset, enabling them to focus better on schoolwork, and thereby gradually leading them to self-regulate with the use of the strategies learned. The programme consisted of three segments. The first to be introduced was a presentation on the adolescent brain, its functions related to learning, and the idea of growth mindset. This was followed by time management techniques. Finally, an awareness programme on yoga techniques pertaining to focusing was conducted, aiding 29 Grade 11 students to construct a toolbox of strategies for themselves to self- regulate and promote learning. The action research continued for a period of six months. Test marks and semi-structured interviews were used as tools of data collection. The statistical data revealed that the majority has scored higher marks in the post-test than in the pre-test. Interview data relating to the video presentation on the teen brain indicated that they had understood the phenomena of learning, most stating that repeated viewings would have been beneficial. It was also disclosed the average ability students used the time management techniques taught more often than the higher ability students. The data also showed most had employed at least one yoga technique taught to suppress the obstacles of focusing. Further, it was indicated some students had employed strategies to self-regulate beyond the classroom. However, repeating the intervention would lead to a compact, precise program.

Keywords: *focus, growth mind set, self-regulation, time management technique, yoga techniques*

Adopting Motivated Strategies for Learning Questionnaire to assess self-regulated learning skills in university students

D. Vajira Manjarie De Silva, M. V. Vithanapathirana

Department of Educational Psychology, University of Colombo, Sri Lanka

The objective of the study was to select and adopt a tool to assess the self-regulated learning skills in university students. According to the literature, the Motivated Strategies for Learning Questionnaire (MSLQ) is a self-report instrument which has been applied and validated at different educational levels, both university and non-university, and is both a motivational and strategy-oriented instrument. MSLQ is grounded in the social cognitive theory and it assumes that self-regulated learning is context-specific. Therefore, it has been designed for use at the course level. MSLQ is composed of two main sections: a motivation section which comprises 31 items, and a learning strategies section which includes 50 items. The literature revealed that MSLQ has been used extensively and translated into more than 20 languages, and has undergone formal assessment of validity and reliability in two other languages—Spanish and Chinese. However, it had not been translated into the Sinhala language. To address this gap in knowledge, MSLQ was translated into Sinhala before being administered to the students. After permission was obtained, the standard translating procedure established by the World Health Organization (2014), which consists of steps (namely, forward translation, expert panel back-translation, pre-testing and cognitive interviewing and final version), was followed. This final version of the translated MSLQ was administered to 24 B.Ed students to measure their self-regulated learning skills in three courses, before and after each cycle of an action research. Data gathered from MSLQ were analysed by assessing the impact of the intervention. The scores obtained through the MSLQ provided an understanding about the self-regulated learning skills of students and encouraged the use of appropriate strategies to develop those skills. Therefore, this Sinhala version of the MSLQ is a valuable instrument which fills a gap in knowledge in Sri Lanka.

Keywords: *Motivated Strategies for Learning Questionnaire, self-regulated learning skills*

**Prosocial attitudes of students at the end of the compulsory education span:
Development of a self-report scale for a status study prior to an intervention**

H.G.S.K. Wimalasiri, M.V. Vithanapathirana

Department of Educational Psychology, University of Colombo, Sri Lanka

Students are the foundation of future human capital, contributing to the development of the country. Yet evidence points to a deterioration of pro-social attitudes amongst students in Sri Lanka. According to several reports on out-of-school children, it is evident that there has been a significant growth of various forms of delinquency among school children. There is hardly any research on this issue. The lack of prosocial attitudes and behaviour is troubling for those who are concerned about the social climate of this country. There are 4 main types of prosocial attitudes: altruistic, compliant, emotional, and public pro-social attitudes. Altruistic prosocial behaviours were identified as voluntary, helping motivated primarily by concern for the needs and welfare of another. Compliant prosocial behaviours were defined as helping others in response to a verbal or nonverbal request. Emotional prosocial attitudes are an orientation toward helping others through emotional issues. Public prosocial attitudes are the orientation to be helpful in public by a desire to gain others' approval. A study of freely available standardized tools, Helping Attitude Scale (HAS) by Nickell (1998), Adapted Version of the Self-Report Altruism Scale by P. C. Rushton et al (1981, original) and Scale of Altruistic Behaviours of Peter Witt and Chris Boleman (2009, adapted version) was conducted. In developing a tool to explore the status of prosocial attitudes of students in grade 9, selected statements were paraphrased from the original tool while parallel statements were developed in relation to some to maintain contextual relevance. All tools were on 5-point rating scales. The developed scale incorporated 13 positive statements to measure pro-social attitudes and behaviours toward family; 15 positive statements related to pro-social attitudes toward school; 10 positive statements toward broader society; and 20 mixed statements. The instrument was piloted with ten students selected at convenience. After minor revisions to the questionnaire, it was administered to 400 students to find the gaps in student prosocial attitudes. The tool was found to be effective, as student responses indicated the tendencies of different types of attitudes of students. Each component of the tool revealed that students had to be supported with a suitable intervention.

Keywords: *prosocial, delinquency, compulsory education, self-report scale*

**Symptoms of stress in adolescent students' due to home related problems:
An exploration to facilitate designing an intervention**

Rev. P. D. Sangamitta, M.V. Vithanapathirana
Department of Educational Psychology, University of Colombo, Sri Lanka

Psychological wellbeing is an essential element for a person of any age. Currently, issues of psychological distress and maladjusted behaviour are frequently reported among school children. Stress is a significant and persistent risk factor for psychopathology in childhood and adolescence, affecting students' learning and wellbeing. Among types of stressors that affect student learning, home and family related issues of stress are of particular importance. Psychological interventions designed to address this issue are not very common in Sri Lankan school contexts. The research objective is to study the symptoms of stress among adolescent students through a fact-finding survey to facilitate designing a remedial psychological intervention in the next phase of the study. A student sample of 160 with stress symptoms mainly arising from home- and family-related problems were selected from 6 national and 2 provincial schools of the Colombo education zone in consultation with teachers of grades 9-12 and counsellors of the schools. The tool selected to identify the stress symptoms was Stress Scale for Childhood and Adolescence SSKJ 3-8. The stress symptoms were classified under issues arisen within the past month due to home-related factors. The specific areas of symptoms were problems encountered in interpersonal relationships, issues of family background, emotional problems, and educational problems. The items were on 5-point Likert scale. The highest mean values, which were above 3, were for feelings of sickness, anger, restlessness, sadness, isolation, and fatigue, along with headache, reluctance to study, low marks in school tests, problems with friends, and forgetting studied content. Based on these findings 40 students were selected for an intervention. It was inferred that further interviews were necessary to avoid the problem of overlap between coping strategies representing emotion-focused coping and symptoms of psychological distress. Although the students indicated that these symptoms arose due to home-related factors, many stressful events or circumstances do not have clear beginnings or may be multifaceted. However, since home and family would be a root cause, this sample may be considered for the psychological intervention.

Keywords: *stress symptoms, childhood and adolescence, family, psychological, educational*

FACULTY OF GRADUATE STUDIES



New Trends in Education, Health and Security for Human Advancement

14 November 2017

**MESSAGE FROM THE DEAN, FACULTY
OF GRADUATE STUDIES**

Senior Professor Nayani Melegoda



The Faculty of Graduates Studies (FGS) will hold its Annual Research sessions on November 14, 2017 on the theme “New Trends in Education, Health and Security for Human Advancement”. This year, the Sessions will include presentations from all disciplines, and, as is the norm at FGS, will encourage interdisciplinary discourse to enable our researchers and postgraduate students to learn from one another. I am happy to report that the Sessions will feature 41 research presentations on Education (in Human Rights/Public Administration/Information Systems and Gender Studies); Health and Wellness (Physical and Psychological); Security Studies (Human Security/Environmental Challenges/National Security Concerns); and Sustainable Development. These conference tracks reflect the profile of FGS as a leading Faculty addressing national needs.

The oldest Faculty of graduate studies in Sri Lanka, FGS offers a total of 30 postgraduate programmes. In keeping with quality assurance and accreditation requirements, all FGS postgraduate programmes adhere to the Sri Lanka Qualifications Framework (SLQF). This is an important year for FGS, with the Faculty winning the Golden Globe Tiger Award for the Educational Institute with Best Academic and Industrial Interface. Another FGS landmark is the pioneering Doctoral study, “Developing and validating a Language assessment tool to diagnose aphasia in a Sri Lankan Sinhala speaking context”, which was completed in Sri Lanka this year.

I thank Hon. Kabir Hashim, M.P, Economist and Cabinet Minister of Public Enterprises Development, for accepting our invitation to be the Chief Guest. I am very grateful to all members of the Faculty of Graduate Studies for organizing the 2017 Research Sessions. I take this opportunity to send my best wishes to all our guests, session chairpersons, researchers, postgraduate students and participants for a productive and enjoyable event.

FACULTY OF GRADUATE STUDIES

PROGRAMME

14 November 2017

- 1.30 p.m. - 2.00 p.m. - Arrival of Guests and Registration
- 2.00 p.m. - 2.10 p.m. - Inauguration: Lighting of the Oil Lamp, National Anthem
- 2.10 p.m. - 2.20 p.m. - Welcome Address by Professor Nayani Melegoda - Dean/FGS
- 2.20 p.m. - 2.30 p.m. - Address by the Guest of Honor
Senior Professor Lakshman Dissanayake
Vice-Chancellor, University of Colombo
- 2.30 p.m. - 2.45 p.m. - Address by the Chief Guest
Hon. Kabir Hashim
Minister of Public Enterprise Development
2. 45 p.m. - 3.15p.m. - Keynote Speaker, Professor Chandrika N. Wijeyaratne
Faculty of Medicine, University of Colombo, Sri Lanka
- 3.15 p.m. - 3.25p.m. - Vote of Thanks by Dr. Achala Jayathilake
- 3.25 p.m. - 4.15 p.m. - Refreshments
- 4.30 p.m. – 7.00 p.m. - Panel Presentations on Track 1/Track 2/Track 3/Track 4

INTRODUCTION TO THE KEYNOTE SPEAKER

Professor Chandrika N. Wijeyaratne

Faculty of Medicine, University of Colombo, Sri Lanka



Professor Chandrika N. Wijeyaratne is a Professor in Reproductive Medicine in the Department of Obstetrics and Gynaecology, Faculty of Medicine, University of Colombo and a Honorary Consultant Physician and Endocrinologist in the De Soysa Hospital for Women, Sri Lanka. She is the first Endocrinologist in Sri Lanka to be appointed to an academic position (in 1993) and is a pioneer Obstetric Physician in the South Asian region. Her current research encompasses areas including Polycystic Ovary Syndrome and Insulin Resistance in South Asians, medical disorders in pregnancy, gestational diabetes and thyroid disease. Professor Wijeyaratne is the author of 64 research publications in peer-reviewed indexed journals with 1243 research gate citations for January 2017. She has contributed to 6 book chapters and has delivered 5 prestigious orations based on her own research: namely the Sir Nicholas Atygalle Oration in 2002, Sir Marcus Fernando Oration in 2005, Dr Henry Rajaratnam Inaugural Oration in 2009, Faculty Oration of the Faculty of Medicine Colombo in 2011 and Murugesar Sinnetamby Oration in 2012. Prof. Wijeyaratne is a recipient of many National and International awards the latest being the International Excellence in Endocrinology Award of the Endocrine Society (USA) in 2017.

Professor Wijeyaratne was the Convenor of the National Coordinating Committee for Research in Human Reproduction (WHO) in Sri Lanka from 1993-1998 and its Chairperson from 2009-2013. She initiated the establishment of a database of local research in Reproductive Health. Through the NIROGI Lanka National level project she pioneered a cohort of nurse educators for diabetes in the state sector to take universal screening for gestational diabetes to grassroots level. She was a founder member since 2013 and the Vice President of the South Asian Initiative for Diabetes in Pregnancy in 2015. She was instrumental in giving the leadership to the 1st ever SAIDIP and DIPAP conference in September 2016 on maternal diabetes, hypertension and metabolic syndrome that provided the platform for South Asian research networking and dissemination of results.

FACULTY OF GRADUATE STUDIES

List of Abstracts

1. Role of common factors in counselling in determining therapist competency in Sri Lanka 129
A.M.N.D. Abeysinghe, B.A. Kohrt and A. Galappatti
2. What do they assess?: an analytical study of question papers based on Bloom's Taxonomy 130
M.C. Amarasinghe
3. Correlates of psychological well-being of the elderly in Sri Lanka: A proposed study model 131
B.S.K. Ariyaratne, M.P. Dissanayake and P. De Zoysa
4. The level of ICT usage and perceived barriers for ICT adoption in Sri Lankan SMEs 132
J.C. Athapaththu and B. Nishantha
5. Cultural acceptability and effectiveness of the Sinhala version of mindfulness-based Cognitive Therapy for depression 133
Rekha Aththidiye, Shamil D. Wanigaratne, Malathi Dissanayake and Samudra Kathriarachchi
6. Investigating stress among married public-sector workers in Sri Lanka 134
I.R. Bandara and A.T.P.L. Abeykoon
7. A study of surface water pollution due to hazardous waste from selected leather tanning industries in the Colombo District, Sri Lanka 135
S. J. S. Bandara and Ranjana U.K. Piyadasa

- | | | |
|-----|---|-----|
| 8. | Access and utilization of maternal health care services among women in rural areas of Bauchi State, Nigeria
<i>Magaji Dafi</i> | 136 |
| 9. | Comparison on chemical profiles: Tamalakyadi decoction with its freeze dried, spray dried and <i>ghanasara</i> forms
<i>J.M. Dahanayake, P.K. Perera, P. Galappatty, P. Fernando and L.D.A.M. Arawwawala</i> | 137 |
| 10. | Impact of entrepreneurship education in promoting entrepreneurial intentions of undergraduates
<i>B.J.A. Dankanda and W. Madurapperuma</i> | 138 |
| 11. | Impact of trade on employment in the manufacturing industry in Sri Lanka
<i>Sajith De Mel</i> | 139 |
| 12. | New prospects for GI producers?: An appraisal of the proposed Amendment Bill to the Intellectual Property Act of Sri Lanka
<i>L.M. de Silva and N.S. Punchihewa</i> | 140 |
| 13. | Implementing the laws governing witness protection in Sri Lanka: A critical analysis
<i>S.T.M.N. Gunasinghe</i> | 141 |
| 14. | Restoring psychosocial well-being of Parentless School Going Adolescents (PSGAs): Role of traditional healers in the Northern Province of Sri Lanka
<i>S. Hariharathamotharan, Dilrukshi Abyesinghe and S. Jeevasuthan</i> | 142 |

15. Morphological and microscopic analysis of five *Curcuma* species grown in Sri Lanka using Multivariate Test 143
H.M.I.C. Herath, T.D.C.M.K. Wijayasiriwardena and G.A.S. Premakumara
16. Vulnerability of coastal communities and infrastructure by the impact of sea level rise in Maldives 144
K.W. Indika, E.M.S. Wijerathne, G.W.A.R. Fernando, M. Ranagalage, R.M.D.I. Rathnayaka and S.S.L. Hettiarachchi
17. Foreign direct investment and policy inconsistency in Nigeria: 1970-2015 145
M.Y. Kabara and K. Amirthalingham
18. Power balance in Indian Ocean Region: Sri Lanka's foreign policy towards Indo-Sino Relations (2015-2017) 146
Hasith Kandaudahewa
19. Impact of social aspects for the information security in internet banking: Study among the employees of Seylan Bank in Sri Lanka 147
P.M. Kotalawala
20. Food security/insecurity and policy responses in Sri Lanka: A review of food security indices 148
P.M.P. Anura Kumara
21. Influence of Social Networking Sites (SNS) on Diploma students taking Animal Husbandry: A case study in Sri Lanka School of Animal Husbandry, Department of Animal Production & Health, Karandagolla, Kundasale 149
G.C.S. Kurugala

22. Application of knowledge management concepts in international schools: a comparative study of three international schools in the Colombo District 150
R.L. Kuruppu
23. Language classroom in the Sammanthurai Education Zone: An ecological perspective 151
S. Rifa Mahroof
24. Heavy metal levels in muscle tissues of selected Mud Crabs (*Scylla serrata*) from Negombo Estuary 152
B.R.C. Mendis, M.M.M. Najim and H.M.P. Kithsiri
25. Challenges in implementation of Sustainable Consumption and Production (SCP) indicators in Sri Lanka 153
C.S.N. Mohottige
26. Importance of participatory decision making in local government of Sri Lanka 154
W.K. Moramudali
27. Association between family factors, parental stress, executive functions and emotional-behavioural regulation among pre-school children in the Colombo District 155
C.M. Munasinghe and P.K.S. Godamunne
28. Life histories and experiences of lesbian, gay and bisexual persons in Colombo: An exploratory study 156
S.K. Munasinghe, J. Marecek and P. Godamunne
29. The adoption of cloud-based E-Learning Systems 157
A.S.T. Nishadi

30.	The challenges in ESD implementation through junior secondary Science in Sri Lanka <i>A. Nithlavarnan, G.I.C. Gunawardana and K. Sinnathamby</i>	158
31.	The strategic implications of the concept of “Mandala’’: A case study of ASEAN <i>S. C. Padmakumara</i>	159
32.	‘Challenging the Elo Rating’: The harm in comparing the incomparable transitional justice process of post-war Sri Lanka <i>Maneesha S. Wanasinghe – Pasqual</i>	160
33.	Social perceptions of caste discrimination: reference to university students in Sri Lanka <i>M.J.D. Peiris</i>	161
34.	Military occupation of private lands and its impact on land rights: A case study of Valikamam North, Jaffna <i>T. Ratnavel</i>	162
35.	Sizing of small-scale hydroelectric machinery for optimum use of water <i>Ranil Senaratna and Devini Senaratna</i>	163
36.	Human threats to the sea turtles and their nesting beach: A case study, Thalalla beach, Matara <i>M.A.F. Shazna</i>	164
37.	Studies in local resource and hybrid-peacebuilding post-conflict in Sri Lanka: from the perspective of international actor and local actor <i>Ryo Uchida</i>	165

38. Economic impact of climate change on paddy yield in Kurunegala District 166
V. Upananda and S.A. Norbert
39. Teaching with Technology and Activity Theory in tertiary education institutes: A literature review 167
P.A. Warusavitarana
40. Time series analysis of Tuberculosis: New cases in the Western Province, Sri Lanka 168
W.M.D.H. Weerakoon, W.M.K.P. Weerakoon and N.R. Abeynayak
41. Domestic violence against women in Sri Lanka: Inter-professional collaboration and practice 169
M.S. Wijesekara and D. Abeysinghe

Role of common factors in counselling in determining therapist competency: the case of Sri Lanka

A. M. N. D. Abeysinghe¹, B. A. Kohrt², A. Galappatti³

Faculty of Graduate Studies, University of Colombo, Sri Lanka

²Duke Global Health Institute, Duke University, USA

³Faculty of Graduate Studies, University of Colombo, Sri Lanka

Common factors in counselling are an important aspect contributing to successful therapeutic interventions. Identifying common factors specific to a country and/or culture enables objective evaluation of therapists across therapeutic modalities. The Enhancing Assessment of Common Therapeutic Factors (ENACT) tool was developed to evaluate counsellors in Nepal for this purpose. This country/culture specific tool contributed in facilitating objective therapist evaluation in Nepal. Similarly, if common factors that are specific to Sri Lanka are identified, they could be used for therapist evaluation and provide guidelines for training of therapists. This paper presents the preliminary findings of the first phase of a multiphase research on common factors in counselling in Sri Lanka. The objective of this phase of the study is to identify and deepen the understanding of common factors that are perceived as influencing therapist competence in mental health care in Sri Lanka. We used in-depth interviews (60-90 minute) with nine clinicians and three clients. The participant selection was based on therapists' areas of speciality, experience as a therapist or client and accessibility. Our preliminary analysis enabled the identification of common themes that correspond with the existing ENACT tool. These included factors such as active listening, demonstration of interest and respect, and rapport formation. Novel factors mentioned by interviewees included allocation of more time as it communicated the therapist's availability for the client, use of humour, and positive energy emitted by the therapist. These factors were specifically mentioned by clients' in addition to the emphasis they placed on confidentiality, respect and genuinely established parity by the therapist. We intend to conduct more interviews and focus group discussions with respondents from diverse socio-economic backgrounds to validate and strengthen these findings. We expect the findings of this research will enable us to suggest improvements to therapist assessment, and clinical training for counsellors/psychotherapists in Sri Lanka.

Keywords: *Common factors, Counselling, Psychotherapy, ENACT, Therapist competency*

What do they assess?: An analytical study of question papers based on Bloom's Taxonomy

M.C. Amarasinghe

Faculty of Graduate Studies, University of Colombo, Sri Lanka

This study aims to analyse the GCE Ordinary Level Science papers conducted by the Examination Department of Sri Lanka using the revised Bloom's Taxonomy (Anderson & Krathwohl, 2001). The rationale for the study comes from the fact that there is a marked mismatch between the skills gained by the pupils through formal education in Sri Lanka and the skills preferred by the private sector employers. Based on interviews with CEOs and HR managers of private sector companies it is identified that to be competitive in the world of work, it is important to possess skills such as analysing, evaluating, and creating. Bloom's Taxonomy categorises these as higher order skills that lead to deeper learning and transferable knowledge. For this particular study, a content analysis of the questions from papers between the years 2013-2016 were carried out to identify the extent to which the questions examined the lower order skills: remembering, understanding, applying and higher order skills: analysing, evaluating and creating. The data was processed using a frequency distribution of questions and the percentage of marks allocated to each category of the Taxonomy. The study finds that between the years 2013-2016 an average of 76% marks were allocated for the lower order skills and an average of 23% for the higher order skills. Hence, the study concludes that a greater percentage of questions test lower order skills and less emphasis is paid on testing higher order skills. In an examination oriented society like Sri Lanka, the learning opportunities are linked with examinations and if it is not tested the teachers will pay less attention in cultivating such skills. This study recommends that more emphasis needs to be paid to incorporate questions that test higher order skills, when formulating questions for examinations.

Keywords: *Revised Bloom's taxonomy, Higher order skills, Lower order skills, Content analysis, Sri Lanka*

Correlates of psychological well-being of the elderly in Sri Lanka: a proposed study model

B. S. K. Ariyaratne¹, M.P. Dissanayake², P. De Zoysa³

¹*Faculty of Graduate Studies, University of Colombo, Sri Lanka*

²*Department of Psychology and Medical Psychology, SAITM, Sri Lanka.*

³*Department of Psychiatry, Faculty of Medicine, University of Colombo*

Developmental theories of emotion regulation contend that, with advancing age, when the boundaries on time are perceived, the elderly tend to prioritise the achievement of emotionally fulfilling goals compared to expansive goals. As a result, the elderly tend to attain a greater sense of mastery in emotion regulation characterized by increased strengths in the frequency and successful use of attentional strategies, appraisals, and behaviours to regulate emotional experiences. The literature attests to this theoretical postulation by indicating a positive correlation between acquisition of effective emotion regulation strategies and experience of higher levels of psychological well-being in old age. This research will study the emotion regulation capacities of a selected group of elderly individuals (60 years of age and above) using the psychological construct of Regulatory Emotional Self-efficacy beliefs and its impact on the Psychological Well-being, using Carrol Ryff's model for understanding and measuring psychological well-being. Regulatory Emotional Self-efficacy beliefs encompass the idea of modulation of negative affect along with appropriate experience and expression of positive affect. Taken from Aristotle's notion of 'Eudemonia' which denotes the human capacity to flourish and live up to one's full potential, Ryff's model of psychological well-being has reported two points of convergence as personal meaning and growth. Hence the multi-faceted model includes the dimensions of self-acceptance, positive relations with the other, environmental mastery, autonomy, purpose in life and personal growth. Exploratory, cross-sectional research design will be used to collect and analyze data to establish the association between the two constructs. A gender balanced sample of 550 healthy, older adults will be selected using stratified convenience sampling method from the Colombo District. The research findings will contribute to Socio-Emotional Selectivity Theory to determine emotion regulation trajectory and literature on the psychological well-being of the elderly in Sri Lanka.

Keywords: *Elderly, Regulatory Emotional Self-efficacy, Psychological Well-being, Socio-Emotional Selectivity Theory*

The level of ICT usage and perceived barriers for ICT adoption in Sri Lankan SMEs

J.C. Athapaththu¹, B. Nishantha²

¹ *Department of Management and Organization Studies, Faculty of Management and Finance, University of Colombo, Sri Lanka*

² *Department of Management and Organization Studies, Faculty of Management and Finance, University of Colombo, Sri Lanka*

Information Communication Technology (ICT) plays a major role in today's business and also significantly impacts on organizational performance (Hajli & Sims, 2015; Melville et al., 2004). Additionally, Small and Medium Enterprises (SMEs) plays a significant role in Sri Lankan economy as a strategic partner. Even though SMEs play a major role in Sri Lankan economy, they are facing greater challenges in the modern business world under tough competition, rapidly changing new technologies and globalization of products and services (Kanagasingam, 2012). According to Chon (1996) in contrast to the large firms, SMEs face various problems when implementing ICT to their firms. This study examines the current level of ICT usage and perceived barriers on ICT adoption in SMEs in Sri Lanka. The study has used a questionnaire-based survey and data was collected from 67 SME owners from all Provinces with the exception of the Northern Province of Sri Lanka. The convenience sampling method was adopted to select the respondents for the study. According to the results, the majority of the respondents used e-mail (89.6%) for their business. Thereafter, IT was used for; privacy (50.7%), logistics operation (14.9%) and information systems (37.3%). Responses to the perceived barriers were analysed by principal component factor analysis with varimax rotation. The findings revealed that, despite the fact that a majority of the respondents used IT for essential functions, they lacked proper internal IT infrastructure, personal motivation, internet connection issues, trust, and knowledge. These factors were identified as the perceived barriers for ICT adoption in SMEs in Sri Lanka.

Keywords: *SMEs, ICT, ICT usage, ICT adoption, Perceived barriers*

Cultural acceptability and effectiveness of the Sinhala version of mindfulness-based Cognitive Therapy for depression

Rekha Aththidiye¹, Shamil D Wanigaratne², Malathi Dissanayake³,
Samudra Kathriarachchi⁴

¹*Faculty of Graduate Studies, University of Colombo, Sri Lanka*

²*College of Medicine and Health Sciences, United Arab Emirates University.*

³*South Asian Institute of Technology and Medicine (SAITM), Sri Lanka*

⁴*Colombo South Teaching Hospital, Sri Lanka*

Adapting psychotherapy to suit diverse ethno-cultural groups has become an important aspect of Clinical Psychology. The Formative Method for Adapting Psychotherapy (FMAP) carries a scientific and systemic way of adapting psychotherapy for ethnic minorities. It accounts for the cultural, linguistic, and socioeconomic context of ethno cultures. The research objective is to ascertain whether Mindfulness Based Cognitive Therapy (MBCT) is a culturally applicable intervention to reduce depressive symptoms and relapses among Sinhala-speaking depressed patients. This paper outlines the cultural adaptation of MBCT as the systematic modification of evidence-based treatment or intervention (EBT) protocol considering FMAP. The main phase of FMAP applied to MBCT adaptation included: (a) generating knowledge and collaborating with stakeholders (depressed group and 2 groups of mental health professionals); (b) chppsong the English manual of MBCT as the preliminary resource incorporated with empirical and clinical knowledge; (c) Reviewing and revising the initial adapted clinical intervention with stakeholders; conducting two months of intervention of MBCT; (d) testing and implementation of the culturally adapted version; and (e) finalising the culturally adapted therapy manual. FMAP adaptation protocol contains 8 dimensions: “language”, “person”, “metaphor”, “content”, “concept”, “goal”, “method” and “context”. After the adaptation of MBCT manual, 2 focus group discussions were held to finalize the concept. In convergent both versions are group intervention to reduce recurrence relapses of depression, focusing on Mindful concept based on Buddhism, few yoga activities plus cognitive therapeutic approach. Divergently Sinhala version includes nine sessions in contrast eight in English; also, only 10 soundtracks omitting some imaginary guidance in the exercises inverse in English version has 13 soundtracks. In conclusion, the MBCT Sinhala version appears to retain the comprehensive properties of its’ original version.

Keywords: *Cultural Acceptability, Adaptation of Psychotherapy, FMAP, MBCT, Depression*

Investigating stress among married public sector workers in Sri Lanka

I.R. Bandara¹, A.T.P.L. Abeykoon²

¹*Faculty of Graduate Studies, University of Colombo, Sri Lanka*

²*Institute of Health Policy, Sri Lanka*

According to the *Census of Population and Housing 2012*, in Sri Lanka, out of the total employed population aged 15 years or more, 15.2 percent (or 1.3 million) consist of public sector workers. Of these workers, 64.5 % were male and 35.6 % were female. Among them a majority belonged to the 30-34 age group, which comprises of 9.5 % male and 5.7 % female. Married workers have to play multiple roles in their lives today. In this context, they sometimes neglect important daily activities in their lives. There is limited research conducted on stress among married public-sector workers in Sri Lanka. Therefore, the main objective of this paper is to investigate whether married public-sector workers' daily lives reflect their stress. Researchers have investigated and concluded that inadequate sleep and lack of regular physical exercises are two important things that create stress. This study collected information from 300 randomly selected married public-sector workers of both sexes. Out of the total respondents, 40% were male and 60% were female. Results showed that 61.7 % of workers did not engage in regular exercise and 34.3 % of workers did not have adequate daily sleep. The results reflect that there is a strong possibility of creating stress among married public-sector workers. The study concluded that there is a need for further investigation.

Keywords: *Stress, Married Public-Sector Workers, Physical Exercise, Sleep*

A study of surface water pollution due to hazardous waste from selected leather tanning industries in the Colombo District, Sri Lanka

S. J. S. Bandara¹, Ranjana U.K. Piyadasa²

¹*Central Environmental Authority, Battaramulla, Sri Lanka*

²*Department of Environmental Technology, University of Colombo, Sri Lanka*

Surface water pollution is generally induced by anthropogenic activities. The objective of the study is to identify surface water pollution caused by industrial hazardous waste generated by Chromium base leather tanning industry in the Colombo District. According to the CEA records, ten tanneries are located around the Kelani River but only 2 are in operation. Those two tanneries depend on the Kelani River for their water consumption and for the discharge of wastewaters. Water quality variation of Kelani River was analysed under *in-situ* and *ex-situ* conditions. Surface water was analysed during two different weather conditions at 4 selected points near Mattakkuliya area. The aim was to identify the potential pollution factors of surface water due to tanning wastewater. Therefore, study was carried out using water quality results during the dry season. Tanneries discharge their wastewater directly to the Kelani River at a specific period in the daytime and wastewater is contaminated by NaCl, pesticides, strong alkaline, sulphides, inorganic residual compounds, dissolved matter and chromium salts due to the Chrome tanning process. Chromium is, however, recovered in the Chrome Recovery Treatment plant. The Cr⁺³ is recovered to minimise the cost for Chromium Sulphate [Cr₂(SO₄)₃] as a raw material. Accordingly, the largest tanneries in the Colombo District have not emitted Chromium with their wastewater. The study revealed that the wastewater of selected tanneries exceeded all other tolerance limits laid by the CEA and tanning effluent is highly contaminated by Sulphide (20.4 mg/l). Consequently, it is very important to implement strict control, supervision and monitoring by all relevant authorities concern to maintain the discharge of effluent to a total treatment and release the same within the limit of accepted tolerance with regard to all by-products. Balancing of environment, economy and social aspects is the basic requirement to achieve sustainability. Herewith, environmental soundness can be gained with strict monitoring by enforcement of regulating body and it should be the leading factor on the sustainable development of the country.

Keywords: *Wastewater, Chromium, Tannery, Pollution factors, Water quality*

Access and utilization of maternal health care services among women in rural areas of Bauchi State, Nigeria

Magaji Dafi

Faculty of Graduate Studies, University of Colombo, Sri Lanka

The study explores the determinants and impacts of access and utilization of maternal health services among women of childbearing age in rural areas of Bauchi State, Nigeria. Health Belief Model by Stretcher and Rosenstock (1979) and “Three Phases of Delay” developed by Thaddeus and Maine (1994) were adopted for this study. The study uses an exploratory mixed research design. A simple random sampling technique was used in the selection of the study subjects. The sample consists of three hundred (300) women drawn from the three (3) zones in the state. The instruments for data collection are in-depth interviews and questionnaires. The collected data was analysed, interpreted and presented using frequency distribution tables, inferential statistic, and SPSS for quantitative data. The qualitative data was transcribed and analysed thematically. The initial findings of the study revealed that utilization of maternal health care is subject to socio-cultural factors which include cost of health services, attitudes of health workers, culture of pain suppression, patriarchy and culture of shyness. Based on the above findings, the following recommendations were made: Policies and interventions aiming at addressing the cost of health services must be formulated and implemented correctly. Health workers should be culturally sensitive when carrying out their duties. The male’s role in reproductive health and other health issues should not be side-lined. Health campaigns, education and counselling need to be intensified to address the challenge of the culture of pain suppression and culture of shyness in order to maximize the utilization of maternal health care services.

Keywords: *Access, Utilization, Maternal Health Care, Women and Rural Areas*

Comparison of chemical profiles: Tamalakyadi decoction with its freeze rried, spray rried and *ghanasara* forms

J.M. Dahanayake¹, P.K. Perera¹, P. Galappatty², P. Fernando³,
L.D.A.M. Arawwawala³

¹*Institute of Indigenous Medicine, University of Colombo, Sri Lanka*

²*Department of Pharmacology, Faculty of Medicine, University of Colombo, Sri Lanka*

³*Industrial Technology Institute, Sri Lanka*

Decoction preparations are basic Ayurveda dosage forms which are highly effective and have to be used only in a fresh state due to less stability. Tamalakyadi decoction (TD) is a classical formulation mentioned in Sarasankshepaya for nasal diseases and used as a remedy for allergic rhinitis. It has 12 plant ingredients. TD was modified as instant dissolving powder form for convenience and because the traditional decoction has a shorter shelf life. The research compared the phytochemical constituents of Traditional TD with its modified dosage forms as freeze dried, spray dried and *ghanasara* forms. Four samples of TD were prepared according to the traditional method. The first sample was named Traditional Tamalakyadi decoction (TTD), while the second, third and fourth samples were converted in to freeze dried (TDFD), Spray dried (TDSD) and *Ghanasara* (TDGS) forms respectively. Freeze dried and spray dried samples were prepared by using freeze dryer and spray dryer respectively. The freshly prepared decoction was subjected to mild heat, converted to semi-solid form and oven dried to prepare the *Ghanasara* sample. All samples were subjected to organoleptic characters, phytochemical screening and TLC fingerprints-densitogram to compare the most appropriate preparation method. The TLC fingerprint profiles were developed for dichloromethane fractions of 4 selected preparations using dichloromethane, ethyl acetate and cyclohexane in a ratio of 3:0.5:1.5 v/v. Phytochemical screening revealed the presence of alkaloids, saponins, tannins, steroids, flavonoids, phenols and terpenoids in all. However, the alkaloids, saponins, terpinoids and steroids were more prominent in TTD, TDFD and TDGS than TDSD. Similar TLC fingerprint profiles were observed in all samples bearing R_f values at 245nm and one spot observed in TTD bearing R_f value at 366 nm. The area and intensity of the spots appeared in TLC fingerprint profiles of TTD and TDFD samples are more prominent. In conclusion, TDFD shows similar chemical profile with rather TTD than TDSD and TDGS.

Keywords: *Tamalakyadi Decoction, Freeze Drying, Spray Drying, Ghanasara, Dosage Forms*

Impact of entrepreneurship education in promoting entrepreneurial intentions of undergraduates

B.J.A. Dankanda¹, W. Madurapperuma²

¹*Faculty of Graduate of Studies, University of Colombo, Sri Lanka*

²*Faculty of Commerce & Management, University of Kelaniya, Sri Lanka*

Entrepreneurship education (EE) plays an important role in promoting entrepreneurial intentions (EI). This study was conducted with the core objective of exploring the relationship between participation in Entrepreneurship Education Programmes (EEP) and identifying its impact on entrepreneurial intentions of undergraduates; the specific objectives were developed: The study sample consist of 140 undergraduates selected from Open University and University of Kelaniya using the convenience sampling method. A pre-tested structured questionnaire was employed for data collection. The data derived from the questionnaires was analysed by descriptive statistics, correlations and regression analysis using SPSS 23. Conceptual framework was formulated and the data analysis was mainly guided by six hypotheses. The study indicated that a student's participation in EEP under EI shows weaker impact. This means that the core objective was achieved despite the insignificant result. The research emphasizes the critical need of motivating undergraduates to participate the EEP in order to have a career as entrepreneurs. The study is not without limitations. The researchers' attempt to explore the impact of participation in entrepreneurship education on entrepreneurial intention generated interest for further research with a larger and different sample representing higher education in Sri Lanka.

Keywords: *Entrepreneurship Education, Entrepreneurial Intentions, Participation of Entrepreneurship Education Programs, Perceived Entrepreneurial Motivation, Theory of Planned Behaviour*

Impact of trade on employment in the manufacturing industry in Sri Lanka

Sajith De Mel

Faculty of Graduate Studies, University of Colombo, Sri Lanka

We investigated the impact of international trade on employment and wages in the manufacturing industry in Sri Lanka. For empirical testing, the research problem is disaggregated into three overarching research questions. First, the impact of factor endowments on employment and wages following Heckscher-Ohlin trade theory (Heckscher, 1919) is empirically tested. It predicts that a country should export using its abundant factor. Therefore, for an economy whose abundant factor is labour, it will experience an increase in the demand for labour and wages following an increase in labour-intensive exports. Secondly, the impact of technology on manufacturing employment and wages following neo-technology trade theories (Posner, 1961; Vernon, 1966) was empirically tested. This was a predicted increase in the demand for labour and wages following diffusion of technology to developing economies. Thirdly, the impact of global production sharing on employment and wages in the manufacturing industry modelled after Arndt (1997); Feenstra and Hanson (1997); Grossman and Esteban (2008) is empirically tested. They predict an increase in the demand for labour and hence, wages, following linking to global production networks. The empirical models for labour demand and wages are derived after the Cobb-Douglas production function. The resulting base specifications are further augmented to capture the effects of factor endowments, technology, global production sharing. Manufacturing data was captured using the Annual Survey of industries conducted by the Department of Census and Statistics. Trade data was obtained using data from the United Nations Commodity Trade Statistics database. For robustness of the results, we construct an integrated industry-trade panel dataset. For the moment, only the findings for the labour demand model are presented here. Findings suggest a positive and a statistically significant impact of exports on employment confirming Heckscher-Ohlin predictions. Technology is negative and statistically significant on employment, against the neo-technology predictions. The impact of global production sharing on employment is negative against expectations, though statistically insignificant.

Keywords: *Trade, Employment, Wages, Manufacturing*

New prospects for GI producers?: an appraisal of the proposed Amendment Bill to the Intellectual Property Act of Sri Lanka

L.M. De Silva¹, N.S. Punchihewa²

¹ *Faculty of Graduate Studies, University of Colombo, Sri Lanka*

² *Faculty of Law, University of Colombo, Sri Lanka*

The protection of Geographical Indications (GIs) has attracted increasing attention among policymakers and scholars, both at the international and the domestic level. Sri Lanka is a country that owns a number of GIs, even though they are not harnessed and protected adequately. For instance, GIs such as Dumbara mats, Ratnapura Sapphires, Ambalangoda masks, Jaffna mango, *paruthithuai thatti vadai* and Ruhunu curd have obviously failed to make potential use of the GIs, due to the GI producers of the returns and absence of adequate legal protection. In March 2017, the government of Sri Lanka published a draft Amendment Bill to the Intellectual Property Act, No. 36 of 2003 (IP Act) in the gazette, giving power to the Minister to prescribe GIs. This created doubts as to whether this was the amendment required to accord a better protection for GIs in the national and international markets. Therefore, this research primarily aims to identify the challenges faced by the Sri Lankan GI producers under the current legal regime and evaluate whether the proposed Amendment Bill to the Intellectual Property Act is adequately equipped to address the perceived inadequacies in the law relating to GIs in Sri Lanka. Drawing examples and best practices from the European Union (EU) and India on GI registration systems, this research proposes the establishment of a new GI registry for Sri Lanka. The research was based mainly on the black letter approach using both primary and secondary data. Even though the study was based on a socio-legal analysis, empirical data has been used in a complementary manner to address the specific objectives of this study.

Keywords: *Intellectual Property, Geographical Indications, Proposed Amendment Bill*

Implementing the laws governing witness protection in Sri Lanka: A critical analysis

S.T.M.N. Gunasinghe

Faculty of Graduate Studies, University of Colombo, Sri Lanka

Witnesses play a vital role in all stages of criminal proceedings, from initial reporting of a crime to the end of the trial. Their contribution to develop the efficacious criminal justice system is paramount. Therefore, it is a duty of the government and all the law enforcement authorities to protect the witnesses with utmost priority. Although this is an essential part of the criminal justice system, Sri Lankan Witness Protection legislation which has only been introduced in 2015 and therefore is still in its infancy. There has been no scholarly attempt to critically and methodically analyse the practicality of the Act since the Act was passed in 2015. The research investigates whether the mere enactment of legislation is adequate or not to ensure the effective protection for witnesses of crime, fundamental rights violation cases and torture cases. Therefore, by undertaking this research, the researcher mainly aims at addressing that deficiency in the legal scholarship in the country. The study focuses on examining whether the newly enacted Sri Lankan Act for Providing the Protection to the Victims of Crime and Witnesses of 2015 is able to reach its desired goals. It further explores the nature and mechanism that would ensure effective implementation of a witness protection programme, which is an urgent need in the Sri Lankan criminal justice system as there is witness intimidation. The research will basically employ a qualitative approach of legal research to gather data and analysis. Primary and secondary data will be collected and analysed to examine the effectiveness of the existing witness protection laws and mechanisms in Sri Lanka. In addition to the in-depth interviews, the study will be based on secondary sources such as Journal articles, books, national and international legal instruments, case records, etc. The research will make recommendations to improve the existing legal regime and, accordingly, highlight how the provisions of legislation should be linked with practice to overcome these challenges.

Keywords: *Witness Protection, criminal Justice System, Sri Lanka, APVCW*

Restoring psychosocial well-being of Parentless School Going Adolescents(PSGAs): Role of traditional healers in the Northern Province of Sri Lanka

S. Hariharathamotharan¹, Dilrukshi Abyesinghe², S. Jeevasuthan²

¹*Faculty of Graduate Studies, University of Colombo, Sri Lanka*

²*Department of Sociology, University of Colombo, Sri Lanka*

³*Department of Sociology, University of Jaffna, Sri Lanka*

This study examines the role of traditional healers who function outside the official supportive care system in promoting the psychosocial well-being of the Parentless School Going Adolescents (PSGAs) in the Northern Province. An Interpretative Phenomenological Approach with a snowball sampling method was adopted in order to gain an in-depth understanding of traditional healers' practice with PSGAs. Therefore, in-depth interviews were carried out with traditional healers representing Hindu and Christian faiths. The identified themes were categorized under psychosocial challenges of PSGAs, process of healing, role of healers, PSGAs and caretakers in healing process. The findings showed that traditional healers were not only treating PSGAs, but were also involved in caring for PSGAs using traditional support by providing them with basic needs and psychosocial support. The healers have a significant role in caring for PSGAs in communities even though they are hardly reported. The study also appears to cement the psychosocial support model that has to be examined to enrich PSGAs' well-being with the focus on the role of government to support these types of healers through its policy.

Keywords: *Psychosocial Well-Being, Traditional Healers and Northern Province, Parentless School Going Adolescents*

Morphological and microscopic analysis of five *Curcuma* species grown in Sri Lanka using Multivariate Test

H. M. I. C. Herath¹, T. D. C. M. K. Wijayasiriwardena², G. A. S. Premakumara²

¹Faculty of Graduate Studies, University of Colombo, Sri Lanka

²Industrial Technology Institute, Colombo, Sri Lanka

Curcuma is an important genus used in Traditional Medicine in the world. Due to similar morphological characters and same *Sinhalese* vernacular names of *Curcuma* species, adulteration or substitution takes place. *C. albiflora* is endemic and threatened. *C. albiflora* and *C. oligantha* are unexplored species. These plants species have reported to have different chemical compositions. Therefore, accurate identification of the plant is important. The current study was conducted to understand the morphological and microscopic characters by analysing data using multivariate test on all the five-species available in Sri Lanka: *C. albiflora*, *C. aromatic*, *C. longa*, *C. oligantha*, and *C. zedoaria*. Whole plants of *Curcuma* species were collected from wet and intermediate zones of Sri Lanka. Voucher specimens of the plants were authenticated from National Herbarium, Peradeniya. Morphological characters of the 5 *Curcuma* species and microscopic characters of the 5 *Curcuma* species using 5 observations of each plant were analysed. The experiment was conducted as per WHO guidelines. Statistical tests were performed using Minitab 17. Multivariate tests were used to determine the complex relationship among variables by simple correspondence analysis. Analysis examined the relationships between the 25 observations and similar morphological and microscopic observations were identified from their positions. Statistical analysis of current study showed differentiation by morphological and microscopic characters of *Curcuma* species clustered into five different groups. Therefore, morphological and microscopic analysis is one of the strong methods to identify authentic raw materials in the market and like characters found within the same species can easily be identified by using multivariate test.

Keywords: *Multivariate, Curcuma, Albiflora, Oligantha, Adulteration*

Vulnerability of coastal communities and infrastructure by the impact of sea level rise in Maldives

K.W. Indika¹, E.M.S. Wijerathne², G. W. A. R. Fernando³, M. Ranagalage⁴, R.M.D. I Rathnayaka, S.S.L. Hettiarachchi⁵

¹*Faculty of Graduate Studies, University of Colombo, Sri Lanka*

²*School of Civil, Environmental and Mining Engineering, University of Western Australia,*

³*Department of Physics, Open University of Sri Lanka* ⁴*Department of Environmental Management, Rajarata University of Sri Lanka*

⁵*National Hydrographical Office, National Aquatics Resources Research and Development Agency*

⁶*Department of Civil Engineering, University of Moratuwa, Sri Lanka*

Sea level is the mean water level at which the oceans exist when averaged between high and low tides. It is associated with forcing agents in the sea caused by astronomical forces and hydrological forces. Sea level variation were observed based on time scale that variability occurs from hours to two decades such as tides, annual sea level variation, inter-annual and long term. The tide data was used to establish the tide station at Hulhule, Male, Maldives under its Meteorological Department. The *in-situ* gauge data, accessed through GLOSS, is an international programme conducted under the auspices of the JCOMM and satellite observations were used from AVISO as a different data source. Monthly mean sea level value was analysed for the long-term variation and 1-minute frequency data was used for the daily, monthly and annual variations. The astronomical impact removed residual sea level values were obtained by Harmonic analysing using Math lab software. The vulnerability of coastal belt was classified using SRTM 90m DEM originally produced by NASA with horizontal datum WGS84 and Vertical datum EGM96 using Arc Map 10.1. The signals obtained from coastal tide gauge and satellite were super positioned at same axis visualizing equality of the final results generated different data. The time series observations showed 5 ± 0.4 mm/year of higher sea level trend in Northern Indian Ocean, comparatively low sea level rising trend of 3.4 mm/year in Maldives' Male coast during more than 2 decades (July 1993 to October 2013) of satellite observation. The vulnerability was classified under 3 categories, highly, moderately and low, using elevation from the mean sea level in 1 m contour as a factor of vulnerability assessing. The resultant sea level trend was manifested as 80% of less than 1 meter of coastal land elevations submerge partially or almost within future hundreds of years, losing livelihoods of coastal community.

Keywords: *Sea Level, Climate Change, Vulnerable, Maldives*

Foreign direct investment and policy inconsistency in Nigeria (1970-2015)

M.Y. Kabara¹, K. Amirthalingham²

¹*Faculty of Graduate Studies, University of Colombo, Sri Lanka*

²*Department of Economics, University of Colombo, Sri Lanka*

Foreign Direct Investment is the dominant and the most reliable source of deficit financing to mostly developing and third world nations characterized by low investible fund since early 80s. This is set against the backdrop that investible funds generated from high saving are a necessary condition for economic growth. However, the all-encompassing determinant of FDI is the consistency in the economic policy, especially in the third world and developing economies like Nigeria. It is against that this study seeks to measure the effect of policy inconsistency on the flow of FDI in Nigeria from 1970 to 2015 using Annual and Cumulative Growth Rate approach. The study revealed that policy inconsistency within the period reviewed has a serious impact on the flow of FDI. In line with this, it was part of the recommendations that Nigerian governments at all levels should reduce the rate of policy change and volatility through the design and pursuance of long term economic and FDI related policies with a strong legislation that they must remain uninterrupted even with a change of political leadership.

Keywords: *Investment, Multinational cooperation, policy inconsistency*

Power balance in Indian Ocean region: Sri Lanka's foreign policy towards Indo-Sino Relations (2015-2017)

Hasith Kandaudahewa

Department of International Relations, University of Colombo, Sri Lanka

The proposed research focuses on the role of Sri Lanka in the balance of power in the Indian Ocean Region (IOR) in the present context. Geopolitical advancement of Sri Lanka has shaped its intrinsic value for centuries in the IOR and will continue to grow in the future. Naturally, it allows Sri Lanka to act as a central player who maintains the balance of power within the region. Meantime, global and economic power shifts point towards an increased significance of IOR due to Asian giants within the current something-more-akin-to multipolar system in power politics. Sri Lankan foreign policy related to IOR focuses on increasing the influence towards those regional and world powers; not only in present but also future. Since early republic days, Sri Lanka adopted a Non-aligned foreign policy (NAP), especially during the Cold War era, to face the systematic stimuli and to survive. This continued even in the post-Cold war era with application seen as peaks and valleys. Recently, Sri Lanka has shown an interest in balancing and bandwagoning Indo-Sino relations to navigate its interests within the international system by giving equal opportunities to both nations instead of antagonising one party. The fair access to 'Port City' projects and strategic alignment via economic agreements, for example, helped to reduce tension between the main parties. The main objectives of this paper are to evaluate the role of Sri Lanka in balancing power in the IOR with special focus on the Sri Lankan foreign policy trends during 2015-2017. Through that, an understanding of small state foreign policy trends and influence on the regional system is examined using the Neo-Classical Realism (NCR) perspective. The main research problem is centred on why and how Sri Lanka is endeavouring to balance and bandwagon policies among Indo-Sino at an equal level. The proposed study primarily adopts a deductive approach in the field of social science. It is driven by qualitative methods that obtain data from primary and secondary sources. Three specific research methods, process tracing, documental analysis (archival), and case study, was used.

Keywords: *Indian Ocean Region (IOR), China, India, Balancing and Bandwagoning*

**Impact of social aspects for the information security in internet banking:
Study among the employees of Seylan Bank in Sri Lanka**

P.M. Kotalawala

Faculty of Graduate Studies, University of Colombo, Sri Lanka

Internet Banking (IB) systems consist of the most lucrative information assets, which hackers look forward to steal by performing social engineering attacks. Social, Human, Organizational, and Cultural are the main aspects of information security (IS). Social engineering belongs to the social aspects of IS. Several banking frauds have been reported due to gaining of illegal access to lucrative information assets in commercial banks. This has become a social issue within the commercial banks in Sri Lanka and these intrusions are also known as social engineering attacks. Therefore, this study was conducted to understand the impact of social aspects on IS of IB at Seylan Bank (SBK) PLC. The study focused on 338 employees who use the IB facility. Quantitative research methodologies were facilitated by data collected using close-ended questionnaires. Aiming to investigate whether the social engineering threats have an impact on IS of the IB system in SBK, this study examined the relationship between the IS measures in banks and vulnerabilities in IB system in SBK. It then examined the most influential factor among social engineering threats and vulnerabilities as well as the awareness of the system with reference to the security of IB in SBK. The results reflected that social engineering threats and vulnerabilities of IB have a significant and negative relationship with IS of IB. Awareness of social engineering has a significant positive relationship with the IS of IB system. Furthermore, if the bank increases the IS measures in the IB service, then social engineering threats and vulnerabilities of IB could be reduced. Moreover, improvements in the awareness of social engineering increases the security of IB. Further analysis showed that awareness of social engineering can be explained as the most influential factor for the IS of IB. This was more significant than vulnerabilities and social engineering threats. Therefore, awareness of the social engineering is the key to protect information assets from the social engineering attacks.

Keywords: *Social Engineering, Information Security, Internet Banking, Awareness, Vulnerabilities, Threats*

Food security/insecurity and policy responses in Sri Lanka: A review of food security indices

P.M.P. Anura Kumara

Faculty of Graduate Studies, University of Colombo, Sri Lanka

The research is based on a review of policy responding measures on food insecurity in Sri Lanka. The food security considered essential to fulfill the provision of food for an active and healthy life for all people in a territory (FAO 1996). Because of this, this research looks at “Why does inadequate food security continue to be a policy challenge, despite the government responses the food insecurity?” as it would be an issue for Sri Lanka. The global warming leads to environmental change and then it impacts on the biodiversity. Human activities had led to unsustainable returns has in turn resulted in the changes to the environment and global warming (Ingram and Brklacich 2002). By the year 2030, Sri Lanka has to achieve and fulfill the Sustainable Development Goals (SDGs) in the context of the World Agenda of 2015 (UNO 2016). The problem of reaching these targets, particularly in relation to nutritional status of children and women, is difficult for Sri Lanka. The research study is based on qualitative data of households to calculate numerical indicators which are commonly derived in many countries. These indices play a very important role as analytical tools. For the calculation, existing data or timely collected data have been used. Those are used to examine the achievement of goals through given targets using indicators. The indices relevant to food security sector study (Vhurumuku 2014) are used here.

The present food policies are evaluated in terms of their direct, indirect or intermediate contribution; as well as in terms of their long-term, short-term or medium-term impact in accordance of the feature they address. The United Nations Children's Fund has suggested a ‘project cycle management’ in food and nutrition programmes to improve the efficiency and effectiveness. It is very useful to follow this to get benefits of the government’s programs (Gross, et al. 2000). Finally, this study uses the targeted indices, relevant to food security sector, examine the most suitable, efficient and effective manner to reach the SDGs.

Keywords: *Food Insecurity, Food Security Indices*

Influence of Social Networking Sites (SNS) on Diploma students taking Animal Husbandry: A case study in Sri Lanka School of Animal Husbandry, Department of Animal Production & Health, Karandagolla, Kundasale

G.C.S. Kurugala

Faculty of Graduate Studies, University of Colombo, Sri Lanka

Social networking sites (SNS) are used to communicate with friends. There is an increasing trend among students of tertiary institutions towards SNS. The magnitude of the influence of SNS on students was the research problem. The objectives including looking into the type of SNS, how they are used, the influence on knowledge and peer groups influence. The survey method involved collecting data from a sample of eighty students between 20-22 years of age of both sex. These were selected randomly from all 3 mediums at a School by filling the distributed questioner. A set questionnaire was designed, pre-tested and was revised before use. Data was analysed using a statistical package to convey as percentage of the total population with regard to the magnitude of the influence of SNSs. Yahoo Messenger and Facebook Messenger more was popular (84%) than WhatsApp messenger (59%). The usage per day is one hour (68%) and >2 hours (25%). 100% mobile phones and 25% tabs were used to communicate in the three medium. Search for educational articles/ materials with self-package by 19%. SNSs to change their habits; by having more online friends; expressing ideas and feelings freely; improve the knowledge; and the way of study. The study timing affected (67%) and 61% agree as an effective tool. All use to share information to do homework while (53%) gather information than the actual class; (63%) find information on academic and career development; (58%) improve their marks. This study proves the preference on usage of SNSs by students can be used to acquire enjoyable learning activities after improvements.

Keywords: *Social Networking Sites, Facebook, Influence, Study Habits, Learning Tool*

Application of knowledge management concepts in international schools: a comparative study of three international schools in Colombo District

R.L. Kuruppu

Faculty of Graduate Studies, University of Colombo, Sri Lanka

World is moving fast towards a knowledge-based economy. Due to that, economies heavily depend on information and knowledge. This has become a major cause to consider knowledge management as a critical success factor for information-driven organisations. Knowledge management is explained as a method of bringing together different areas of information used in different platforms into a streamlined integrated platform to generate intelligence. This is important to international schools in Sri Lanka as service-oriented organizations in the education sector. Therefore, the question of how knowledge should be managed by enhancing positive factors and eliminating negative factors is an important concern. This research is aimed at studying the available practices for knowledge management and further to study a limited number of people, process and technology related influencing factors which affect in application of knowledge management concepts in the field of international school education in the context of Colombo, Sri Lanka. Leadership and strategy, technology and infrastructure, organisation culture and people skills related to knowledge management were considered, as those factors are more prominent in the selected cases. The ability to acquire, share, store, retrieve, and update knowledge and technical skills to manage knowledge were considered as 5 key ‘people competencies’ on applying knowledge management concepts as they are more relevant for the teachers as academics and for the students as learners. Furthermore, this research was conducted as a comparative study using three cases identified as A, B and C in the text, based on a random judgmental sampling. Conclusions were derived using qualitative and quantitative, primary and secondary data, used with the triangulation process of iterating through methods, theories and analysis. The results revealed that in both the personal factors such as strong people competencies and in the organisational factors such as technology and infrastructure, leadership and strategy and organisational culture are equally critical to be successful in managing knowledge. This was the perspective of the academic staff and students.

Keywords: *Information, Knowledge, Information Driven Organisation, Knowledge Management*

**The teacher, pedagogy, and target language use in the English as a Second
Language classroom in the Sammanthurai Education Zone:
An ecological perspective**

S. Rifa Mahroof

Faculty of Graduate Studies, University of Colombo, Sri Lanka

In Sri Lanka, English is taught as a compulsory second language in state schools from grade three to grade thirteen and there is heavy investment on teacher training to improve ESL learning opportunities. Despite the training given to teachers, there is lack of awareness and success in their instructional practice (Wijesekera, 2012). Several studies have found that the instructional methods used by teachers in the Sri Lankan school contexts provide inadequate TL input to improve communication skills (Karunaratne, 2003; Perera, 2001; Samaranayake, 2016). Drawing from Gibson (1979). Van Lier (2000) defines affordance as the opportunities for learning provided by a context in relation to the abilities of the learner. For Van Lier, it is not the amount of comprehensible input that is available, but “the opportunities for meaningful action that the situation affords” and “input” is replaced by “affordance” (p. 252). This study investigates how the teachers provide target language affordance during ESL instruction in Sammanthurai education zone. Using a qualitative case study research design, data was obtained from junior secondary ESL classes through classroom observation and interviewing over a period of three terms in 2016. The teacher interviews reveal that the teachers are unaware of the pedagogical changes brought about by the reforms. There was a pervasive use of L1 and classroom instruction was found to be text focused, exam oriented and teacher-centred which did not serve the communicative purpose of learning English. There was overwhelming consensus on the suitability of the present text books. It can be concluded that the instructional practice of the teachers did not provide opportunity for teachers and learners to use the TL. This creates the need for teachers to use a judicious amount of L1 to scaffold TL learning during ESL instruction.

Keywords: *Affordance, Target Language, Teacher Training, ESL Instruction, First Language*

Heavy metal levels in muscle tissues of selected Mud Crabs (*Scylla serrata*) from Negombo Estuary

B.R.C. Mendis¹, M.M.M. Najim², H.M.P. Kithsiri³

¹Faculty of Graduate Studies, University of Colombo, Sri Lanka

²South Eastern University of Sri Lanka Oluvil, Sri Lanka

³National Aquatic Resources Research and Development Agency, Colombo, Sri Lanka.

Scylla serrata is one of the estuarine aquatic crustacean species that has a high demand in the local market. They are abundant in estuaries of the northern, eastern and western region of Sri Lanka. The burrowing nature of the organism brings it into constant contact with pollutants that build up in the sediments. The objective of this study was to determine the heavy metal levels, specifically lead (Pb), mercury (Hg), copper (Cu), zinc (Zn) and cadmium (Cd) in the edible muscle tissues in mud crabs. Samplings at selected sites were done during the one-year study period from January to December 2016. For this study, crab samples were collected from 4 main locations of the Negombo estuary; namely Pitipana, Munnakkaraya, Duwa, and Katunayake sites. The amount of the five selected heavy metals present in the muscle tissue of sampled crabs was determined using standard analytical methods. The results revealed that the average concentration (mgkg^{-1}) of the five selected heavy metals, Pb, Hg, Cu, Zn and Cd in crab tissues ranged from 0.04 ± 0.02 to 0.071 ± 0.07 ; 0.02 ± 0.01 to 0.34 ± 0.05 ; 0.36 ± 0.08 to 0.38 ± 0.08 ; 0.03 ± 0.01 to 3.95 ± 1.95 and 0.21 ± 0.01 to 0.29 ± 0.03 respectively. The results reveal that mean concentration of Cu and Cd levels in crab tissues have exceeded the EU permissible threshold limits. Further, the levels of heavy metals in crab tissue were comparatively high in Munnakkaraya and Duwa area located in the northern region of the estuary that receives a high discharge of industrial effluents and domestic solid waste.

Keywords: Heavy Metal, Human Consumption, Industrial Effluents, Mud Crabs

Challenges in implementation of Sustainable Consumption and Production (SCP) indicators in Sri Lanka

C.S.N. Mohottige

Faculty of Graduate Studies, University of Colombo, Sri Lanka

The absence of a purposely developed Sustainable Consumption and Production (SCP) indicator system has created problems in the implementation of SCP related programmes in Sri Lanka. Analysis of the existing challenges and assessing the opportunities to upgrade the implementation of SCP-related indicators in selected sectors is the objective of the study. A questionnaire survey was conducted with 16 experts and responsible officers to analyse the challenges. Intensities of issues were analysed using one sample two-tailed Student t test at 95% confidence interval. Opportunities were identified through a literature review and through interviews of expertise and responsible officers on SCP. The study found 300 SCP-related indicators in selected sectors and 55 issues related to SCP-related indicators. Issues were categorized into 9 measuring variability and technology, financial, administrative, communication, technical issues and barriers for scientific studies are challenging measuring variability. Wide area to collect data; obsolete and inadequate IT facilities; inadequate finance for data collection, capacity building, training, technology improvement, expertise and gap analysis; inappropriate priority in financial allocation; inadequate staff in regional institutes; absence of efficient evaluation procedure; inadequate number of responsible officers; poorly identified responsibilities by the main institutions; inefficiency of staff; unsatisfactory monitoring, coordination, unsatisfactory responses and communication facilities in regional institutions; poor network; poor knowledge updates, training and capacity building; lack of trainings; inappropriate priority for indicator implementation; inadequate facilities; fewer studies carried out and inadequate facilities for carrying out studies are the significant issues. The study found opportunities in institution, national, regional and global level could be used to develop or upgrade SCP indicator system in Sri Lanka.

Keywords: *Sustainable Consumption and Production, Resource Efficiency, Indicators, SCP Indicators, SCP Related Indicators*

Importance of participatory decision making in local government of Sri Lanka

W.K. Moramudali

Faculty of Graduate Studies, University of Colombo, Sri Lanka

Conventionally, the public sector has been following the top-down approach in decision making. Along with the New Public Management (NPM) reforms governments have been adopting private sector strategies to address democratic values such as bottom-up and participatory decision making. The objectives of this study were to identify the importance of citizen participation in public decision making and the citizens' contribution in the process of decision making in the local government of Sri Lanka. Practices of other countries were studied to highlight the importance of incorporating citizens' inputs in public decision making. This study was carried out in local government institutions in the Western Province. A qualitative approach was employed in this study. Eight unstructured interviews were conducted with frontline and middle level employees to identify the ongoing citizen participation events. Further interviews were conducted with community leaders and religious leaders. Citizen participation activities can be categorized into political participation and administrative participation. Citizens are highly engaged in political participation activities such as rallies, demonstrations, and strikes. The findings of this study revealed that the local governments have limited methods such as formal meetings, questionnaires, and citizen councils to get citizens involved in the process of decision making. The findings also indicated that the bureaucrats in local governments have less training and experience in dealing with citizen participation activities. Most of the government reports and minutes are not available for public scrutiny. Both government and citizens have less interest in participatory decision making. Citizens have limited awareness of public programmes and are not interested in raising their voice for their needs, since they think that their input will never be used.

Keywords: *Citizens, Public Sector, Local Government, Participatory Decision Making, Bureaucracy*

Association between family factors, parental stress, executive functions and emotional-behavioural regulation among pre-school children in the Colombo District

C. M. Munasinghe¹, P. K. S. Godamunne²

¹*Faculty of Graduate Studies, University of Colombo, Sri Lanka.*

²*Faculty of Medicine, University of Kelaniya, Sri Lanka*

Executive Function (EF) refers to an amalgamation of multiple higher level cognitive-skills such as planning, organizing, cognitive flexibility, inhibition and working memory where pre-school years have been identified as a crucial period in the emergence and development of EF. Core executive functions are significant for pre-school children as they are essential for problem solving, reasoning and planning. Identifying the earliest roots of executive dysfunctions that manifest as disorders later in childhood or adolescence is important to provide the necessary support. Limited research has been carried out on the family factors that affect the development of EF's in children and are mostly restricted to English speaking populations. The present study aims to assess the association between socioeconomic status, parental stress, cognitive development and emotional-behavioural regulation among pre-school children. The first phase of the study focused on developing tools to assess core executive functions, working memory, cognitive flexibility and inhibition where the reliability and validity of them are assessed. The second phase of the study focused on identifying the link between parental stress, socioeconomic status, EFs and emotional-behavioural regulation among pre-school children. The findings of this study is expected highlight the importance of identification of children with deficits on EFs early and in providing them with necessary support. The study is also expected to provide a better understanding of the difficulties children with poor executive functions may have in relation to their behaviour and provide them with necessary support to overcome the difficulties they have. It is also hoped that the findings from this study will highlight the impact of social and parental factors on the development of EFs in children and guide the attention of the government, non-government organizations, health practitioners, policy makers, parents, teachers and community towards the importance of altering underlying social factors for betterment of the cognitive and psychological development of children in Sri Lanka.

Keywords: *Executive Functions; Parental Stress; Socioeconomic Status; Pre-Schoolers; Emotional-Behavioural Regulation*

Life histories and experiences of lesbian, gay and bisexual persons in colombo: An exploratory study

S.K. Munasinghe¹, J. Marecek², P. Godamunne³

¹*Faculty of Graduate Studies, University of Colombo, Sri Lanka.*

²*Department of Psychology; Swarthmore College Swarthmore College, USA*

³*Department of Medical Education, Faculty of Medicine, University of Kelaniya, Sri Lanka*

Despite an increase in social acceptance similar the South Asian context, homosexual conduct is criminalized in Sri Lanka and lesbian, gay and bisexual (LGB) persons are targets of widespread systemic and personal oppression and violence. Social marginalization makes key services like education, legal protection and healthcare largely inaccessible. Compromised mental health is common in this cohort while glimpses of resilience are also seen. While LGB adult's experiences have been sporadically studied in Sri Lanka, there is no systematic empirical literature on the influence of adolescent sexual experiences on adulthood, the function of resilience, how specific psychosocial factors shape adult wellbeing, and whether coming out in adolescence shapes adult resilience. Thus, a narrative life history interview and analysis design is proposed to fulfill the study's overarching objective of gaining insight into the nuances of the participants' contextually dependent lived experiences. Narrative interviews engage participants into the natural process of storytelling and is therefore a nonthreatening method of addressing sensitive topics such as sexual experiences, discrimination and the process of coming out. Following ethical approval, this study aims to fill this gap through the in-depth life narratives of 30 LGB adults fluent in English and Sinhalese of any ethnicity. Narratives will be analyzed for overall meaning and thematic content to address the objectives of exploring the influence of adolescent sexual experiences and the coming out process on adulthood, the function of resilience in adulthood, the unique psychosocial factors that shape stress and coping, and finally, and finally how they frame and foresee their future. Accordingly, a pathway to inform multisectoral collaboration towards culturally sensitive community based mental health and sexual education programs and avenues for future research aimed at increasing visibility and access to mental health services for LGB adults in urban Colombo are anticipated.

Keywords: *LGB, Identity Development, Coming Out, Resilience, Life History Narratives*

The adoption of cloud-based E-Learning Systems

A.S.T. Nishadi

Faculty of Graduate Studies, University of Colombo, Sri Lanka

Cloud computing is considered an emerging technology for hosting and delivering services over the internet. Therefore, there is a high adaptability to move with cloud based systems. The research was conducted to ascertain the adoption of cloud based e-learning in the private sector higher education institutions. Sixteen institutions approved by UGC and BOI were selected in Colombo district. The theoretical models of TOE, TAM and DOI were used to build the conceptual model. Sixteen hypotheses were tested under 4 different contexts: (i) technological (security, compatibility, complexity, reliability and bandwidth), (ii) organizational (institutional size, financial constraints, technology readiness, top management support and resource availability), (iii) environmental (legal aspect, service provider support and relative advantage) and (iv) user behavioural (learner adaptability, skills of IT staff and motivation of academic people). A mixed method approach consisting of quantitative and qualitative was used to gain indepth views. There were 177 total respondent participants, representing 88 learners, 60 academics, 16 IT management and also 13 from management level in the quantitative phase. Interviews were used in qualitative phase in judgmental or purposively selected of 45 respondents (16 academics, 16 IT management people and also 13 respondents from top management) to gain in depth background knowledge. The statistical techniques of the Spearman's correlation and binary logistics regression analysis rendered F statistics and R² values to test the predictive models. The findings of 16 hypotheses explores the significance of those variables which effect on the adoption of cloud based e-learning. There were 8 hypothesis identified as significant predictors and eight other hypotheses were not statistically predicated. Among the accepted significant predicators compatibility, bandwidth, top management support and motivation of academics were positively associated with the adoption while reliability, size, financial constraints and resource availability were negatively associated. Finally, the study has further identified the qualitative findings with regard to the four aspects of the study.

Keywords: *Cloud Computing, E-Learning, Architecture, Virtualization, On-Demand Network*

Challenges in ESD implementation through junior secondary Science in Sri Lanka

A. Nithlavarnan¹, G.I.C. Gunawardana², K. Sinnathamby³
¹*Faculty of Graduate Studies, University of Colombo, Sri Lanka*
²*Open University of Sri Lanka, Nawala, Sri Lanka*
³*Faculty of Graduate Studies, University of Jaffna, Sri Lanka*

Education for Sustainable Development (ESD) is an approach to teaching and learning based on the ideals and principles that underlie sustainability. This study attempts to reveal the constraints and strategies for addressing these challenges in the ESD implementation process through the subject of Science at junior secondary level. Principals and 136 Science teachers from 58 secondary schools in the Northern Province of Sri Lanka participated as the survey sample.

The results illustrate that most of the schools are not only struggling with student related issues but that the schools have to also tackle other issues including issues related to Science curriculum and resources. Problems faced by students, such as low basic literacy, poor attendance at school, low interest in studying at school and at home, disciplinary problems and inadequate awareness about the importance of Science among the students and parents were noted. Science teachers identified the problems related to curriculum such as the examination-oriented nature of the curriculum, the load of content, inappropriate pedagogy, subjective and in-depth contents, inadequate time for some competencies and the reality of the competency levels, some concepts being difficult to understand and results of prescribed 'activities' not being mentioned in the Science text books. There are also several problems related to schools such as inadequacy of resources in the Science laboratory, shortage of well-trained teachers also identified. Science teachers and school principals proposed several suggestions in the survey for improving junior secondary science curriculum, pedagogy, resources and school community.

Keywords: *Education for Sustainable Development, Challenges, Science, Junior Secondary Level, Sri Lanka*

Strategic implications of the Concept of “Mandala”’: A case study of ASEAN

S. C. Padmakumara

Department of International Relations, University of Colombo, Sri Lanka

This research paper conceptually reflects on the historical notion of “Mandala” in pre-colonial Southeast Asia and explores its strategic implications for understanding contemporary regional strategic practices. Particularly, it argues that strategic considerations coming from “Mandala” Systems provide useful insights to analyse how modern Southeast Asia within its institutional framework stipulates regional strategies. Generally, the system of “Mandala” can be defined as a combination of overlapping “circles of kings” in which in each of these “Mandalas”, one king is identified with the divine and universal authority (Wolters, 1999, p.27). From a strategic point-of-view, under the “Mandala” management, subordinated rulers were treated with equal courtesy provided that they assisted the overlord in warfare and were not suspected for seeking protection elsewhere (Wolters, 1999, p.30). By using this strategic backdrop, the paper makes attempts to examine two major objectives. Firstly, it aims to offer a descriptive account on Southeast Asian “Mandala” systems as a historical model for understanding regional strategic practices. Secondly, it intends to focus on how such strategic lessons can be transferred to the milieu of contemporary regional strategic frameworks by particularly adopting the case study of ASEAN. Methodologically, this paper adopts a qualitative approach and limits its analysis to spatial and operational dimensions of the “Mandala” systems. While drawing theoretical insights from Constructive perspective, the study reveals that strategic properties of Southeast Asian “Mandala” systems are largely ideationally shaped and are reasonably fitting for a model of regional strategic framework which is more of a normative engagement.

Keywords: “Mandala” Systems, ASEAN, Regional Strategies, Constructivism

‘Challenging the Elo Rating’: The harm in comparing the incomparable transitional justice process of post-war Sri Lanka

Maneesha S. Wanasinghe - Pasqual

Department of International Relations, University of Colombo, Sri Lanka

Transitional Justice (TJ) combines criminal, restorative, and social justice with accountability, truth, recovery, reconciliation, institutional reform and reparation. TJ became an approach to post-war recovery since World War II. However, there have been a number of iterations of TJ since then. Yet, tracking the progress within a specific country is difficult since the concept of TJ and the injustices faced within a specified conflict are complex. This paper argues that research into the Sri Lankan TJ context has focused on what has not been done rather than what needs to be done in terms of the details. While there is cautious praise for concrete policies and established mechanisms, the criticism has continued on the ‘justice’ and ‘accountability’ elements of TJ. Yet, the details on how to achieve this in specific areas such as the criminal justice system (CJS) has not been examined. The CJS requires building the capacity of law professionals, including lawyers, police, and even the military in areas pertaining to ‘accountability’. There is a lacuna of baseline data, information on knowledge of forensic investigations of cold cases, victim and witness protection, and Standard Operational Procedure (SOP) manuals. Nor has there been a systemic effort to enhance the capacity and networking of those within the CJS and those representing the TJ mechanisms through dissemination of knowledge, training and designing SOP manuals. The paper, utilizing primary and secondary data, concludes that research into the neglected areas have to be conducted to highlight the uniqueness of the Sri Lankan situation. This in turn will prevent the country constantly being compared to incomparable cases, which is a hindrance to the TJ process.

Keywords: *Transitional Justice, Criminal Justice System, Sri Lanka*

**Social perceptions of caste discrimination:
reference to university students in Sri Lanka**

M.J.D. Peiris

Faculty of Graduate Studies, University of Colombo, Sri Lanka

The social structure of Sri Lanka has notably changed with the centuries and it is difficult to adequately define all the caste systems in Sri Lanka. The history of the caste system in Sri Lanka is unclear since there is little historical information and numerous research carried out into the subject have been criticized for being biased. This study will prove to be beneficial as it identifies whether social activities are still dependent on the caste among the university students. This study problem is “how has the caste systems been maintained in social splits among university students and how has it manifested in their day-to-day life activities”? The main objective of this paper is to examine the change of perceptions of social class systems among modern university students. In addition, the study intends to identify the specific activity they have been unchanged when thinking of a lower caste. This study uses both primary and secondary data. Primary data involved using data from a pilot survey gathered from 50 respondents from both genders at the University of Kelaniya. This study revealed that there is an extended awareness of what a “high” and “low” castes in the society among the students. However, the historical phenomena of the caste system are gradually reducing among the emerging youth generation. There appears to be no limitations for lower castes when it comes to relationships and building connections. When the caste issues is concerned with marriage proposals, the study proposes to highlight families who married outside of their own caste. The factors for success in mixed caste marriages emphasize that rather than caste, it was economic, cooperation, sincerity that held the relationship together. This research concluded the necessity of educating children from the initial point of education in order to minimize the prejudices and the perceptions of the caste discernment among students.

Keywords: *Caste, University Students, Perceptions, Social, Sri Lanka*

**Military occupation of private lands and its impact on land rights:
A case study of Valikamam North, Jaffna**

T. Ratnavel

Faculty of Graduate Studies, University of Colombo, Sri Lanka

Land occupation by Military is one of the most serious issues faced by the people in Valikamam North which could be termed as a serious violation of Human Rights. Parts of Valikamam North were declared as High Security Zone in 1990 and the legal land owners were forcibly evicted from their residences. At present, 3rd generation continue to live in camps. Article 17 of the UDHR states “Everyone has the right to own property and no one shall be arbitrarily deprived of his property”. Constitution of Sri Lanka does not recognize the right to own lands as an expressed fundamental right. However, an acquisition by the State may be challenged on the ground of arbitrary action postulated by the concept of the Rule of Law, flowing from the right to equality under Article 12 (1) of the Constitution. This research explores the importance of land from the point of view of a person from Valikamam North, with a focus on the difficulties faced by them. Data was collected through a questionnaire from Mallakam Refugee Camp with a sample of 40 victims of land occupation. Interviews were done with Government Officials representing Ministries and key Informants. Key findings of the research have drawn attention to the problems faced by those in the camps, including freedom of movement, security, health, livelihood, cultural activities and other aspects of their lives. They have been ostracized as “camp dwellers”. At present they are engaged in daily labour work without doing traditional occupations such as agriculture and fisheries. The ownership of land is linked with the community’s identity and they are emphatic that they would like to go back to their native houses before they die. The conclusion is that the government should take necessary action to return all private land in Valikamam North as a way to reconciliation. The Government must appoint a Commission for Reparation and Reconciliation in Sri Lanka and mandate the commission to implement the recommendations of the LLRC on returning lands and resettlement. The military has released some parts of the private lands in the area but this land was not in a habitable condition. The affected Valikamam North people hope for the day to reinvent their lives after three generations of the nomadic pattern of existence and then hand over a stable and bright future to their fourth generation.

Keywords: *Land Occupation, Human Rights, Land Rights*

Sizing of small-scale hydroelectric machinery for optimum use of water

Ranil Senaratna¹, Devini Senaratna²

¹*Faculty of Graduate Studies, University of Colombo, Sri Lanka*

²*Machine Learning Consultant, Roam Analytics Incorporated, USA*

In the selection of turbine-generator (TG) sets for small hydropower generation facilities, reliability, safety and cost govern decision making. However, selecting capacities of TGs have hitherto been based on spare parts inventory cost rather than optimum use of water. This paper details research carried out to optimize the latter, which implies maximizing the electrical energy generated (kWh) for a given water flow regime. The research first examined currently used facilities management techniques. This was found to be irrelevant to the task at hand. It was also observed that engineering considerations are givens and therefore need not be specifically analysed. A hypothetical site, with a water flow regime representative of small hydropower sites found in Sri Lanka, was analysed to calculate the capacities of TG sets to maximize kWh generated. Analysis of standard TG sizes showed that there were 21 possible combinations, and the PuLP library in “Python” was used along with problem specific code to give the TG set sizes that maximize kWh generated. These were found to be 200 kW, 400 kW and 1000 kW. A spread sheet was designed to determine the quantum of water that should be released through each TG set in real-time to maximize electricity (kWh) generated. This information can be programmed into the power plant computer mounted on the electrical panel of most small-scale electricity generating plants, to optimally release water into the turbines. The framework developed shows how the hydropower resources of a site, where the water flow particulars are known or can be measured, can be optimally exploited to generate electricity for the national electricity grid. The same framework can also be used – with minor modifications - to minimize the use of diesel fuel in standby electricity generators in large industrial or commercial complexes, when more than one such generator are used.

Keywords: *Operations Management, Facilities Management, Small Hydropower Systems, Water Conservation, Optimization*

Human threats to the sea turtles and their nesting at Thalalla beach, Matara: A case study

M.A.F. Shazna

Faculty of Graduate Studies, University of Colombo, Sri Lanka

Sea Turtles (STs) are globally considered as threatened species as six out of the seven species are listed as threatened in the IUCN Red list of threatened species (Miller, 2004). Most of the Sea Turtle nesting beaches in Sri Lanka can be found in the Southern, South Western and the South-Eastern coasts and the threats to the STs are very high in these regions. In Thalalla, killing of STs and collecting eggs are common. Conservation of STs, their nesting beaches and protection of eggs are vital importance. The objective of this study was to recognize the human threats to the STs and their nesting beach in Thalalla. As per the research methods, purposive sampling has been used as one of the main techniques to collect data. Among the villagers, 30 were selected for a questionnaire survey while four focus groups discussions; and two key informant interviews were conducted during the months of April and December in 2016. Besides this, direct observation was undertaken. According to the survey, Leatherback (6%), Green (18%), Hawks Bills (27%) and Olive Ridley (49%) STs have been visiting Thalalla beach for nesting from December to April, at night between 11.00 pm and 1.00 am. Around 65% of them make their visit during December and 9% during the month of October. Stealing of STs' eggs and hatchlings is one of the major threats (64%) in Thalalla beach. Besides, killing of STs intentionally for consumption as food mainly by locals (12%), for making handicrafts from their shells (6%). Other threats are from accidentally getting caught in the nets and hooks laid to trap fish (18%). Moreover, tourism related activities, coastal pollution and destruction of coastal vegetation also disturb STs and their coastal habitat. However, the adaptation of a proper management strategy is essential to protect the ST and their coastal habitat, especially at Thalalla nesting beach.

Keywords: *Sea Turtles, Hatchlings, Human Threats, Nesting Beach*

**Studies in local resource and hybrid-peacebuilding post-conflict in Sri Lanka:
from the perspective of international actor and local actor**

Ryo Uchida

Faculty of Graduate Studies, University of Colombo, Sri Lanka

In the post-Cold War era, the international society has intervened in the domestic issues impacting the state sovereignty. They carried out the peacebuilding activities to rebuild the peaceful foundation and prevent the relapse of conflict in conflict affected areas. In particular, United Nations (UN) and leading countries have promoted liberal peacebuilding based on international values, such as democracy, market-economy and rule of law. However, these values are likely to lead to a lot of abrupt fluctuations to the area impoverished by conflict and cause the recurrence of conflict if they introduce those values to the post-conflict area. Under this current situation, the theory of peacebuilding has been actively discussed in the academic field. This research focuses on the hybrid theory of peacebuilding and examines how the hybrid phenomenon is concretely generated and why hybrid phenomenon occurred in the process of peacebuilding in the case of Sri Lanka. This research would attempt to criticize the conventional hybrid theory of peacebuilding from the perspective of fluctuations which can be brought on the process of peacebuilding. One aspect is the fluctuation of international values which were brought from outside the conflict affected area by peacebuilding activities and another aspect is the fluctuation that local resources traditionally existing inside of conflict affected areas have been revised on the process of peacebuilding. To concretely describe the hybrid phenomenon on the process of peacebuilding, this research focuses on the Grama Niladhari (GN) as a local actor in Sri Lanka and United Nations Development Program (UNDP) as an international actor. It examines how the GN system, which is rooted in indigenous and customary normative values in Sri Lanka, has been modified and swayed by the meeting with UNDP. These findings can demonstrate a significant model of hybrid theory of peacebuilding.

Keywords: *Peacebuilding, Liberal Peacebuilding, Hybridity, Local Resource*

Economic impact of climate change on paddy yield in Kurunegala District

V. Upananda ¹, S.A. Norbert ²

¹*Faculty of Graduate Studies, University of Colombo*

²*Department of Geography, University of Colombo*

This study assesses the economic impact of climate change on paddy production in the Kurunegala District using the theory of Ricardian model. There were three objectives: to analyse the relationship between farmers' net revenue and rainfall and temperature; to analyse the past trends of climatic variables and paddy production; and to capture farmers' perceptions of climate variability and adaptation strategies of farmers in response to these changes. Simple random sampling method was used to select 89 farmers. Primary data was collected through a questionnaire. The secondary data was collected from the Departments of Meteorology, Census and Statistics and Agriculture. To capture the 'normal climate' scenario, data on temperature, rainfall, and net revenue covered the period of 30 years from 1986 to 2015. Annual net and gross revenue per hectare of paddy was regressed on climatic variables. Several econometric methods such as multiple linear regressions, time series analysis, inter quartile range and descriptive statistics were used for the analysis. The result of this study implies that historical climate change has generally been beneficial to the agriculture sector as a whole. The impact of historical mean annual temperature and rainfall on average land value (net revenue) is positive. Results suggest that agriculture net income has both linear and nonlinear relationship with the climatic variables. Although there is an increase of temperature and rainfall, the yield of paddy and the net revenue still increase concomitantly, thereby implying the farmers' continuous adaptation. Factors affecting the farmers' perceptions and choice of adaptation methods suggests that the farmers appear to be well aware of climate change, with only 1.2% of farmers seemingly not actively undertaking adaptation measures to counteract climate change. Furthermore, respondents do not hold strong opinions on the impact of climate change.

Keywords: *Climate Change, Economic Impact, Temperature, Rainfall, Kurunegala District*

Teaching with Technology and activity theory in tertiary education institutes: A literature review

P.A. Warusavitarana

Faculty of Graduate Studies, University of Colombo, Sri Lanka

Technology plays a significant role in the twenty-first century in many sectors while giving more prominence to the education sector. Teaching with Technology (TwT) is one of the key changes that many tertiary education institutions are investing to offer a better learner experience. TwT provides a wide range of benefits to learners especially enabling convenience, portability and flexibility in learning. Teaching with Technology stretches to a wide range, starting from the use of multimedia in teaching up to virtual lectures. Teaching with Technology makes learning interesting as it blends the notion of mobility where a learner has the freedom of deciding what, when, and where they want to learn. The learner is neither constrained to prescribed materials nor confined to a physical classroom, or even a particular time. Activity Theory (AT) is defined as a cross-disciplinary framework for studying different forms of human practices and serves as a tool to investigate educational technology applications. Activity Theory has been one of the best theories used in academia by researchers to investigate ‘learners’. It explains how learning, cognition, and technology are influenced by the outcome of a triangular framework which has subject, object and instruments. The Activity Theory focuses on the whole systems of activity. Rather than considering individuals in isolation, it locates individuals within the activity system(s) in which they are involved. Activity Theory has similarly been applied in the area of implementation of innovation in education. Further, Activity Theory has been used to study the design and implementation of learning supported by technology. Finally, the research notes that Activity Theory could be integrated into new technologies in education which move from “usability” to “sociability”. The article concludes with the argument that technology plays a vital role in tertiary educational institutes and Activity Theory has been a useful tool in Teaching with Technology.

Keywords: *Teaching, Learning, Technology, Tertiary Education, Activity Theory*

Time series analysis of Tuberculosis: New cases in the Western Province, Sri Lanka

W.M.D.H. Weerakoon¹, W.M.K.P. Weerakoon², N.R. Abeynayake³

¹*Postgraduate Institute Of Agriculture, University of Peradeniya, Sri Lanka*

²*Postgraduate Institute of Medicine, University of Colombo, Sri Lanka*

³*Faculty of Agriculture and Plantation Management, Wayamba University of Sri Lanka*

Tuberculosis (TB) is an airborne infectious disease which has become the leading cause of death due to a single infectious agent among adults in the world. Over 75% of the deaths due to TB come from the age group of 15-54 years. In Sri Lanka, nearly 17,000 people (89/100,000) are estimated to have TB and around 11,000 new cases (60/100,000) are being reported annually. The Western Province recorded 42.7% of the total number of TB patients. This study was designed to find out the trend regarding the spread of TB and to forecast new incidence of TB cases in the Western Province. Secondary data of quarterly TB new cases of Western Province for the years 2005 to 2016 was obtained from the National Programme for Tuberculosis Control and Chest Diseases (NPTCCD). Time series analysis was done using Minitab 17 statistical software and error ARIMA (Autoregressive Integrated Moving Average) model/model of regression with ARIMA errors was used. In trend analysis, quadratic model $Y_t = 713.2 + 9.92 t - 0.1278 t^2$ was found as the best fitted model with the lowest MAPE of 4.66. Modeling procedure was followed according to Pankratz, 1991 for the residuals (first 38 points). SARIMA (0,1,1) (0,1,1)₄ was found as the model with the best parameters and 10 residual points ahead were forecasted. Using forecasted and original residual values, model forecasting accuracy was assessed. SARIMA (0,1,1) (0,1,1)₄ was used to forecast residuals for the four quarters of 2017. Final calculated TB new cases for the time indexes 49, 50, 51 and 52 were 869, 883, 911 and 857 accordingly. TB incidence showed an increasing trend and a significant seasonality. Further studies are required to find out the underlying factors for the presence of seasonality in TB new cases in Western Province. This study could be expanded to include the entire population of Sri Lanka.

Keywords: *Tuberculosis, Time Series, SARIMA, Forecasting, Regression*

Domestic violence against women in Sri Lanka: Inter professional collaboration and practice

M.S. Wijesekara¹, D. Abeysinghe²

¹*Faculty of Graduate Studies, University of Colombo, Sri Lanka*

²*Departments of Sociology, University of Colombo, Sri Lanka*

Domestic Violence (DV) perpetrated by male partners on women has been perceived as a silent suffering within the family. Although adequate laws and legislations have been formed, there does not appear to be a decrease in domestic violence against women in Sri Lanka. The aim of this paper is to evaluate research evidences on DV in order to develop appropriate intervention strategies for Sri Lankan women who have been victimized by Domestic Violence. The paper reviewed recently published and gray literature on DV against women in Sri Lanka in providing evidence that would be useful for developing intervention strategies. A total of 20 recent articles were reviewed based on its focus via a thematic analysis. The findings focused on themes such as Individual and family factors; Community factors; Service related factors; and Responses of different professionals towards DV against women. Studies have shown that 60% to 80% of women remained with their abusive husband and 38% of women who experienced violence and left the home, but they did not consider leaving as a permanent solution. Pregnant women undergoing violence were at high risk. Some studies highlighted the interpersonal, societal and community factors of DV. But their multidimensional relationship and gendered perception of DV have not been broadly studied. Victims found help from family networks, neighbours, friends and community leaders than formal support agencies. Even though healthcare professionals can play a significant role in providing services, little research has focused on the health sector responses to DV. Several organizations have responded to DV by providing legal aid, counselling, shelters and referral services and medical and material assistance to survivors. In conclusion, socio-culturally appropriate effective intervention services and multi-sectorial effort are needed to prevent, diagnose, and follow up of women survivors to overcome this problem.

Keywords: *Domestic Violence, Inter Professional Collaboration, Practice, Review*

FACULTY OF LAW



Legal Research for Development: Challenges and Opportunities

25 November 2017

**MESSAGE FROM THE DEAN,
FACULTY OF LAW**

Ms. W. Indira Nanayakkara



It is with great pleasure and pride that I provide this message on the occasion of the Annual Research Symposium of the University of Colombo, which is perhaps the most important event that showcases the research capabilities of its academics.

Research is the driving force behind innovation, and innovation is required in every field of human endeavour. Universities have been charged with the important task of innovating in areas where social needs are urgent. The Faculty of Law, for example, prioritises research in areas where legal responses are required to ensure the smooth functioning of the society and the facilitation of human relationships. To this end, our staff researches into areas that are becoming increasingly complex and areas that demand a multi-disciplinary approach. The Annual Research Symposium gives our academics the opportunity to test their theories and improve on them before disseminating their findings to the wider public.

I congratulate all those who were involved in this event and I wish the presenters, discussants and participants a fruitful time at their respective sessions. I am confident that the research findings generated through this symposium would be used to enhance the human potential of our nation, and enrich the lives of its people.

FACULTY OF LAW

PROGRAMME

25 November 2017

- 8.30 am Registration
- 9.00 am Lighting the Oil Lamp
- 9.05 am Video Presentation
- 9.15 am Welcome Address, Ms. Indira Nanayakkara,
Dean, Faculty of Law
- 9.20 am Address by Senior Professor Lakshman Dissanayake,
Vice-Chancellor, University of Colombo
- 9.30 am Introduction of the Keynote Speaker:
Dr. Shanthi Segarajasingham
- 9.40 am Keynote Speech: “Legal Research for development:
Challenges and Opportunities”
Mr. K. Kanag-Isvaran, President's Counsel
- 10.25 am Vote of Thanks, by Professor Sharya Scharenguivel
Professor of Law
- 10.30 am Tea and break for Departmental Sessions

Introduction to the Keynote Speaker

Mr. K. Kanag-Isvaran

President's Counsel, Supreme Court of Sri Lanka



Mr. Kanag-Isvaran, LLB (University of London), Barrister of Lincoln's Inn, Advocate of the Supreme Court of Sri Lanka and President's Counsel, is well-versed in Private, Commercial, Public and International Law, having engaged in these fields for more than 50 years. He has been a Visiting Lecturer, examiner, moderator and supervisor at the Faculty of Law, University of Colombo, at undergraduate and postgraduate levels, and at the Sri Lanka Law College. He has reviewed many abstracts and articles and has delivered keynote addresses at many seminars, including at the Faculty of Law. He is also the Founder Director, Member, Lecturer and Examiner of the Institute for the Development of Commercial Law and Practice.

Mr. Kanag-Isvaran has been a Member of the Faculty Board, Law Faculty, Colombo University for over 15 years, and a Member of the Council, Colombo University for over a decade. Posts held by him include Chairman (Company Law Advisory Commission of Sri Lanka; Intellectual Property Commission of Sri Lanka that drafted the Arbitration Act of 1995; Committee which drafted Mutual Assistance in Civil and Commercial Matters Act of 2000 and the Reciprocal Enforcement of Judgments Act; Law Committee of the BASL; Board of Trustees, National Council for Mental Health); Chairman and Consultant (Technical Groups on Drafting New Legislation on Commerce and Business, LJRP, Justice Ministry, and International Development Agency); Member (Law Commission of Sri Lanka; Commonwealth Expert Group on Modernization of the Law of Evidence, London; Commonwealth Secretariat; Committee on Arbitration Law, Justice Ministry; Panel of Advisors Justice Ministry; Legal Cluster, National Council for Economic Development; Law Committee of Computer and Information Technology Council of Sri Lanka; of the Board of Trustees of the National Trust Sri Lanka); Commissioner (Commission for the Elimination of Discrimination and Monitoring of Human Rights); Director (Law and Society Trust). He is currently the Deputy President of the National Trust (from 2016) and Chairman of the Committee of Experts drafting the new Securities Exchange Act 2017. Mr. Kanag-Isvaran's research, published widely, includes the (co-authored) essays, 'Arbitration Law in Sri Lanka' and 'Company Law'.

Legal Research for Development: Challenges and Opportunities

Mr. Kanag-Isvaran

President's Council

The legal field has developed beyond a mere representation of clients' interests in a court of law to a subject demanding a multi-structural applied approach that is capable of anticipating and solving the problems of society. In a developing country such as Sri Lanka, legal research is often a tool that can bring about the changes that society needs in order to meet the demands of a society growing increasingly more complex in its needs and aspirations. For example, laws dealing with subjects such as company law and intellectual property law were drafted to be ahead of the needs of society, but such laws enabled the environment within which activities that were related to those fields could be regulated efficiently and swiftly, without being in limbo for want of a proper facilitative legal environment.

The challenges of legal research for development are many in the local context. Firstly, lawyers, who are rigorously trained in legal research, are often not able to adapt to the methods of social scientific research, which call for a more applied approach. Secondly, the resources available for high-quality legal research are not available to local law students. Thirdly, legal research takes a long time to be translated into a developmental tool, as the findings of research need to be incorporated into suitable legislation, which can take years to see the light of day.

In spite of such obstacles, there are many opportunities for legal researchers as well. The focus on research methodology that is currently being taken will give junior legal researchers the capabilities they need to undertake applied research. Research tools are being developed in this field, and with an increasing focus on academic scholarship in this area, which can be linked productively with the experience gained from both Bench and Bar, it is hoped that the resources required for legal research will be more readily available to legal researchers. Finally, the administrative delays that surround law-making need to be addressed constructively in order to ensure that legal research can truly contribute toward the developmental efforts of the nation.

FACULTY OF LAW

List of Abstracts

1. From a bane to a blessing: Constitutionalism-based transformation of the intricacies of language 179
Binendri Perera
2. Forced migrants in South Asia: A case for regional legal regime 180
C.L. Akurugoda
3. Taking the next step: in defence of judicial enforcement of Economic and Social Rights in Sri Lanka 181
D. Samararatne
4. A critical analysis of the Sri Lankan Legal Framework on air pollution 182
G.I.M Liyanage
5. 35 years of UNCLOS: A pathway towards equity and justice 183
I.M. Dharmadasa
6. Rethinking the law relating to abortion in Sri Lanka: A critical examination 184
T.R. Galappaththige
7. Reflection on the Payment of Gratuity Act in light of promotion of social security of workmen 185
A. Sarveswaran
8. Critical analysis of the minimum age of marriage in Sri Lanka with special reference to Muslim Law 186
E.M.Y.G. Ekanayaka

9.	Marital rape and women's right to sexual autonomy: An analysis of the state obligation of Sri Lanka in adhering to the CEDAW standards <i>G.I.D. Isankhya Udani</i>	187
10.	The legal impact of Revocation of Irrevocable Deeds of Gift on the Ground of Gross Ingratitude Act, No. 5 of 2017 <i>G.P. Dumindu Madhushan</i>	188
11.	Hedges, verges and ditches: Unpacking property rights <i>M. Abeyratne</i>	189
12.	Tracing the history of land registration in Sri Lanka <i>E.R. Anno Helan Menaka</i>	190
13.	Redefining the sex of political participation: Legal regime governing women's agency in representative local bodies in Sri Lanka <i>Rose Wijeyesekera</i>	191
14.	Occupier's liability: towards a new regime in delict <i>D.S.E.U.S. Liyanage</i>	192
15.	Protecting biotechnological innovations in Sri Lanka: Prospects and challenges <i>Jeyakala Jeyarednam</i>	193
16.	Regulation of investments: The Sri Lankan Experience <i>N. Kamardeen and D. Panditaratne</i>	194
17.	Possible impact of economic crimes on international investment arbitrations <i>P.S.P.G. Vithanage</i>	195

18. Certification mark system to promote Ayurveda tourism: An analysis 196
Nishantha Sampath Punchihewa
19. Corporate fraud 197
Shanthi Segarajasingham
20. Establishing the link: Some concerns of corporate criminal liability 198
Yanitra Kumaraguru

From a bane to blessing: constitutionalism-based transformation of the intricacies of language

Binendri Perera

Faculty of Law, University of Colombo, Sri Lanka

Language is an integral aspect of the individual and of the communal identity of human beings. It is thus is a Human Right that empowers many rights. Hence, how the complexities of language are dealt by a nation has far-reaching impacts on the inclusion or marginalisation of diverse communities residing in heterogeneous societies. Due to the significance and sensitivity of the issue, language policies are outlined in the Constitution of the land itself and delineated further via legislation. Whereas practical influence of language is prevalent everywhere, education and administration are two of the key points at which state needs to carefully focus and regulate its language policy to guarantee that language rights of people and communities are safeguarded. Sri Lanka has made various attempts since independence to deal with its language policy in constitutional, legislative, educational and administrative spheres, albeit in inconsistent ways that led to rather harsh results. Indeed, intricacies of language has been more of a bane than a blessing in the chronology of events, creating frustration, mistrust, and agitation among communities. However, as a country that is thinking afresh in terms of peace and reconciliation Sri Lanka needs to formulate and effectively implement a holistic language policy that upholds the ideals of constitutionalism. Constitutionalism is applied in the sphere of language policy as a bench mark to ensure that state powers do not tamper with such policies for narrow, short-term gains, and thereby, achieve a language policy which can be framed and implemented for the benefit of persons and people in the country. On this basis, this paper explores the possibility of constitutional and right based transformation of language policy at the legal and practical level.

Keywords: *Language policy, Language rights, Constitutionalism, Education, Administration*

Forced migrants in South Asia: A case for regional legal regime

C.L. Akurugoda

*Department of Public & International Law, Faculty of Law, University of Colombo,
Sri Lanka*

None of the states in the South Asian region have become party to the 1957 Refugee Convention or its 1967 Protocol. Despite its significant impact on economic, cultural and political environment in the region and the rights and freedoms of the population concerned, the South Asian countries do not appear to be ready to develop a formal legal framework to address the issue at any level in their governance. There is neither a willingness to enact a domestic piece of legislation nor the enthusiasm to adopt a regional instrument to set out a relevant, normative and legal framework to deal with this problem. With recent developments taking place in the global arena, it can be argued that the refugee problem has spread in a massive scale, even in the South Asian region. Ironically, none of the state in the region are ready to accede to the 1957 Refugee Convention or its 1967 Protocol. Thus, the absence of a particular piece of legislation has created a lacuna in the law relating to the protection of forced migrants in the region. To address the issues relating to forced migrants, these states of the region prefer to negotiate among countries and work out bilateral agreements. These are often political solutions. They do not create a legally binding instrument which would be applicable to the entire region. Thus, this qualitative research paper argues that even in the absence of a specific law governing the forced migrants, there is a positive obligation arising from other international Human Rights Conventions, which each of the States in the region is party to. It concludes that this will protect the forced migrant population. However, the research suggests that it is much more effective to develop a regional mechanism to address the issue that can strike a balance between the rights of forced migrants as well as the sovereignty of the states in the region.

Keywords: *Forced migrants, South Asia, protection mechanism*

Taking the next step: in defence of judicial enforcement of Economic and Social Rights in Sri Lanka

D. Samararatne

Department of Public & International Law, Faculty of Law, University of Colombo, Sri Lanka

The justiciability of Economic and Social Rights (ESRs) and the provision for the same in proposals for constitutional reform in Sri Lanka is the focus of this paper. The recommendations made by the Public Representations Committee and the Sub-Committee Report on Fundamental Rights include proposals for justiciability of ESRs. However, strong opposition has been advanced from different quarters; thereby reviving a debate that has taken place in many other parts of the world on this same issue. This paper offers a critical examination of the arguments against the inclusion of justiciable ESRs in the current proposals and goes on to defend their inclusion. It is argued that justiciable ESRs are essential to transition from a patronage system of accessing welfare services to a rights-based system. Transitional justice requires the vindication of ESRs through judicial remedies alongside of ensuring accountability for violation of Civil and Political Rights. Moreover, judicial enforcement of these rights would strengthen deliberative democracy and accountability of governments. Finally, the justiciability of ESRs in a constitution could be used as a remedy by individuals and groups affected by the ongoing neo-liberal economic and political reforms. These arguments are made on the basis of human rights law principles, legal and moral reasoning and theoretical developments related to transitional justice. The paper concludes by proposing a specific formulation for judicial enforceability of ESRs in Sri Lanka.

Keywords: *Economic, Social Rights, Judiciary, Constitutional reforms, Sri Lanka*

A critical analysis of the Sri Lankan legal framework on air pollution

G.I.M. Liyanage

*Department of Public & International Law, Faculty of Law, University of Colombo,
Sri Lanka*

Clean air is extremely important for a healthy life. At the same time, air is something that can be damaged or polluted easily but this pollution cannot always be seen at once. Although air pollution was not a crucial environmental problem in ancient Sri Lanka it has now become a major environmental concern. There are several factors contributing to this environmental damage. When we analyse the existing air quality with the World Health Organization (WHO) standards, Sri Lankan air quality does not align with the WHO criteria. There are many laws and regulations under the Sri Lankan legal system that attempt to eliminate environmental pollution, including air pollution. Due to the polluted air quality in Sri Lanka, several health as well as environmental issues have arisen. This in turn has severely affected the ecosystem of the country. In this study author examines the legal mechanisms relating to air pollution in Sri Lanka. The main problem examined in this paper is “The legal mechanisms do not effectively assist in the reduction of air pollution in Sri Lanka, especially in the urban areas?” This study also expects to evaluate the Sri Lankan legal standards in comparison with the international environmental law mechanisms. The methodology involves a desk research utilising secondary published and unpublished documents and primary sources such as legal statutes, international instruments, academic expressions and judicial decisions. This study engages in an analysis of the concepts of international environmental law as whole. The findings argue that although there are several legal mechanisms which have been introduced to mitigate this issue, the air pollution still remain. This is due to problems in implementation, lack of resources and lack of public awareness. This is ultimately negatively affecting the humans and environment. Effective implementation of laws and regulations locally and giving consideration to the international measures could help in controlling this issue sustainably.

Keywords: *Air Pollution, International Standards, Legal Mechanisms*

35 years of UNCLOS: A pathway towards equity and justice

I.M. Dharmadasa

Faculty of Law, University of Colombo, Sri Lanka

The Law of the Sea is the law by which states (coastal and land-locked) or international organizations regulate their relation to areas subject to coastal state jurisdiction and in relation to sea areas and seabed beyond national jurisdiction. This legal regime dates back many centuries where the sea was firstly considered to be *res communis* or *res extra commercium*, where the sea was considered as a common property that can be used for the benefit of everyone. It was not open to the acquisition of any state or individual. No state could claim any part of the sea. The Law of the Sea as we know of it now has its origins in the 15th century. Since then it has developed to a great extent. During the course of its development, many countries and experts collaborated with the intention of building a codification of rules and regulations. Along with the emergence of sovereign nation status, the need arose for equality amongst states. In the aftermath of World War II, soon after the creation of the United Nations Organization in 1945, this new world organization requested its International Law Commission to consider the codification of existing Customary International Law relating to oceans. After two failed attempts, the first in 1958 (in Hague) and the second in 1960 (in Geneva), the third Convention on the United Nations Convention on the Law of Sea was implemented in 1982. The Convention came into force on 16th November 1994, after Guyana became the 60th country to ratify the Convention. Looking at it after three and a half decades, the Convention proves that it has strived to attain maximum equity and equality among status in all possible circumstances.

Keywords: *Law of the Sea; Codification*

Rethinking the law relating to abortion in Sri Lanka: A critical examination

T.R. Galappaththige

*Department of Public & International Law, Faculty of Law, University of Colombo,
Sri Lanka*

There are many arguments for and against the law of abortion around the globe. Though Sri Lankan law has remained static on the subject, many of the ideologies and the laws of other countries have changed with the ground realities. Under the Sri Lankan law, abortion has been criminalized under sections 303 to 306 of the Penal Code. Since the enactment of the Penal Code of Ceylon in 1883, there has been no amendment brought about for the provision relating to abortion. However, in recent decades, increased interest has been focused on laws of abortion and attempts have been made to reform the laws of Sri Lanka. This situation has reached its pinnacle with the effort of the recent cabinet paper on amending the current law on abortion. There are three objectives in this research. The first is to evaluate the existing legal structure of the law relating to abortion in Sri Lanka and see whether it adequately addresses the social needs and realities. Secondly, to examine how certain other countries, especially neighbouring India have modernised their laws. Thirdly, to suggest reforms for Sri Lanka. This research was conducted primarily as a qualitative research, mostly using secondary sources. However, interviews were also carried out in reaching a conclusion. This research, while examining the global trends relating to abortion, identifies that the jurisdictions around the world permit abortion on seven grounds while Sri Lanka accepts only one of them. However, the research concludes that it would not be advisable for Sri Lanka to adopt criteria which underpin Western ideologies. The principles, culture and the moral values that underlie the Sri Lankan society must be seriously considered in deciding appropriate amendments. Similarly, it is vital to maintain a balance between providing access for termination in genuine cases and to ensure that the law is not abused. The researcher therefore suggests reforms to the existing provisions adopting via media.

Keywords: *Abortion, Penal Code, Reforms, Ideologies*

Reflection on the Payment of Gratuity Act in light of promotion of social security of workmen

A. Sarveswaran

Department of Private & Comparative Law, University of Colombo, Sri Lanka

Gratuity is a retirement benefit of workmen in the semi-government and the private sectors and is paid to the workmen as gratitude for the services rendered to their employers. In 1983, the Payment of Gratuity Act (PGA) was enacted to provide a statutory right for gratuity to workmen employed in the workplaces where 15 or more workmen are employed. The provision is unreasonable as it has meant the non-payment of gratuity to workmen employed in workplaces which employ less than 15. The judiciary has liberally interpreted 'completed service' for the purpose of gratuity calculation to include interruption in service due to political victimisation and interdiction in service as these interruptions would not be due to the workman's fault. Their interpretation to add the period of service in Government Owned Undertakings (GoU) and in the companies that undertake the functions of the GoU also promotes social security of workmen. However, in *Brown and Company Ltd*, the Supreme Court decided that payment of gratuity at the time of retirement and employment thereafter on fixed term contracts break continuous service. This decision defeated the objective of the legislation; which is payment of gratuity for 'completed years of service' but not for 'continuous years of service'. The PGA expressly excludes domestic servants and personal chauffeurs. Yet, since they work very closely with their employers who expect faithfulness and sincerity more than workers in other categories, denial shows ingratitude and negates provision of social security to them. It is suggested to amend the PGA to make it applicable to all workmen irrespective of number of workmen employed by their employers and also to include domestic workers.

Keywords: *completed service, continuous service and cessation of employment.*

Critical analysis of the minimum age of marriage in Sri Lanka with special reference to Muslim Law

E. M. Y. G. Ekanayaka
Faculty of Law, University of Colombo, Sri Lanka

This study examines the legal framework governing marriage under Muslim Law in Sri Lanka (SL). The main objective was to evaluate the adequacy of existing legal measures to eliminate child marriages (CMs). Even though CMs are prohibited in many parts of the world, CMs continue to be permitted by law in SL. Muslim marriages and divorces are governed by the Muslim Marriage and Divorce Act No. 13 of 1951 (MMDA), which is silent on the minimum age of marriage. Therefore, CMs are allowed. This may be mentally, physically, socially and/or morally dangerous and harmful to the girl child. These girls are not only deprived of their childhood, but also undergo risks that threaten their entire life due to pregnancies. It is noteworthy that MMDA contains provisions which contradict state obligations stipulated in the Convention on Elimination of All Forms of Discrimination against Women. According to section 23 of MMDA, a girl below the age of twelve cannot be given in marriage without Quazi's permission. However, Section 47 (1) (j) of the Act mention that it is permitted to register the marriage of a girl below twelve years with the permission of Quazi, after applying to Quazi courts. Therefore, it can be argued that the law permits to register marriages even of girls below the age of 12. This paper argues that legislative intervention is necessary to revise the existing legal framework in order to bring it on par with international standards. Hence, there should be a minimum mandatory age of marriage for women in SL, irrespective of race or religion. The existing law of minimum age for marriage should be increased up to 18 years of age in the light of international standards. Such guarantees would allow the girl child in the Muslim community to maintain equality with the other communities. Even though, this area has been analysed by scholars earlier, the author argues that there is a timely need of revisiting this area in the perspectives of gender justice and child rights. This research is mainly based on domestic legislation, statistics, policies and International Conventions.

Keywords: *Minimum age, Marriage, Discrimination, Women and Child Rights*

Marital rape and women's right to sexual autonomy: an analysis of the state obligation of Sri Lanka in adhering to CEDAW standards

G.I.D. Isankhya Udani

Department of Private & Comparative Law, University of Colombo, Sri Lanka

In a historical vestige of the legal doctrine of 'coverture', sexual coercion among spouses was not regarded as a form of challengeable victimisation (Stringer, 2014). Today this exemption for marital rape has become an outdated patriarchal notion. In modern times, marriage is regarded as a partnership of equals and no longer one in which the wife must be the subservient chattel of the husband (R v. R). Article 16 (1) of the UDHR declares that, "men and women are entitled to equal rights as to marriage and during marriage." Similarly, Article 23 (4) of the ICCPR and Article 16 (C) of CEDAW state that, "States parties shall ensure equality of rights and responsibilities of spouses as to marriage and during marriage." However, criminalizing marital rape still remains controversial in many countries, despite their international obligations to eliminate all forms of discrimination against women, irrespective of women's marital status. In Sri Lanka, marital rape is not a criminal offence unless the husband and wife are judicially separated. In CEDAW Concluding Observations on the periodic reports of Sri Lanka, the committee repeatedly recommends that marital rape should be criminalised, regardless of judicial acknowledgement of separation. Therefore, outlawing marital rape is a breach of international treaty obligations, as well as a violation of the Constitutional guarantees of Sri Lanka and a major obstacle to achieving the 5th Goal of the SDGs. The main objective of this research is to make effective recommendations to ensure women's rights and sexual autonomy during marriage, by providing strong protection against the offence of marital rape. In order to achieve this purpose, the study recommends the need for legal and institutional reforms, judicial training, empowerment of victims, and public awareness programmes. Eliminating socio-cultural myths about marital rape is also important. This qualitative research references legislation, judicial decisions, international conventions, research reports, academic writings, and electronic databases. This comparative analysis has been adopted from selected jurisdictions, such as India, England and Nepal.

Keywords: *Marital Rape, UDHR, CEDAW, ICCPR, Sexual Autonomy*

The legal impact of Revocation of Irrevocable Deeds of Gift on the ground of Gross Ingratitude Act, No. 5 of 2017

G.P. Dumindu Madhushan
Faculty of Law, University of Colombo, Sri Lanka

The Roman Dutch Law (RDL) is recognized as the Common Law of Sri Lanka. Unless a person is governed by a special law, the RDL will cover many aspects of Personal Laws including Property. The land law is therefore governed by the principles of RDL. With regard to land, the rights therein could be granted to another by a deed of transfer or a deed of gift. When a land is gifted/donated under a deed of gift/donation, concepts of donation was also governed by the RDL. Under the RDL the donee has a right to revoke a deed of gift due to 'Gross Ingratitude'. Until recently this aspect was governed by the principles of RDL. However, due to a lack of clarity regarding this particular area of the RDL some confusion has crept in to the legal system and this was clearly seen in the case of *Wilson vs. Sumanawathie & others*. To clarify, the law relating to revocation of irrevocable gifts, the government introduced the Irrevocable Deeds of Gift on the ground of Gross Ingratitude Act, No. 5 of 2017. However, the current legislation has not considered some important facts with regard to its subject area. Therefore, the author has examined some key aspects of the current legislation with regard to an effective implementation of the act. One major issue is, if the donee has made some developments or has increased the value of the gifted property the respective rights of a donee where the said deed is revoked is not described in the Act. Due to that reason a donor maybe be unjustly enriched. Further the Act does not cover third party rights where the donee has created interest in the property so gifted on behalf of third parties. The Act has changed the RDL law regarding the time period where one must file the case. Under the Act one must file action within two years from the cause of action and it has to be within 10 years from the date of donation. In addition the Act does not cover the situation if the donor is incapacitated or if the donor is dead. If there is collusion between the donor and the donee to defraud, the bank could always revoke an irrevocable deed of gift without recourse to the courts. These are the identified issues that impact the operationalisation of a piece of legislation. The high cost of litigation and dragging time is the one of severe issues with regard to land matters. Therefore Act should require courts a special attention on these cases to decide further delays.

Keywords: *Roman Dutch Law, Land Laws, Gross Ingratitude*

Hedges, verges and ditches: Unpacking property rights

M. Abeyratne

Department of Private & Comparative Law, University of Colombo, Sri Lanka

Land use, a primary driver of human development, essentially is exploitation of space. Whether this human settlement is a megacity, town or village, a ubiquitous facet of spatial use of land is the presence of hedges, verges and ditches. Hedges connoting boundaries of private ownership; verges and its *avatar*, the pavement, constituting the strip of land bordering a path or road; and ditches comprising long, narrow, open holes dug into the ground beside a road for removing water; are spatial features of settlement landscapes. Though long accorded little recognition, and often underestimated, they are today a focus for beautification of urban environments and eradication of disease. Verges and ditches constitute public urban space, continuously exploited all hours, daily. Observation of the use of such space shows that: some users appropriate the space for private benefit/profit, such as by enclosing the space by repositioning a private hedge or using the space to carry on a commercial enterprise; the state often restricts access to this public space for one category of users to promote the cause of another category, such as protestors agitating for a cause, and commuters; and the state neglects urban space causing environmental and health problems to the public. At the heart of these conflicts lie property rights. Though cities generate development, they also spawn injustice and inequity, contrary to sustainable urban development calls for inclusive, safe, resilient and supportive cities. Confluence of property law, public urban space and development is the focus of this article. It answers the following primary questions: Does breach of property law in public urban space challenge achieving sustainable urban development? Is justice and equity promoted by safeguarding property rights in public urban space? Research methods included analysis of scholarly sources in property law, development, built environment and urbanization, and primary sources of statutes and cases. Roman-Dutch property law, the commons concept in English law, the notion of common goods, and trusteeship were analytical tools. This research concluded that firstly, use of public urban spaces in breach of property law poses a challenge to development. Secondly, adherence to property law promotes justice and equity in achieving development goals. Thirdly, lax monitoring and enforcement of law precludes attitudinal and behavioural change in users of urban space.

Keywords: *property, development, urbanization*

Tracing the history of land registration in Sri Lanka

E.R. Anno Helan Menaka

Department of Private & Comparative Law, University of Colombo, Sri Lanka

This study is based on the system of Land Registration in Sri Lanka. There is limited information available about the historical evolution of the land registration system in Sri Lanka. Attempts to introduce title registration dates back to the Colonial era. The first Land Registration Ordinance, which contemplated both registration of title and registration of deed, was based on the Australian Torrens Model. In fact, registration of title was the primary object of that Ordinance. This Ordinance made elaborate provisions for registration of title based on a cadastral survey. Unfortunately, provisions relating to registration of title were never brought into operation. Another attempt was made to introduce a system of registration of titles by enacting the Ordinance No. 03 of 1907. However, provisions of this Ordinance were also not implemented. Therefore, in this research, the author intends to discuss the substantial provisions of the Ordinances, to examine the extent to which the provisions were implemented and reasons for the failure of the Ordinances. Accordingly, the research problem of this paper is that despite the fact diverse range of land policies have been imposed during different time periods in Sri Lanka that have had a significant impact upon the evolutionary process of land registration, these systems have not provided an efficient mechanism for the utilisation of land in this country. The design of the research is mainly qualitative in approach.

Keywords: *Land Registration, Land Registration Ordinance*

Redefining the sex of political participation: legal regime governing women's agency in representative local bodies in Sri Lanka

Rose Wijeyesekera

Department of Private & Comparative Law, University of Colombo, Sri Lanka

Compared to many other 'developed' nations, Sri Lanka has had liberal policies towards women's agency in public affairs. Yet, covert discrimination against women has pervaded in society. Thus, Sri Lanka has failed in raising women representation even above 6% at national and local levels. The Constitution of Sri Lanka guarantees equality before the law and equal protection of the law, thus prohibiting *de jure* discrimination on the basis, *inter alia*, of sex. The laws relating to local and national election processors does not overtly discriminate against women. However, the low representation of women at national and local decision-making bodies has raised concerns at domestic and international fora, stressing the need to take affirmative action, ensuring equality in women's agency in these decision-making bodies. Even though several political parties have pledged to ensure gender equality in political representation, a concerted effort has not been taken until a mandatory quota for women in Local Government Elections was introduced in 2016. The Local Government Elections (Special Provisions) Act No.1 of 2016 (LGESP) and the Provincial Councils Elections (Amendment) Bill (PCEAB) gazetted in Parliament on 10th July 2017 have made it mandatory that all political parties and independent groups field at least 30 percent female candidates at the election for Local Government bodies and Provincial Councils. This research examined the adequacy of the mandatory quota system introduced by the LGESP and PCEAB in addressing the critical condition of Sri Lankan women's participation in political decision-making at local level. These laws and the underpinning policy measures are analysed in light of applicable regional and international standards relating to women's agency in state elected bodies. This analysis is undertaken from a comparative legislative experience in Rwanda, Nepal and India. The choice of jurisdiction is based on socio-legal similarities with Sri Lanka. The research adopts a qualitative research method. The research concluded that, while specific statutory recognition of a quota for women is necessary to ensure equal female participation in political representation in Sri Lanka, there should be a Constitutional guarantee for achieving substantive equality of women's political agency to break the 'customary barrier'.

Keywords: *Women political participation, agency*

Occupier's liability: towards a new regime in delict

D.S.E.U.S. Liyanage

Department of Private & Comparative Law, University of Colombo, Sri Lanka

Occupiers are a group of persons who have some control over the premises. Delictual liability of occupiers in Sri Lanka is determined with the law of negligence. Persons who are handling dangerous premises are also liable for causing harm to third parties under the general principles of delictual liability. It is subsumed in the law of negligence. Foreseeability is one of the elements of the test for negligence. Foreseeability is a standard, which is defendant oriented. As per the standard, it is questioned whether all unknown entrants are trespassers in view of occupiers. The capacity to move onto various places which includes inherently dangerous and dangerous in the circumstance is very high in the modern day. Construction sites are good examples in this nature. It is argued that the foreseeability test which is used in the law of negligence ignores the duty of a specific occupier of a dangerous property. Some persons come to a premise as just entrants and may become visitors by the time they leave. Also, there are occasions that persons are treated as neither licensee nor trespasser. The way that the law treats them in like situations is not without prejudice. Occupier's liability must be concerned with imposing a duty of care on the person responsible for the safety of visitors on premises. The law relating to these situations have not been adequately interpreted by the court under the common law to date, though an effort is made in the primary court very recently. Comparatively, in the English law, the statutory involvement in this area is significant. A 'common duty of care' has been established by the statute against lawful visitors and, trespassers are being treated with common humanity. Singapore has established foreseeability as the standard of negligence as opposed to the English statutory law. In view of the above, this paper examines whether it is needed to introduce a specific duty of care of the occupiers who are handling dangerous premises by a statute in Sri Lanka.

Keywords: *Delict, Occupier, dangerous premises, visitors, trespassers, duty of care*

Protecting biotechnological innovations in Sri Lanka: Prospects and challenges

Jeyakala Jeyarednam

Department of Commercial Law, University of Colombo, Sri Lanka

‘Human creativity’ is the cutting-edge factor for economic prosperity in the 21st century. As Article 2 of the Convention on Biological Diversity 1992 defines ‘biotechnology as any technological application that uses biological systems, living organisms or derivatives thereof, to make or modify products or processes for specific use’. This definition is broad enough to encapsulate all modern biotechnologies and traditional activities. In a knowledge-based economy, it is of vital importance to protect biotechnological inventions in order to promote a robust and more competitive agricultural sector in the country. As such, undoubtedly, biotechnological inventions constitute a vital technology-driven innovation eco-system. There are different types of intellectual property (IP) tools for the protection of inventions and creations such as copyright and related rights, patents, utility models, trademarks, industrial designs, geographical indications, trade secrets, layout designs of integrated circuits, and new varieties of plants. However, patents are the most effective IP tool in the protection of biotechnological inventions. The World Intellectual Property Organization (WIPO) states that microorganisms, viruses, cell lines, plants, seeds and medical devices are entitled to be granted a patent right. The prime importance of biotechnological inventions in the agricultural sector is expanding the production of food and alleviating poverty in the world. As a country wishing to achieve economic growth and development, Sri Lanka is no exception to this reality. Sri Lanka has seen an increase in research and development (R&D) expenditure during the post-war period. Nevertheless, Sri Lanka is still at the initial rungs of the technological ladder in terms of biotechnological sector when compared to other developing countries in the region. And most importantly, it is not very clear whether the current IP Act accords adequate protection for the biotechnological inventions. Moreover, the country is still unable to provide protection for new plant varieties and protection for the rights of the breeders under IP law. Therefore, this paper aims to analyse how best Sri Lanka should improve the existing legal framework on biotechnological innovations in the agricultural sector by implementing effective IP rights and suggesting practical recommendations to encourage more R&D investment in the future.

Keywords: *patent, biotechnology, prospects*

Regulation of investments: The Sri Lankan experience

N. Kamardeen¹, D. Panditaratne²

¹*Department of Commercial Law, University of Colombo, Sri Lanka*

²*Lakshman Kadirgamar Institute of International Relations and Strategic Studies, Sri Lanka*

Sri Lanka has been a ‘host state’ inviting foreign investment as a means to promote economic development since the open economic policy adopted in the late 1970s. Foreign investment in Sri Lanka recorded a steady, though not exponential growth, surviving many fractious years of civil strife, and was supported by various concessions granted by developed countries from time to time. Sri Lanka entered the post-war era only to find that its position as a Host State was threatened by several other developing nations offering similar or better conditions. The country’s inability to offer appropriate incentives was hurting both investors and investment alike. Several negative experiences at dispute resolution fora have also left the state reeling, as it finds that the compensation it is obliged to pay often outweighs the proposed benefits of the investment. The island state, once prized for its location, has found this to be a burden of as well, as regional superpowers vie for investment opportunities that will indirectly grant them strategic military benefits in the Indian Ocean. Against this backdrop, this paper attempts to analyse the Sri Lankan experience of foreign investment, and assess the position taken by the state in both its treatment of investors as well as the harnessing of investment for the developmental activities of the state. It will evaluate the disputes that Sri Lanka was a party to, and elicit the reasons for the decisions given, commenting in the process, on the measures that could have been taken by the state, or that could be taken in future, to ensure that the investment experience is not a totally negative one for Sri Lanka. The paper will also discuss the diplomatic tussle for control that has been taking place between the regional superpowers that are investing heavily in Sri Lanka, with a view to ascertaining the position that should be adopted by Sri Lanka in averting a possible future fallout with either of them. Finally, it will argue that the largely reactionary nature of governmental response in the entire field of foreign investment is not appropriate in the dynamic present setting, where the rules are constantly changing, requiring a proactive approach.

Keywords: *Investments, International Relations, development*

Possible impact of economic crimes in international investment arbitrations

P.S.P.G. Vithanage

Department of Commercial Law, Faculty of Law, University of Colombo, Sri Lanka

International investment is inevitable and we can perceive a gradual increase in foreign investment globally. However, it is notable that investment is formed and carried out by way of economic crimes such as corruption, fraud, deceitful conduct, tax evasion, money laundering, illicit capital inflows and crimes committed by public officials etc. These activities of economic crimes in foreign investment have become an international evil across borders. The implications of these are relevant to investment and it can extend to erosion of public order and ultimately would adversely affect the development agenda of the state. Since the traditional approaches of International Investment Tribunals in deciding matters in investment disputes were not designed to address disastrous modern realities such as ‘economic crimes’ in investment, it has challenged the role of Arbitrators. Nevertheless, growing concerns towards combating Economic Crimes in investment has been a red light for the Investment Tribunals to expand their role in Investment Arbitration. This research is motivated by the increasing allegations of economic crimes all over the world and their implications on the global investment and trade transactions. The main objective of this paper is to examine the challenges and risks related to allegations of economic crimes in International Investment Arbitration. This paper utilises a critical approach to the existing framework of International Investment Arbitration and the effects of economic crimes on the merits of Investor-State disputes, State Attribution and responsibility and its impact as a bar to jurisdiction are also examined. It further aims to analyse the importance and ways of enhancing the role of the Arbitration Tribunals in deciding upon the matters connected to economic crimes. This research is mainly a qualitative and descriptive analysis based on library-based secondary sources. The research ultimately intends to propose theoretical recommendations to expand the modern fabric of Investment Arbitration in order to provide an effective framework to govern economic crimes.

Keywords: *Economic Crimes, Investment Arbitration, Responsibility, State Attribution*

Certification mark system to promote Ayurveda tourism: An analysis

Nishantha Sampath Punchihewa

Department of Commercial Law, University of Colombo, Sri Lanka

Trademarks (TM) are prime advertising tools and are of paramount importance in the marketing and commercialisation of goods and services to any business, big or small. TMs may consist of one or more words, letters, numbers, drawings, symbols, logos, slogans, shape and packaging of goods, etc. In the Sri Lankan context, three main categories of marks are recognized under the Intellectual Property Act, No. 36 of 2003. These are: TM and service marks; certification marks (CM); and collective marks. A certification is a mark indicating that the goods and services in connection with which it is used, are certified by the proprietor of the mark in respect of origin, material, and mode of manufacture of goods or performance of services, quality, accuracy or other characteristics. Hence, the owner of a CM can allow anyone to use it provided they meet certain prescribed standards. From a tourism perspective, Ayurveda and other traditional healing services in Sri Lanka have great potential to develop in the health and wellness tourism industry. In recent years, Sri Lankan policymakers have identified Ayurveda and wellness tourism sector as one of the key areas for promotion of tourism. Thus, the potential use of a CM system to enhance the quality of the Ayurvedic products and services (health resorts, spas, hospitals/clinics, herbal cosmetics, beauty care products, spa equipment, etc.) has attracted considerable attention. This paper investigates whether and to what extent a CM system can be effectively used to capture value in Ayurveda by standardising, monitoring and controlling the quality of products and services used in tourism. Empirical evidence gathered during field visits and key-informant interviews suggests that the Sri Lankan Ayurvedic Department can register its brand/logo as a CM and issue guidelines for using the brand of ‘Certified Sri Lankan Ayurveda/Sri Lankan Traditional Medicine’ on every product and service that conform to the set standard. This is, by no means, an attempt to exclude others who practice Ayurveda and traditional medicine in the country. The use of the logo guarantees that the particular product/service is of quality and the CM can effectively prevent dubious practices that are conducted under the guise of Ayurveda and make Sri Lanka an Ayurvedic hub for medical and wellness tourism.

Keywords: *intellectual property, certification marks, tourism, Ayurveda*

Corporate fraud

Shanthi Segarajasingham

Department of Commercial Law, University of Colombo, Sri Lanka

It is widely accepted that companies/corporations have contributed tremendously to economic development. It has also been observed with regret that certain companies engage in unacceptable activities as well. Certain fraudulent individuals have exploited the golden principles of 'legal personality' and 'limited liability' in company law in order to conduct their illegal activities (financial statement scams, insurance frauds, investment fraud, money laundering and exchange control racket). Fraudsters seem to be either incorporating a limited liability company for the purpose of carrying out the fraudulent activities or planning a scam using companies as a tool to carry out the same. The said legal concepts are paving the way for the perpetrators to manipulate their activities on a sly. Corporate fraud is nothing new to the world. In fact, the South Sea Company fraud in the 18th century prompted the then government of the UK to enact a statute to regulate companies. As companies and company law developed, so too did the frauds. Sri Lanka, as with other countries, has its own experience of battling with corporate fraud. The West gained the requisite experience to handle corporate fraud and has developed specific statutes to have a control mechanism and specialists. However, none of these have stopped frauds being committed. It can be noted that the number of corporate frauds is on the rise, there is an increase in the monetary cost of battling fraud, and public confidence in the authorities is deteriorating everywhere, including Sri Lanka. Sri Lanka is experiencing the collapse of companies, mainly due to fraud. The revelation of Panama Papers of the involvement of Sri Lankan companies in alleged illegal activities adds to it. This exploratory research does not have a final finding. However, the truth is that Sri Lanka has formulated no device to fight corporate fraud. Forensic accounting is not popular in Sri Lanka. The existing FCID or Special Commissions of Investigation has not shown positive results. Jail sentences have not been imposed on perpetrators of fraud in Sri Lanka for the public to gain confidence with the system. Shareholder activism is lacking in Sri Lanka, but there is agitation from creditors of failed companies. There is no proactive fraud prevention mechanism. It is apparent that neither the provisions of the Companies Act 2007 (especially with regard to directors' duties) nor Corporate Governance has complied with.

Keywords: *Fraud, Sri Lanka*

Establishing the link: some concerns about corporate criminal liability

Yanitra Kumaraguru

Faculty of Law, University of Colombo, Sri Lanka

With the passage of time, corporations have come to play an increasingly large role in society. Almost parallel to the increasing involvement of corporations in society has been the steady climb in incidents of corporate wrongdoing. Corporate criminal liability is in many ways an artificially crafted legal response to this issue, based on the premise that it is more effective than its civil law alternatives and the corporate governance measures often put in place by companies. While the concept of corporate criminal liability does have arguments of deterrence and retribution frequently cited in its favour, it must be noted that the process of introducing criminal liability for corporations is not a smooth one. The concept draws on, extends and plays with the traditional boundaries of the law with regard to liability. The formulation that results therefore raises a few concerns in its application. These issues formed a significant component of the discussion surrounding corporate criminal liability in its early years. There is however at present a tendency for such issues, albeit unresolved, to be lost or buried amidst the desperate need to hold corporations accountable for their actions. This normative paper explores two unusual and, what is argued to be, uncomfortable departures from the traditional application of the law that corporate criminal liability has entailed: the extension of the application of criminal liability from individuals to corporate entities and the importing of principles, traditionally within the civil law arena, in order to establish criminal liability. Concerns stemming from these two departures include an excessively hostile extension of the criminal law, innocent parties being forced to share in the burden of punishment, leveraging of disproportionate power by the prosecutor and the risk of injustice. Through a study of literature and the practice and experience of foreign jurisdictions, the author therefore argues for a system of corporate criminal liability with parameters that have been designed consequent to due recognition of the concerns discussed.

Keywords: *Corporate Criminal Liability*

FACULTY OF MANAGEMENT AND FINANCE



**MESSAGE FROM THE DEAN, FACULTY OF
MANAGEMENT AND FINANCE**

Dr. R. Senathiraja



I am pleased to send this message for the Annual Research Symposium of the University of Colombo which will be held on 15th November 2017.

The Faculty of Management and Finance is not having a separate faculty session this year as the annual International Research Conference on Management and Finance (IRCMF), organized by the faculty will be held on 27th October 2017. IRCMF strives to create a research culture among the academia and the industry and a platform for academics to discuss and debate with the industry experts on management related issues from different theoretical, methodological, and practical perspectives, this year's conference will feature papers from academics of our university, other universities and foreign scholars. The keynote speaker of the conference is Dr. Patrick McNamara, University of Nebraska, Omaha, United States of America who is specialized in innovation and social entrepreneurship.

Although we will not be having a separate faculty session this year, our faculty will provide its fullest support towards organizing the University Research Symposium. I would also like to thank the organizing committee and all the staff who supported to make this symposium a success.

I wish the Annual Research Symposium 2017 the very best and hope that this event will create a new platform for research capturing the opportunities and successfully meeting the challenges in line with this year's theme 'Research for Development: Challenges and Opportunities'.

FACULTY OF MEDICINE



Research for Development; Promoting Innovation to Drive Healthcare

28 November 2017

MESSAGE FROM THE DEAN, FACULTY OF MEDICINE

Professor Jennifer Perera



I am pleased to provide this message for the Annual Research Symposium of the Faculty of Medicine. This is an important calendared event of the University. This year's theme, "Research for development: promoting innovation to drive health care" describes the need to promote innovative research to address the country's health needs. This requires a paradigm shift in the research agenda as the health needs must be identified prior to designing research. To achieve this end healthcare professionals and researchers need to be trained and empowered. The community is the main stakeholder to whom products and results of research will be of benefit to improve their life in both health and disease. Their involvement in healthcare research needs to be taken into consideration in designing research.

The funds allocated to research grants by the state have increased exponentially during the last 3 years and we hope that this trend will continue. It is strongly encouraged to have multi-stakeholder collaboration in health research as Health is an integral component of all types research work. This must be considered a social responsibility of each researcher as most health related research are conducted using public funds and humans. Ethics play a seminal role in ensuring that research is appropriately conducted. We at the Faculty of Medicine will be conducting our respective programme with the patronage of our chief guest, the Vice Chancellor, University of Colombo who has provided leadership to many of the projects in the Faculty of Medicine in particular. Dr Ajith de Alwis, our Guest of Honour is a visionary researcher who has moved from narrow confines of chemical engineering research to provide a much broader area of research leadership linking innovation to national development and aptly suitable for this occasion. As the chief project officer of COSTI, he has been able to change the research pathway of the country for better. I am very grateful to the Symposium organizing committee, led by Professor Vajira Dissanayake for organizing this event. On behalf of the Faculty of Medicine, my sincere good wishes for a very productive and enjoyable event that would yield very fruitful outcomes.

FACULTY OF MEDICINE

PROGRAMME

28 November 2017

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| 8.00 am | Registration |
| 8.30 am | Academic Procession |
| 8.40 am | National Anthem and Traditional Lighting of the Oil Lamp |
| 8.50 am | Welcome Address by the Chairperson, Faculty of Medicine
Annual Research Symposium
Professor Vajira H. W. Dissanayake |
| 8.55 am | Address by Professor Jennifer Perera, Dean,
Faculty of Medicine |
| 9.00 am | Address by the Chief Guest, Senior Professor Lakshman
Dissanayake, Vice-Chancellor, University of Colombo |
| 9.10 am | Keynote Address, “Research with Purpose: Challenging the
Frontiers”
Professor Ajith De Alwis, Project Director, Coordinating
Secretariat of Science Technology and Innovation (COSTI),
Ministry of Science, Technology and Research |
| 9.50 am | Vote of Thanks by Dr. Tharanga Thoradeniya, Secretary, Faculty
of Medicine, Annual Research Symposium |
| 10.00 am | Refreshments |

INTRODUCTION TO THE KEYNOTE SPEAKER



Professor Ajith de Alwis

*Department of Chemical and Process Engineering
University of Moratuwa*

Professor Ajith de Alwis completed his Ph.D at University of Cambridge, UK, after completing his B.Sc. (Eng) honours degree from Moratuwa University. He also has an MBA from Post Graduate Institute of Management (PIM), Sri Jayewardenepura University. He is the recipient of numerous awards in recognition of his work, most notable being the Senior Moulton Medal of Institution of Chemical Engineers (UK), Danckwerts-Maxwell Award from University of Cambridge (D/Chemical Engineering) for the best PhD Thesis, University of Moratuwa Research Awards from 1997 to 2007. A Professor at the Chemical and Process Engineering Department, Moratuwa University, he is also the Director of the University of Moratuwa-Cargills Food Process Development Incubator. He was the Chairman of Engineering Research Unit (ERU) of Moratuwa University (2005-2007); a Science team leader for Sri Lanka Institute of Nanotechnology (SLINTEC) from its inception in 2008 to 2011; and in national policy formulation subcommittees (Biotechnology, Nanotechnology, e-waste etc.).

Professor de Alwis is currently the Project Director of the recently instituted Coordinating Secretariat for Science, Technology and Innovation (COSTI), Sri Lanka. He is also a member of the Advisory Commission on Intellectual Property (Min of Industries and Commerce); the Governing Council of National Institute of Occupational Health (Min of Labour) as well as various professional bodies including the Cambridge Philosophical and Commonwealth Societies, the American Institute of Chemical Engineers (MAICChE), the Editorial Board of the European Journal of Food & Bioproducts, Fellow of the National Academy of Sciences Sri Lanka, Life Member of Sri Lanka Society for the Advancement of Sciences, and also the founding President of Sri Lanka Biogas Association of Sri Lanka. Prof de Alwis was also a Post-doctoral research fellow at University of Reading, UK, and Visiting Scientist at the Indian Institute of Science (IISc) in Bangalore. He has published many research articles and book chapters in various international and local journals. He is also a regular columnist to the *Daily FT* on Innovations, Science, Technology and National Development.

Research with Purpose: Disrupting frontiers

Professor Ajith de Alwis

Director, Coordinating Secretariat for Science Technology and Innovation (COSTI)

Ministry of Science Technology and Research

Professor of Chemical and Process Engineering

University of Moratuwa, Sri Lanka

In the classical sense universities should play a central role in a country's innovation ecosystem and it is research that is the lifeblood of this process. In Sri Lanka, we observe perhaps a 1000 scientific papers (that are published with peer review) and a multitude of conferences. Today almost all universities have more than one international conference in a calendar year. Premier scientific bodies of the country also have their own sessions, which are open to present research taken place related to their scientific profession. If the researcher publishes and or presents findings and stop there is unlikely to be any impact from the research carried out. Societies and economies change when research is carried out with a purpose and subsequently from the impact. To derive the impact when the recipients perhaps stay passive researcher perhaps need to reach out outside the peer base. This is outcome-oriented behaviour and is something that needs to be cultivated by the Sri Lankan researcher. Going back to medical research, Fleming perhaps is an excellent example of a researcher who was goal oriented from the beginning but who did falter perhaps in the last stages which fortunately did not finally matter as Florey and Chain really followed up and paved the way for success. Plenty of lessons are available to a researcher from discoveries and inventions, which subsequently made their way to innovations.

Today three things are changing at rapid pace – technology, globalization and climate change – and as a researcher, perhaps times can be vastly challenging. However, in my view times are quite opportune too in making an impact through one's work. The success would accrue if one takes a research problem that is on the edge of current knowledge or one where not much work has happened. In a well-studied area then one will be called to come up with a quite a creative approach for an impact to be created. It is to be stressed that a researcher from inception should be goal oriented beyond a mere publication or a presentation – the initiative imperative!

FACULTY OF MEDICINE

List of Abstracts

1. The need for continued awareness raising on Cutaneous Leishmaniasis in Sri Lanka: A case series 209
M.A.B. Deepachandi, S. Weerasinghe, N.H. Silva, S. Senanayake, T.N. Samaranayake, S.S.S.B.D.P. Soysa, N.D. Karunaweera and H.V.Y.D. Siriwardana
2. *Phlebotomus argentipes*, the vector of leishmaniasis in Sri Lanka: study on insecticide susceptibility patterns 210
K.P.D Ruwanika, N.D. Karunaweera and S.H.P.P. Karunaratne
3. Comparison of extraction methods of the parts of Pomegranate fruit based on their antioxidant capacity 211
U. Yapa Bandara and C. Witharana, P. Soysa
4. Induction of Apoptosis in Hepatocellular Carcinoma (HepG2) and Rhabdomyosarcoma (RD) Cells by fresh leaves of *Camellia sinensis* grown in Uva Province, Sri Lanka 212
R.A.U.I. Ranatunge and P. Soysa
5. Potential of Thermotherapy as an alternative treatment for Cutaneous Leishmaniasis with poor response to Intra-lesional Sodium Stibogluconate: A preliminary case study from the Southern Province, Sri Lanka 213
N.H. Silva, S. Weerasinghe, P.L.A.N. Liyanage, R. Fernandopulle and N.D. Karunaweera
6. Cloning and expression of recombinant fruit bromelain of *Annanas comosus* in prokaryotic host system 214
U.P.A.C.S. Karunanayake, G.L. Gunaratne, N.V. Chandrasekharan and W.S.S. Wijesundera

7.
Therapeutic effects of Pranayama: A systematic review
H.A. Ranawaka, W.D.N. Dissanayake, A.D.A. Fernando and R. Jayawardena
215
8.
Effect of phytochemicals of pomegranate peel powder on hepatocellular carcinoma
C.L. Jayasekara, C. Witharana and P. Soysa
216
9.
Health status and physiological parameters of institutionalized elderly in the Colombo District: Study protocol for a cross sectional descriptive study
W.M.L.V. Wanninayake, A.D.A. Fernando, C. Dalpadatu, R. Jayawardena, M. Gunatilake, P.A. Atapattu, W.D.N. Dissanayake, S. Wasalathanthri, H.A. Ranawaka and N. Vamasivam
217
10.
Atalantia ceylanica, an effective hepatoprotective agent against acetaminophen induced HepG2 cell damage
J.H.A.C.P. Jayathilake and P. Soysa
218
11.
Genotyping common FSHR polymorphisms in polycystic ovary syndrome (PCOS) by high resolution melting (HRM) analysis
B. Umayal, S.N. Jayakody, N.V. Chandrasekharan, W.S.S. Wijesundera and C. N. Wijeyaratne
219
12.
Histopathological features predictive of liver metastasis in a cohort of patients with colorectal carcinoma: A prospective study
M.I.M. De Zoysa, D.N. Samarasekera, G.K. Wijesinghe, L.D.J.U. Senarath and M.D.S. Lokuhetty
220
13.
Prevalence of the thrombotic PAI-1 4G allele in a Sri Lankan cohort
B.A.P. Sajeewani, D.P.A.A.U. Ranasinghe, R.W. Mendis, L.H. Chandi, A.A.G. S. Abeysekera and V.H.W. Dissanayake
221

14. Comparative study of gross morphology of the amniotic membrane and culture characteristics of amniotic epithelial cells in gestational diabetes mellitus (GDM) vs. non-GDM Pregnancies 222
D. Hettiarachchi, C. Ishak, V.H.W. Dissanayaka, and H.W.W. Goonasekara
15. Chromosomal abnormalities in a cohort of women with primary amenorrhoea 223
U.G.I.U. Kariyawasam, P.H.J. Cooray, P.K.D S. Nisansala, W.A.K.S. Saumya, A D.S. Perera, B.A.T. Amalka, C.S. Paththinige, U.N.D. Sirisena and V.H.W. Dissanayake
16. Next generation sequencing study of Mesenchymal Stem Cells in *de novo* Myelodysplastic Syndromes 224
A.J.I.S. Rathnayake, N.F. Neththikumara, V.H.W. Dissanayake and H.W.W. Goonasekera
17. Next generation sequencing approach to understand the mutational status of *de novo* myelodysplastic syndromes' haematopoietic stem cells 225
W.M.M.S. Bandara, N.F Neththikumara, H. W. W. Goonasekera and V.H.W. Dissanayake
18. Does delayed cord clamping and early skin-to-skin contact between mother and baby improve neonatal behaviour? A randomized controlled trial at a university unit, at a tertiary care maternity hospital in Sri Lanka 226
M. N. Lucas, A. Sakalasuriya, R. Isman, D. Samaranayake and H. Senanayake
19. Cytotoxicity and apoptosis inducing ability of Triphala 227
J.W.N. Yasara and P. Soysa
20. Prevalence and trends of the diabetes epidemic in the Middle East: A systematic review 228
V. Nishanthika, K.P.C. Dalpatadu, S.A. Alkahtani and R. Jayawardena

The need for continued awareness raising on Cutaneous Leishmaniasis in Sri Lanka: A case series

M. A. B. Deepachandi¹, S. Weerasinghe¹, N. H. Silva¹, S. Senanayake¹,
T.N. Samaranyake¹, S. S. S. B. D. P. Soysa², N. D. Karunaweera¹,
H. V. Y. D. Siriwardana¹

¹*Department of Parasitology, Faculty of Medicine, University of Colombo, Sri Lanka*

²*Department of Biochemistry and Molecular Biology, Faculty of Medicine,
University of Colombo, Sri Lanka*

An outbreak of cutaneous leishmaniasis (CL) caused by *Leishmania donovani* was identified in Sri Lanka in 2003 and cases are continuously detected. Infected humans act as potential parasite reservoirs. Therefore, WHO recommends early case detection and management as the main disease control strategy. Presently, patients are mainly detected passively after self-referrals. Few patients proceed for pre-treatment laboratory confirmation due to multiple reasons. This case series highlights the need for raising disease awareness in public and medical settings. Three males from Polonnaruwa, Anuradhapura and Kalutara Districts were presented to the Centre for Leishmaniasis, Colombo University recently. They were 23, 40 and 20 years-old respectively and had single skin lesions that started as painless/acne-form papules. The lesions were a rounded-erythematous-nodule (1.5 cm, 16 months) on the forehead, a rounded-hyperpigmented-ulcer (2 cm, 3 years) over the left leg and an irregular-erythematous-papule (1 cm, 24 months) on the stomach. Surrounding skin was normal/erythematous and non-scaling. Infections were not associated with visceralizing symptoms. The CL diagnosis was confirmed by microscopy and culture. None of the patients had disease awareness despite two patients being residents of disease-endemic areas. They delayed self-referral as lesions were not enlarging/painful/itchy. Patients opted for medical advice only when the lesion interfered with appearance/or with enlargement and redness on sun exposure. In the first 2 cases, CL was not considered in their first visit (<1 year) as the lesions were clinically diagnosed as a pimple and a rash respectively. Mean duration from first visit to clinical suspicion was 17.3 months. However, only 1-3 weeks were taken for diagnosis. Infected patients can act as parasite reservoirs. Patients are less likely to seek treatment for symptom-free lesions. Clinical markers for field screening have been reported recently. Raising awareness among general public and improved clinical awareness among clinicians/health care workers is invaluable in controlling CL.

Keywords: *Cutaneous leishmaniasis, Raising awareness, Sri Lanka*

***Phlebotomus argentipes*, the vector of leishmaniasis in Sri Lanka:
A study on insecticide susceptibility patterns**

K.P.D. Ruwanika¹, N.D. Karunaweera¹, S.H.P.P. Karunaratne²

¹*Department of Parasitology, Faculty of Medicine, University of Colombo, Sri Lanka*

²*Department of Zoology, Faculty of Science, University of Peradeniya, Sri Lanka*

Phlebotomus argentipes is the known vector of *Leishmania donovani*, the causative organism of the disease leishmaniasis. Development of resistance to insecticides is a major challenge for an effective vector control programme. Galgamuwa in North-Central Province and Pannala in North-Western Province were selected as study locations based on the leishmaniasis cases/vector prevalence. Identification of *Ph. argentipes* was confirmed using standard taxonomic keys. Collected sand-flies were reared and the F₁ progeny was exposed to DDT, malathion, deltamethrin and propoxur insecticides. The results were validated with the control mortalities using Abbott's formula. After one hour of exposure, the knockdowns were 60%, 60%, 61%, 63% and 64% for 1.5%, 2.0%, 2.5%, 3.0%, 4.0% DDT and 67%, 74%, 74%, 75% and 75% for 2.0%, 2.5%, 3.0%, 3.5%, 5% Malathion respectively. For Deltamethrin, knockdowns were 64%, 64%, 65%, 67% and 67% for 0.02%, 0.025%, 0.03%, 0.035%, 0.05% - Deltamethrin and for Propoxur 64%, 65%, 65% for 0.03%, 0.07% and 0.1% Propoxur respectively (N=100; 5 replicates). However, there were no survivors after 24-hour recovery period. No differences could be observed in the numbers of knockdowns and mortalities between the villages of Pannala and Galgamuwa for each insecticide. For 0.4% DDT, 0.5% Malathion, 0.005% Deltamethrin and 0.01% -Propoxur (N=100; 5 replicates), all flies were alive after one hour exposure and even after 24 hour recovery period. Hence, the colony population is susceptible to concentrations above 1.5% of DDT and above 2.0% of Malathion, above 0.02% Deltamethrin and over 0.03% Propoxur whereas resistant to 0.4% DDT, 0.5% Malathion 0.005% Deltamethrin and 0.01 Propoxur. Research work is continuing to obtain log-probit mortality curves and to establish the susceptibility patterns of Sri Lankan *Ph. argentipes* to synthetic insecticides.

Keywords: *Phlebotomus argentipes*, DDT, Malathion, Deltamethrin, Propoxur.

Comparison of extraction methods for the parts of Pomegranate fruit based on their antioxidant capacity

Udeshika Yapa Bandara, Chamindri Witharana, Preethi Soysa
Department of Biochemistry and Molecular biology, Faculty of Medicine, University of Colombo, Sri Lanka

Pomegranate fruits are used for cancer management in Ayurveda, Sri Lanka. Antioxidant potential of natural products are associated with prevention of many diseases, as well as for the treatment. It is reported that pomegranate fruits have shown several health benefits such as antibacterial, antiviral, antioxidant and anti-inflammatory activities. In this study, water extracts of pomegranate peel, pericarp, juice and seeds were screened for their antioxidant activity. The method of extraction is a crucial step in screening biological activities, the study was also directed towards different extraction methods. According to literature, five extraction methods were selected: Boiling with an electric burner (BL), Sonication (SN), Microwaving (MC), Heating in a 50°C water bath (WB) and Sonication followed by Microwaving (SN-MC). 1, 1-diphenyl-2-picrylhydrazil (DPPH) radical scavenging activity and Ferric Reducing Antioxidant Capacity (FRAP) of extracts were determined spectrophotometrically to evaluate the best extraction method. Sri Lankan Nimali species of Pomegranate fruits were obtained from the Fruit Research Institute, department of Agriculture, Kalpitiya. Fresh fruits (1 kg) were handpicked to select undamaged fruits. Freeze-dried powder (2g) of peel and pericarp were dissolved in 100mL of De-ionized water for extraction. For the peel samples, DPPH activity was high in MC method with $IC_{50} = 3.3 \pm 1.1 \mu\text{g/mL}$. In pericarp, $IC_{50} = 6.2 \pm 0.1 \mu\text{g/mL}$ for DPPH activity for the MC extraction. Our results suggest that, MC method is more effective for extraction of antioxidant compounds in peel and pericarp of Pomegranate fruit. Pomegranate juice was prepared as fermented juice and fresh juice. Among them fermented juice had a higher free radical scavenging activity ($P < 0.05$) with $IC_{50} = 3.1 \pm 0.1 \mu\text{g/mL}$, than fresh juice ($IC_{50} = 754.5 \pm 83.2$). Seed has the least antioxidant activity and the peel which is the main waste component of the fruit has the highest antioxidant activity compared to the other parts.

Keywords: *antioxidant, Pomegranate, extraction, scavenging capacity*

**Induction of Apoptosis in Hepatocellular Carcinoma (HepG2)
and Rhabdomyosarcoma (RD) Cells by fresh leaves of *Camellia sinensis* grown in
selected areas of Uva Province, Sri Lanka**

R. A. U. I. Ranatunge, P. Soysa

*Department of Biochemistry and Molecular Biology, Faculty of Medicine,
University of Colombo, Sri Lanka*

Tea, *Camellia sinensis*, is the most widely consumed medicinal beverage in the world. Polyphenols present in tea leaves are responsible for antioxidant activity, cytotoxicity and apoptotic activity. The leaf bud is used to manufacture white tea and bud and two youngest leaves (tea flush) are used in green and black tea manufacture. The present study was carried out to evaluate the phenol content and anti-oxidative potential of the tea flush as well as the bud of *Camellia sinensis* collected from Uva province. Induction of apoptosis was investigated using Hep G2 and RD cell lines. Fresh tea flush and buds were collected (February 2017) from mature plants of the clone TRI2023 grown in Bandarawela, Haputale and Nayabadda. The water extracts of tea were used in all assays (n=3). The total phenolic content and antioxidant activity were determined using Folin- Ciocalteau method and DPPH assay respectively. Antiproliferative activity was evaluated by 3-(4, 5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) assay after 24-hour treatment of tea extracts. Characteristic morphological features of apoptosis were observed after Ethidium Bromide/Acridine Orange staining (EB/AO). The polyphenol level was highest in tea flush collected from Haputale with a mean (\pm SD) value of 22.0 (\pm 2.6) (w/w% of Gallic acid equivalents). The same sample showed the highest antioxidant activity and the mean (\pm SD) EC₅₀ value was 13.8 (\pm 0.8) μ g/mL. The MTT results showed that the antiproliferative activity of all samples of *Camellia sinensis* was higher in RD cells compared to HepG2 cells. EB/AO staining showed that apoptosis was triggered in both cell lines and more pronounced in RD cells. The fresh tea flush and buds of *Camellia sinensis* collected from Uva province show high antiproliferative activity on RD cells compared to HepG2 cells and the cell death has occurred via apoptosis in both cell lines.

Keywords: *Anti-proliferative activity, Antioxidant activity, Apoptosis, Camellia sinensis, Polyphenols*

Potential of Thermotherapy as an alternative treatment for Cutaneous Leishmaniasis with poor response to Intra-lesional Sodium Stibogluconate: A preliminary case study from Southern Province, Sri Lanka

N. H. Silva¹, S. Weerasinghe¹, P.L.A.N. Liyanage², R. Fernandopulle³,
N. D. Karunaweera¹

¹*Department of Parasitology, Faculty of Medicine, University of Colombo, Sri Lanka*

²*Department of Community Medicine, Faculty of Medicine, University of Ruhuna,
Sri Lanka*

³*Kotelawala Defence University, Colombo, Sri Lanka*

Cutaneous leishmaniasis in Sri Lanka is commonly treated with intra-lesional sodium stibogluconate (IL-SSG) weekly injections. Since poor response to IL-SSG has been reported, alternative treatment methods have to be studied for these patients. Efficacy and safety of thermotherapy has been previously studied as a method of treatment for newly diagnosed cutaneous leishmaniasis patients. The objective of this case study is to demonstrate the potential of thermotherapy as an alternative treatment for cutaneous leishmaniasis with poor response to IL-SSG. This case study included three patients with poor response to IL-SSG. They were treated with thermotherapy given either by ThermoMed device (a single application of 50⁰C for 30 seconds) or by HETC device (application of 51⁰C for 3min (in 1-3 fractions) daily for 7 consecutive days). Patients were followed up for 6 months post-treatment. A 60-year-old female, 44-year-old male and a 60-year-old male had persistent cutaneous leishmaniasis lesions in spite of 12, 13 and 23 IL-SSG respectively. Lesions were not infected. The first two patients were treated with thermotherapy by HECT device while the third patient by ThermoMed device. The 60-year-old female did not have blistering, burns or secondary bacterial infections following thermotherapy, while the 44-year-old male had a superficial burn which healed without an infection or a scar. The 60-year-old male got a blister, which ruptured within 1 week of treatment and healed without any complications by 2 weeks post-treatment. Skin lesions of all 3 patients healed completely following thermotherapy and no relapses occurred within 6 months of follow up period. Thermotherapy given through ThermoMed or HECT device has the potential to be used as an alternative treatment for cutaneous leishmaniasis that fail to respond to IL-SSG. However, safety and efficacy of these devices for poor responders needs to be studied further through a properly designed clinical trial that is underway.

Keywords: *Thermotherapy, Cutaneous leishmaniasis, Poor response, Sri Lanka*

Cloning and expression of recombinant fruit bromelain of *Annanascomosus* prokaryotic host system

U.P.A.C.S. Karunanayake¹, G.L. Gunaratne², N.V. Chandrasekharan²,
W.S.S. Wijesundera¹

¹*Department of Biochemistry and Molecular Biology, University of Colombo,
Sri Lanka*

²*Department of Chemistry, University of Colombo, Sri Lanka*

Bromelain is a collective terminology referred to the mixture of thiol protease contained in the stem and fruit of *Annanas comosus*. The two main types of bromelain are termed as stem bromelain (EC 3.4.22.32) and fruit bromelain (EC 3.3.22.33) depending on their origin. Due to its enormous applications in the pharmaceutical, food, cosmetic and leather industry, mass production of bromelain is important. The major objective of the present study was to clone and express the fruit bromelain gene in *Escherichia coli* bacterial system. A pair of forward and reverse primers were designed to PCR amplify the fruit bromelain gene of *Annanas comosus*, previously cloned into pGEMT vector. The forward primer was designed with an ompA signal sequence to facilitate periplasmic secretion of recombinant protein. The PCR amplified gene containing the ompA signal sequence, was successfully cloned into pGEMT propagation vector and custom sequenced. The amplified gene was then double digested with *Hind* III and *Nco*I restriction enzymes, cloned into pET 28a+ expression vector and transformed into *E.coli* JM 109 for the propagation. Thereafter, the recombinant plasmid DNA was extracted and transformed into *E.coli* BL21(DE3) pLysS expression host. Recombinant *E.coli* colonies were screened and custom sequenced to confirm the presence of the gene. The recombinant bromelain gene exhibited a 100% sequence homology to the coding region of native *Annanas comosus* fruit bromelain in NCBI database (JX989226.1). Over expression of recombinant bromelain protein was induced by adding IPTG to bromelain harbouring *E.coli* BL21(DE3) pLysS cultures and crude bromelain extract was obtained by centrifugation. Tyrosine standard protease activity assay was performed to measure the bromelain activity. The activity of the partially purified recombinant enzyme using ammonium sulfate precipitation was 4.47 U/mL. The molecular weight of recombinant bromelain was estimated as 25 kDa using ProtParam software and confirmed by SDS-PAGE.

Keywords: *Recombinant fruit bromelain, E.coli BL21(DE3) pLysS, Annanascomosus, Cloning, Expression*

Therapeutic effects of Pranayama: A systematic review

H.A.R. Ranawaka¹, W.D.N. Dissanayake¹, A.D.A. Fernando¹, R. Jayawardena^{1,2}
¹*Department of Physiology, Faculty of Medicine, University of Colombo, Sri Lanka*
²*Institute of Health and Biomedical Innovation, Queensland University of Technology, Brisbane, Queensland, Australia*

Yoga is an ascetic discipline, of which pranayama, the yogic art of breathing, is an essential component, consisting of deliberate modifications to the breathing process such as prolongation of inhalation, breathe retention and exhalation. This study aims to systematically evaluate the evidence on the therapeutic benefits of pranayama.

A four staged comprehensive literature search was undertaken in accordance of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement in Medline, Web of Science and SciVerse Scopus databases using the keywords ‘Pranayama’, ‘Pranayam’, ‘Pranayamas’, ‘Yogic Breathing Exercise’ and ‘Yoga Breathing Exercise’. The search was restricted to articles published in English, until June 31st, 2017. Inclusion criteria were pranayama being the sole intervention and study being conducted on disease states. Original studies of any study design were eligible and review was done independently by two reviewers. The total number of hits obtained from the initial search was 669, and 4 articles were added from other sources; 411 studies were excluded at the title level, and 156 at the abstract level. For this review, 36 studies were selected based on inclusion criteria. There were 7 studies on asthma, 7 studies on hypertension, 6 studies on malignancies, 4 studies on cardiovascular diseases, 4 studies on respiratory diseases other than asthma, 2 studies on stroke, 2 studies on psychiatric disorders and one study each on diabetes mellitus, duchenne muscular dystrophy, tinnitus and presbycusis. Statistically significant favourable effects of pranayama were shown on; asthma (n=6, 85.71%) with improvement in symptoms (p<0.01), pulmonary functions (p<0.05) and quality of life (p<0.05); hypertension (n=6, 85.71%) with reduction of blood pressure (systolic-p<0.05, diastolic-p<0.01) and rate pressure product (p<0.001); and malignancy (n=4, 66.67%) with improvement of antioxidant status (p<0.001) and quality of life (p<0.05). Pranayama demonstrates significant therapeutic benefits in asthma, hypertension and malignancy. However, there is heterogeneity in the studies and outcomes, therefore further high-quality studies are required to provide definitive evidence.

Keywords: *pranayama, yogic breathing exercise, therapeutic*

Effect of phytochemicals of Pomegranate peel powder on hepatocellular carcinoma

Chathurika Lakmali Jayasekara, Chamindri Witharana, Preethi Soysa
*Department of Biochemistry and Molecular Biology, Faculty of Medicine,
University of Colombo, Sri Lanka*

Cancer has become a threat to the existence of the mankind with serious social and health- economic consequences. Pomegranate (*Punica granatum* L.) is an ancient fruit which had been effective against numerous diseases due to its high content of phytochemicals. The fruit consists of arils, seeds and peel from which the peel shows an increased polyphenol content rather than seeds and juice. Present study encourages people to use pomegranate fruit grown in home gardens as a tea by microwaving the fine powder directly obtained from blendering of dried peels with water. The study was carried out to determine the antioxidant activity, total polyphenol content and flavonoid content of pomegranate peel powder extract by DPPH radical scavenging activity, Folin-Ciocalteu and aluminium chloride colorimetric methods respectively as well as the effect on hepatocellular carcinoma. Three pomegranate fruits collected from a single plant from a home garden in Colombo in March 2016 were processed separately. Dried peels were subjected to blender to obtain a fine powder and the resulting powder was microwaved with water. Microwaved water extract of pomegranate peel powder showed mean EC₅₀ values at 9.8±1.6µg/mL for DPPH radical scavenging activity. The mean total phenolic content obtained was 22.4±5.0(w/w) gallic acid equivalents whereas the mean flavonoid content was 33.9±11.7µg/mL(w/w) EGCG equivalents. The MTT and SRB assays were carried out to study the antiproliferative activity of pomegranate peel powder extract and showed mean EC₅₀ values at 323.0±73.0µg/mL and 441.1±70.4µg/mL respectively. Microscopic examination of cells stained with Rhodamine 123 staining, Ethidium bromide/ Acridine Orange and Geimsa staining was used to identify the apoptotic changes that occurred in HepG2 cells. Apoptotic changes could be observed on Ethidium Bromide/ Acridine Orange staining and Geimsa staining whereas Rhodamine 123 staining showed decreased mitochondrial transmembrane potential at different concentrations of pomegranate peel powder extracts.

Keywords: *Pomegranate (Punica granatum L.) peel powder, HepG2, apoptosis, EC₅₀*

Health status and physiological parameters of institutionalized elderly in the Colombo District: study protocol for a cross sectional descriptive study

W.M.L.V. Wanninayake, A.D.A. Fernando, C. Dalpadatu, R. Jayawardena,
M. Gunatilak, P.A. Atapattu, W.D.N. Dissanayake, S. Wasalathanthri,
H.A. Ranawaka, N. Vamasivam

Department of Physiology, Faculty of Medicine, University of Colombo, Sri Lanka

Population aging is a common phenomenon throughout world. About 25% Sri Lankan population will be aged over 65 by 2041. Aging has resulted in issues affecting several sectors including health. High prevalence of multiple co morbidities, increased healthcare expenditure, increased psychological disease and social consequences are some major health problems of aging. A well-planned health care policy is a necessity to face consequences of aging. Study of physiology and health status among elders is an important component in geriatric policy making. This paper presents a protocol of a study to describe overall health status and functional capacity among the elderly population in elderly homes in Colombo district. Eligible elders aged over 65 years living in all elderly homes in Colombo district, registered under National secretariat for elders will be included in this cross-sectional study and the study population is about 1300. Ethical approval was obtained from Ethics review committee of Faculty of Medicine, Colombo. An interviewer administered questionnaire will be used for data collection. Basic demographic data and data on medical comorbidities will be collected. Nutritional status will be assessed by 24-hour dietary recall and mini nutritional assessment. Five Fried model indicators; weight loss, exhaustion, low energy expenditure, slowness and weakness will be used to assess frailty. Fracture risk will be studied by the FRAX index. Cognitive assessment by Montreal cognitive assessment and assessment of depression by geriatric depression scale will be performed. Anthropometric measurements will be measured according to standard procedures. Timed up and go test and Five Times Sit to Stand Test will be performed to assess the risk of falls. Descriptive and correlation analysis of data will be performed. This study is a comprehensive geriatric health assessment of Sri Lankan elderly population living in elderly homes in Colombo. The study will contribute in establishing better geriatric care in Sri Lanka and will serve as a model to design an islandwide study on elderly population in Sri Lanka.

Keywords: *Elderly population, elderly homes, geriatric health*

***Atalantia ceylanica*, an effective hepatoprotective agent against acetaminophen induced HepG2 cell damage**

J.H.A.C.P. Jayathilake, P. Soysa

*Department of Biochemistry and Molecular Biology, University of Colombo,
Sri Lanka.*

Acetaminophen is used as an antipyretic and analgesic drug which is safe at therapeutic dose but could cause acute liver failure in overdose. Liver Cytochrome P450 converts acetaminophen into its reactive metabolite N-acetyl-p-benzoquinone imine which is a prerequisite for hepatocyte injury. Herbal medicines are a good source for the treatment of different liver diseases including viral hepatitis B and C, alcoholic liver disease and non-alcoholic fatty liver disease. Tender leaves of *Atalantia ceylanica* (Yakinaran) is prescribed in traditional medicine for liver diseases. Tender leaves of *A. ceylanica* was collected from Kuliyaipitiya area (Kurunegala district). Three individual plant extracts prepared by aqueous extraction, according to the procedure followed by Ayurvedic practitioners were used to study hepato-protective activity of *A. ceylanica*. Different concentrations of the *A. ceylanica* extract was co-exposed with acetaminophen (30 mM) to HepG2 cell line. Positive control with acetaminophen and a negative control were also carried out along with the experiment. MTT assay, AST and ALT leakage were determined after 24 hours. The EC₅₀ value for acetaminophen was 19.4±0.8 mM with MTT assay. No toxicity was found with the plant extract alone (EC₅₀value >3500 µg/mL) on HepG2 cells. Cell viability was significantly increased (p<0.05) after co-exposure of *A. ceylanica* with acetaminophen in a concentration dependent manner. The cell viability was increased from 31.9±2.0% (acetaminophen 30 mM) to 50.0±3.0% relative to the negative control while significant decrease in AST and ALT (p<0.05) levels, after co-exposure with the plant extract (200 µg/mL). The percentage decrease of AST and ALT were 49.8 and 49.2 relative to the positive control respectively. Our results suggest that *A. ceylanica* plant extract has hepatoprotective activity against acetaminophen induced HepG2 cell damage.

Keywords: *Hepatoprotective, Atalantia ceylanica, acetaminophen, HepG2*

Genotyping common FSHR polymorphisms in polycystic ovary syndrome (PCOS) by high resolution melting (HRM) analysis

B. Umayal¹, S.N. Jayakody², N.V. Chandrasekharan³, W.S.S. Wijesundera⁴,
Chandrika N. Wijeyaratne¹

¹*Department of Obstetrics and Gynaecology, Faculty of Medicine, University of Colombo, Sri Lanka*

²*Department of Community Medicine, Faculty of Medicine, University of Colombo, Sri Lanka*

³*Department of Chemistry, Faculty of Science, University of Colombo, Sri Lanka*

⁴*Department of Biochemistry and Molecular Biology, Faculty of Medicine, University of Colombo, Sri Lanka*

Polycystic ovary syndrome is the commonest endocrine disorder, affecting women of reproductive age with a prevalence of 5 – 10%. It is a leading cause of female infertility. PCOS often presents from adolescence. Its heterogeneous phenotype is characterized by anovulation, hyperandrogenism and polycystic ovaries on ultrasound. Since follicle stimulating hormone (FSH) exerts important biological effects, the association between PCOS and follicle stimulating hormone receptor (FSHR) polymorphisms attracts wide attention. We aimed to study the association of FSHR gene polymorphisms rs6165 and rs6166 among Sri Lankan women with PCOS. Consecutive women with PCOS (n=55) and controls (n=110) were recruited. Pre-treatment baseline clinical, anthropometry and biochemical parameters (e.g FSH, LH, Prolactin, Testosterone, fasting blood glucose levels) were measured in all. Venous blood was collected and DNA was extracted using column based kit method. PCR and high-resolution melting assays were carried out for 2 common polymorphisms of the FSHR gene: rs6165 (Ala307Thr) and rs6166 (Ser680Asn). The genotype frequencies of the FSHR Ala307Thr and Ser680Asn polymorphisms were not statistically different between PCOS patients and controls (p-value>0.05). The genotype frequencies for both polymorphisms in control subjects were GG (26.4%), GA (48.2%), AA (25.5%) and in cases were GG (23.6%), GA (47.3%), AA (29.1%) respectively. Genetic association studies showed no significant association of rs6165 and rs6166 polymorphisms with PCOS (chi square =1.585, p=0.453). In conclusion, the Ala307Thr and Ser680Asn polymorphisms of FSHR genes are not associated with PCOS in Sri Lankan women.

Keywords: PCOS, FSHR, High resolution melting analysis

Histopathological features predictive of liver metastasis in a cohort of patients with colorectal carcinoma: A prospective study

M.I.M. De Zoysa², D.N. Samarasekera², G.K. Wijesinghe¹, L.D.J.U. Senarath³,
M.D.S. Lokuhetty¹

*Departments of Pathology¹, Surgery² and Community Medicine³, Faculty of Medicine,
University of Colombo, Sri Lanka*

Tumour and nodal stages are established prognostic factors of colorectal carcinoma (CRC). Other histopathological prognostic factors need prospective evaluation. The objective was to study histopathological features of CRC predictive of liver metastasis (LM) on 5-year follow-up (5yf). Following primary resection at the National Hospital (06.2008–01.2011), 86 consecutive CRC patients were recruited. Patients who had undergone neoadjuvant chemo-irradiation to downstage the tumour were excluded. The researcher and pathologist reviewed selected slides at a double head microscope, histological parameters were assessed and findings recorded. Parameters assessed were tumour stage(pT), nodal stage(pN) tumour grade (defined for this study as high-grade if <50% glandular/tubular/acinar differentiation, high-grade nuclei and abundant mitotic figures and low-grade if >50% glandular/tubular/acinar differentiation, low-grade nuclei, sparse mitotic figures), tumour margin(pushing/infiltrative/combined) tumour budding (isolated tumour cells/clusters of >5 at invasive front), lymphoplasmacytic infiltrate at host-tumour interface(semi-quantitatively assessed-SQA, minimal/extensive), extensive intra/extracellular mucin(SQA, present/absent), extensive tumour necrosis(>50% of a high power field), lymphovascular invasion, intra-tumoral eosinophils(SQA, minimal/extensive) and tumour cell borders(distinct/indistinct)]. LM was determined by radiological assessment on 5yf. Logistic regression analysis was used to analyse histopathological features predictive of liver metastasis. pT3(n=56,65%) and pN0(n=51,59%) tumours predominated. There were 2 mucinous carcinomas. All other tumours were adenocarcinomas (not otherwise specified). Forty-six out of 86 (52.8%) patients developed LM on 5yf. None of the histopathological features were significant on univariate analysis. Two-tiered tumour grade as defined in this study [OR=3.4(95% CI 0.6-15.7);p=0.008], tumour budding[OR=4.9(95% CI 1.0-22.6);p=0.041] and extensive intra/extracellular mucin[OR=7.4(95% CI 1.8-55.5);p=0.048] were significant on multivariate analysis.

Keywords: *Colorectal carcinoma, Tumour Stage, Nodal Stage, Histopathological features*

Prevalence of the thrombotic *PAI-1* 4G allele in a Sri Lankan cohort

B.A.P. Sajeewani^{1,2}, D.P.A.A.U. Ranasinghe², R.W. Mendis², L.H. Chandi², A.A.G. S. Abeysekera², V.H.W. Dissanayake^{1,2}

¹*Human Genetics Unit, Faculty of Medicine, University of Colombo, Sri Lanka*

²*Asiri Center for Genomics and Regenerative Medicine, Sri Lanka*

Plasminogen activator inhibitor 1 (*PAI-1*) is an inhibitor of fibrinolysis. The *PAI-1* 4G allele is known to increase the risk of thrombophilia and is associated with sub fertility and recurrent pregnancy loss. The objective was to report the prevalence of this 4G allele in a cohort of Sri Lankan patients with sub fertility and recurrent pregnancy loss. ARMS PCR was carried out to genotype the *PAI 1*-4G/5G allele. A database of all analysed tests from 27.02.2016 to 28.06.2017 in our lab was maintained prospectively and analysed retrospectively. A total of 90 samples were tested. All were female of age range 20 to 52 years. The genotype frequencies were 4G/4G (22%), 4G/5G (49%) and 5G/5G (29%). The prevalence of high risk 4G allele was 46.67%. This study demonstrates the presence of the 4G allele in patients with sub fertility and recurrent pregnancy loss in the Sri Lankan population. The odds ratio for the risk of subfertility and recurrent pregnancy loss in a dominant allele model (4G/4G + 4G/5G) has previously been reported to be 2 (95% CI 0.8–5.2) in a white western European population. In this Sri Lankan cohort 71% of women had the high-risk genotype. Therefore, it is recommended to test for this variant in Sri Lankan women with sub fertility and recurrent pregnancy loss and institute appropriate treatment.

Keywords: *PAI-1, Sub fertility, 4G/5G allele, Dominant, Recurrent pregnancy loss*

Comparative study of gross appearance of the amniotic membrane and culture characteristics of amniotic epithelial cells in gestational diabetes mellitus (GDM) vs. non-GDM Pregnancies

D. Hettiarachchi, C. Ishak, V. H.W. Dissanayaka, H. W. W. Goonasekara
Human Genetics Unit, Faculty of Medicine, University of Colombo, Sri Lanka

Gestational Diabetes mellitus (GDM) is any degree of glucose intolerance with onset or first recognition during pregnancy. Amniotic epithelial cells (AEC) form a monolayer in the inner surface of the amniotic membrane (AM) encasing the amniotic fluid and foetus. Hyperglycaemic milieu in GDM cause adaptive structural and functional changes in the placenta. The *in-vitro* culture features of AEC in GDM have not been well described. We compared the gross appearance of the AM and cell culture features of AEC in GDM with non-GDM mothers undergoing elective Caesarian section in the De Zoysa Maternity Hospital Colombo. Samples were collected following ethical approval and informed consent. AM was separated from its chorion and transparency assessed and graded; +3 (clear) to +1 (hazy). AEC were obtained following trypsinisation using 0.025% Trypsin in EDTA and cultured in DMEM + 10% FBS in humidified atmosphere of 5% CO₂ at 37°C. Cell viability and proliferation were assessed until passage (P) 3. Ten GDM and 14 non-GDM term placentae were studied. Translucency assessment in GDM AM; Grade +1 (n=8) and Grade +2 (n=2). All non-GDM AM scored +3. The number of viable AEC became lesser with each passage in GDM compared to non-GDM cultures. (Mean cell viability for GDM: P0=0.83x10⁶, P1=1.01x10⁶, P2=0.89x10⁶, and P3=0.83x10⁶ and for non-GDM: P0= 0.92x10⁶, P1= 0.96x10⁶, P2=1.06x10⁶, P3=1.05x10⁶). Time taken to reach 80% confluency was shorter in the non-GDM cultures from P1 to P3. GDM cultures cells proliferated rapidly at P0 and P1 but took longer time to reach 80% confluency in P2 and P3. There were differences between the AM gross morphology and AEC cell growth in the GDM group when compared to non-GDM. These could be related to the structural and functional changes occurring in GDM placenta. Further studies are required to validate AEC culture features and assess the impact of these changes in foetal growth in GDM.

Keywords: *Gestational Diabetes Mellitus (GDM), Amniotic membrane, Amniotic epithelial cells, Cell culture, Placenta*

Chromosomal abnormalities in a cohort of women with primary amenorrhoea

U.G.I.U. Kariyawasam¹, P.H.J. Cooray¹, P.K.D.S. Nisansala¹, W.A.K.S. Saumya²,
A.D.S. Perera², B.A.T. Amalka², C.S. Paththinige¹, U.N.D. Sirisena¹,
V.H.W. Dissanayake^{1,2}

¹*Human Genetics Unit, Faculty of Medicine, University of Colombo, Sri Lanka*

²*Asiri Centre for Genomic and Regenerative Medicine, Colombo, Sri Lanka*

Primary amenorrhoea (PA) is often the result of genetic abnormalities leading to primary ovarian failure or anatomic abnormalities. The genetic abnormalities can be studied both at the cellular and molecular level aiming at chromosomal abnormalities and gene mutations. The objective of this study was to describe the frequency and spectrum of chromosomal abnormalities in a cohort of Sri Lankan women with primary amenorrhea. A database of karyotype results of all the patients with PA tested in our laboratories between January 2012 and May 2017 was maintained prospectively and analyzed retrospectively. Four hundred and twenty-five (425) patients with PA were tested. The mean age was 19.8 years (range: 12-38 years). Of these, 166 (39.1%) patients had chromosomal abnormalities. The commonest cytogenetic abnormality was classical Turner syndrome (TS); 45,X (13.2%). Variant forms of TS were found in 16.2% of patients. The abnormalities in this group included, 46,XX,del(X)(p11-p22) (3.1%), 45,X/46,XX,del(X)(q26-q28) (0.2%), 45,X/46,XX (3.7%), 46,X,i(X)(q10) (3.1%), 46,X,i(X)(q10)/45,X (3.1%), 46,X,i(X)(q10)/46,XX (0.5%), 45,X/47,XXX (0.9%), 45,X/46,X,+mar (0.5%), 45,X/46,X,r(X) (0.47%) and 45,X/46,X,idic(X)(q22). Other chromosomal abnormalities which were detected in 10.2% of the patients included 46,XY (8.9%), 45,X/46,XY (0.5%), 47,XXX (0.2%), 47,XX,+mar/46,XX (0.2%), 46,XX,inv(9)(p11;q13) (0.2%) and 45,X,inv(9)(p11;q13)/46,XY,inv(9)(p11;q13) (0.2%). The frequency and spectrum of chromosomal abnormalities in this cohort is similar to the rate that we have previously reported for the 8 years period from January 2005 to December 2011 from our laboratories, which was (34.0%). In this study 4 out of 10 patients (39.1%) with PA showed chromosomal anomalies. This highlights-the importance of cytogenetic testing in patients with PA.

Keywords: *Primary Amenorrhoea, Cytogenetics, Karyotype, Chromosomal Abnormalities*

Next generation sequencing study of Mesenchymal Stem Cells in *de novo* Myelodysplastic Syndromes

A.J.I.S. Rathnayake, N.F. Neththikumara, V.H.W. Dissanayake,
H.W.W. Goonasekera

Human Genetic Unit, Faculty of Medicine, University of Colombo, Sri Lanka

Myelodysplastic Syndromes (MDS) are a complex spectrum of bone marrow stem cell disorders. Mesenchymal stem cells (MSCs) are considered as precursors of many cell types in marrow stroma that regulate haematopoiesis and thought to be altered in MDS. The molecular basis for altered properties of MDS derived MSCs is poorly examined. In this study, we determined the mutation profiles of *de novo* MDS- MSCs by comprehensive analysis of 54 genes by next generation sequencing on MiSeq platform (Illumina). Our study showed that the MDS-MSCs have mutations in *DNMT3A*, *TET2*, *EZH2*, *ASXL1*, *BCOR/BCORL1* and *KDM6A* genes. These genes were found to be mutated in more than 30% of patients. *NRAS*, *KIT*, *RAD21*, *ATRX*, *KMT2A* and *CUX1* genes were also frequently mutated. Refractory anaemia with excess blasts (RAEB) showed the highest number of mutations and *KDM6A* and *KIT* were common to all RAEB patients. *ETV6*, *CUX1*, *SMC3* mutations were found in MSCs of patients with low hemoglobin levels. *KIT* and *PDGFRA* genes were observed to be co-mutated in two patients. Marrow fibrosis was observed in one RAEB patient who showed a *CALR* mutation. T665P in PDGRFA, M541L & H485P of KIT, H1367P and H1542P of BCOR, L1742W of TET2, H588P of DNMT3A and T181P and T833P of KDM6A were observed recurrently. The study showed mutations particularly affecting the epigenetic mechanisms and signalling pathways of MSCs. The mechanisms of these mutations are yet to be elucidated. Presence of mutations in gene regions that are known to be mutated in MDS-blasts, suggest that the causative mutagen(s) may induce parallel mutations in the MSC compartment. The knowledge of the mutation patterns of both hematopoietic and mesenchymal cell compartments are equally important in understanding the disease pathogenesis and before directing patients to marrow transplantation or targeted therapies.

Keywords: *Myelodysplastic syndromes (MDS), mesenchymal stem cells (MSCs), mutations, next generation sequencing*

A next generation sequencing approach to understand the mutational status of myelodysplastic syndromes' haematopoietic stem cells

W.M.M.S. Bandara, N.F. Neththikumara, H.W.W. Goonasekera,
V.H.W. Dissanayake

Human Genetics Unit, Faculty of Medicine, University of Colombo, Sri Lanka

Myelodysplastic syndromes (MDS) are clonal haematopoietic stem cell (HSC) disorders in the bone marrow (BM). Mutational status of HSCs in MDS provides insights into the disease biology. We performed a comprehensive mutational analysis of HSCs of MDS by Next Generation Sequencing (NGS) based myeloid gene panel which targets 54 genes frequently mutated in myeloid malignancies. Bone marrow samples of 10 MDS patients were collected. HSCs were isolated from BM and purity was evaluated by flow cytometry. HSCs were cultured *in vitro* and DNA was isolated. DNA libraries were prepared using TruSight myeloid sequencing panel and next generation sequencing was performed on a MiSeq sequencer.

We identified 322 novel mutations in 41 genes. Overall 9/10 patients carried at least one mutation of which 80% showed a normal karyotype. *DNMT3A*, *TET2*, *BCORL1*, *CUX1*, *KDM6A*, *STAG2* and *BCOR* were mutated in >70% of patients. Patients with excess blasts carried the highest mutational burden. Pathways that have highly mutated include transcription regulation (*U2AF1*, *SRSF2*), chromatin modification (*EZH2*, *ASXL1*), DNA methylation (*TET2*, *IDH1/2*) and cell signaling. Patients with erythroid dysplasia showed mutations in *ABL*, *ETV6*, *FLT3*, *KRAS*, *SMC1A* and *TP53*. Majority of the mutations (>97%) had allele frequencies < 20%. We detected 14 mutations with known clinical correlations in various malignancies. Mutations in *BCOR* (39916488), *KMT2A* (118374070), and *SF3B1*(198267490) were seen in >3 patients. Our findings confirm that higher risk MDS subtypes show more mutated genes. Mutations in *ASXL1*, *STAG2*, *TET2* and *IDH1* may play a vital role in MDS to AML transformation in our population. These mutations have shown a similar role in other MDS populations. More patients could be screened for *BCOR* (39916488), *KMT2A* (118374070), and *SF3B1* (198267490) mutations in order to check their usefulness as diagnostic markers. Overall the mutational profiling is becoming essential in diagnosis of MDS especially the patients with normal karyotypes.

Keywords: *Myelodysplastic syndromes, HSC, mutations, sequencing,*

Does timing of cord clamping (CC) and/or initial skin to skin contact (SSC) between mother and baby affect neonatal behaviour? A randomized controlled trial among women undergoing elective caesarean section (ECS) at a Tertiary Care Maternity Hospital in Colombo, Sri Lanka

M.N. Lucas¹, A. Sakalasuriya³, R. Isman³, D. Samaranayake², H. Senanayake³

¹*Department of Paediatrics, University of Colombo, Sri Lanka*

²*Department of Community Medicine, University of Colombo, Sri Lanka*

³*Department of Obstetrics and Gynaecology, University of Colombo, Sri Lanka*

The objective was to determine if timing of CC and SSC alone or in combination results in affect behaviour in neonates born to women undergoing ECS. Women awaiting ECS with spinal anaesthesia at ≥ 37 weeks gestation admitted to the University Unit, of a Tertiary Care Maternity Hospital, Sri Lanka were screened. Rhesus positive mothers with normal antenatal scans, vertex presentation were recruited. Healthy babies with birth weight $> 10^{\text{th}}$ percentile were included and allocated into 4 groups: Group 1- immediate-SSC (ISSC) and early-CC (ECC), Group 2- ISSC and delayed-CC (DCC), Group 3- early-SSC (ESSC) and ECC and Group 4- ESSC and DCC, using block randomization. DCC involved CC 90s after delivery and ECC was CC in ≤ 90 s. ISSC occurred within the first minute and ESSC between 1-30 minutes of birth. Baby was assessed by a neonatologist certified in neonatal behaviour assessment scoring (NBAS/Brazelton), who was blinded about group allocation. NBAS were clustered to 7 groups (Lester): habituation, orientation, motor, range of state, regulation of state, autonomic stability and reflexes. Ethical approval was obtained from Faculty of Medicine, University of Colombo. Statistical analysis was done using Kruskal- Wallis non-parametric test via SPSS24. This is an ongoing study, which includes a preliminary analysis of the data obtained so far. Standard formula couldn't be used to calculate sample size due to the absence of similar studies. Power of the study will be calculated based on the differences elicited in the NBAS scores, as the study progresses. 90 babies were recruited with 25, 22, 22 and 21 babies in groups-1, 2, 3, 4 respectively. Age, gestation, birthweight, income, education and ethnicity were not significantly different between the groups. State regulation was higher in ESSC ($p=0.036$) compared with ISSC. There was no significant difference between ECC and DCC. Timing of SSC appears to affect neonatal behaviour. We would be able to confirm/refute this finding as the study progresses.

Keywords: *Delayed cord clamping, Early cord clamping, Early skin to skin care, Immediate skin to skin care*

Cytotoxicity and apoptosis inducing ability of Triphala

J.W.N. Yasara, Preethi Soysa

Department of Biochemistry and Molecular-Biology, Faculty of Medicine, University of Colombo, Sri Lanka

Triphala is a valuable herbal formulation used in Ayurvedic practice. The therapeutic potential of Triphala has been evaluated in various studies. It is composed of equicombination of *Emblica officinalis*, *Terminalia bellerica* and *Terminalia chebula* fruits. The objective of this study is to determine the cytotoxicity and ability to induce apoptosis of Triphala, towards RD cells. The Triphala decoction was prepared according to Sri Lankan Ayurvedic practice. Equal amount (20 g) of each fruit were mixed and boiled with 1920 ml of deionized water until the volume came down to 1/8 of the initial volume (240 ml) and freeze dried. Lyophilized powder of the decoction was dissolved in deionized water and sterilized using a nylon filter. The cytotoxicity of Triphala was determined using Sulforhodamine B (SRB) and Lowry's assays after exposing RD cells to Triphala at different concentrations (10-1000 μ g/ml) for 24 hours. The apoptosis inducing ability was evaluated using Ethidium Bromide/Acridine Orange dual staining (EB/AO), after treatment. DNA fragmentation of RD cells was evaluated after exposing of Triphala for 24 and 48 hours. EC50 values for SRB and Lowry's assays are 795.0 ± 50.2 μ g/mL and 752.5 ± 70.9 μ g/mL respectively. Characteristic morphological features of apoptosis including cellular shrinkage and fragmentation of DNA were observed with EB/AO staining, at concentration >400 μ g/mL. DNA ladder pattern, which is a hallmark feature of apoptosis was observed when RD cells were treated with Triphala for 48 hours. However, fragmentation was not observed in the genomic DNA, after incubating cells with Triphala for 24 hours. In conclusion, Triphala used in the present study showed a cytotoxicity towards RD cells, through induction of apoptosis. However, the DNA fragmentation, which is a feature of the apoptosis, was seen 48 hours post exposure samples.

Keywords: *Triphala, Cytotoxicity, Apoptosis*

Prevalence and trends of the diabetes epidemic in Middle East: a systematic review

V. Nishanthika¹, K.P.C. Dalpatadu¹, Shaea Ayed Alkahtani², R. Jayawardena¹

¹*Department of Physiology, Faculty of Medicine, University of Colombo, Sri Lanka*

²*Department of Exercise Physiology, College of Sport Sciences and Physical Activity, King Saud University, Saudi Arabia*

Diabetes mellitus poses a significant global health concern with an estimated prevalence of 151 million in 2000 which has increased to 415 million in 2015 and it is expected to go up to 642 million in 2040. More devastating impact of this enormity of diabetes problem is experienced by middle and lower income countries including those in the Middle East region. The aim of this study was to analyse the prevalence and trends of the diabetes epidemics in Middle East region. Relevant data regarding the prevalence of diabetes was obtained from Scopus, Web of Science and Medline database using the following keywords "diabetes", "diabetes mellitus", "prediabetes", "prevalence" and "epidemiology". Searches yielded 323 articles out of which 173 articles were chosen for evaluation at title level and 31 at full paper level. Studies in English and on adults (≥ 18 years) were included. Studies that were most recent, nationally representative or with the largest sample size were included. Age-standardized data was used. Prevalence of diabetes varies across the region with the highest prevalence noted in Bahrain where the prevalence was 28.1% and the lowest in Israel (4.1%). The prevalence of prediabetes ranged from 2% in Yemen to 20.2% for UAE for impaired fasting glucose. Most studies focused on urban area where the prevalence was as high as 31.6% (in Riyadh, Saudi Arabia) whereas the studies done on rural area reported that diabetes prevalence ranges from 4.8% in Iraq to 9.8% in Palestine. This analysis revealed an upward trend in the prevalence of diabetes across the region with the highest increase noted in Iran with 35.1% increase in prevalence of diabetes over the period of 2005 to 2011 (OR: 1.04, 95% CI: 1.01–1.07, $p = 0.011$). Similarly, a study done in Riyadh, Saudi Arabia showed that the prevalence of diabetes has increased from 21.9% in 2004 to 31.6% in 2011 (males; 22.4% to 34.7%, females; 21.5% to 31.6%). This study estimates the prevalence of diabetes to rise by about 0.8% in males and 0.6% in females annually ($p < 0.0001$). In conclusion, diabetes mellitus is rising in Middle East countries and it is imperative that measures are taken promptly to overcome this huge epidemic to cope with the rising burden of diabetes.

Keywords: *Diabetes, Middle East, prevalence, trends, epidemiology*

FACULTY OF SCIENCE



Science for Sustainable Development

17 November 2017

**MESSAGE FROM THE DEAN,
FACULTY OF SCIENCE**

Senior Professor K. R. Ranjith Mahanama



It is my great privilege and pleasure to convey this message to the proceedings of the Annual Research Symposium 2017 of the University of Colombo. The theme this year of the Faculty of Science is “Science for Sustainable Development” and it reflects the innovative research carried out by our research students under the able guidance of the proficient academic staff. The presentations at the Faculty of Sciences will be held on 17th November 2017, highlighting current research outcomes of our postgraduate students from a wide array of disciplines in science and mathematics.

In continuing with our vision, the Faculty of Science provides a foundation for intellectual and creative experiences through research, scholarship, and innovative activity. As the premier science faculty in the island, the faculty plays a prominent role in the larger global community as scholars and educators and in preparing students to become leaders in the world in which they live. We create lifelong relationships with our students, foster collaboration, promote quality, recognize excellence, and ensure the thoughtful stewardship of resources.

The work done in the preparation of abstracts and making the presentations is gratefully acknowledged. My sincere gratitude is extended to the reviewers and the research committee for the successful completion of their assignments. On behalf of the academic and non-academic staff of the Faculty of Science, I express my profound gratitude to the organizing committee and all the participants at this Annual Research Symposium 2017, and my heartfelt wishes for a very rewarding and productive event.

FACULTY OF SCIENCE

List of Abstracts

1. Variation of free amino acid profile among selected traditional rice varieties (*Oryza sativa* L.) in Sri Lanka 237
G.V.V. Liyanaarachchi, K.R.R. Mahanama, H.P.P.S. Somasiri, P.A.N. Punyasiri and J. D. Kottawa-Arachchi
2. In-silico approaches to construct novel heavy metal sensing DNA cassettes: Towards a potent biosensor capable of detecting minor levels of Cd²⁺ heavy metals 238
H.M.L.P.B. Herath, Y.I.N.S. Gunawardene, W.R.M. de Silva, K.M.N. de Silva, Luis O.B. Afonso and R.S. Dassanayake
3. *In vitro* tyrosinase, hyaluronidase inhibitory and antioxidant activities of *Artocarpus heterophyllus* 239
G.D. Liyanaarachchi, R. Samarasekara, K.R.R. Mahanama and K.D.P. Hemalal
4. *piggyBac* mediated genetic transformation of dengue resistant genes into Sri Lankan *Aedes aegypti* strain - a step towards developing a dengue resistant transgenic *Ae. aegypti* strain 240
H.P.B.K.D. Ramyasoma, R.S. Dassanayake, Y.I.N.S. Gunawardene, N.V. Chandrasekaran, M. Hapugda and W. Abeyewickreme
5. Effect of the ratio between aryl halide and nucleophile on copper catalyzed modified Ullmann condensation reaction 241
M.A.L. Fernando, D.P. Dissanayake and D.T.U. Abeytung
6. α -Amylase and protein glycation inhibitory activity of the aqueous extract of *Flueggea leucopyrus* 242
V.S. Thrikawala, S.A. Deraniyagala, S.C.D. Fernando and D.N. Udukala

7. A novel bio coagulant for efficient removal of acid dyes from textile dye solution 243
D. Tissera Nadeeka, Ruchira N. Wijesena, Harini Yasasri, Rohini M. de Silva and K.M. Nalin de Silva
8. Aggregation of chitin nanofibers and silver nanoparticles in in-situ medium 244
Ruchira N. Wijesena, Nadeeka D. Tissera, Rohini M. de Silva and K.M. Nalin de Silva
9. A novel set of primers for the sequencing-based typing of HLA-A, -B, -C, -DRB1 and -DQB1 loci of Sri Lankans 245
P.C.D. Perera, B.D.N. Upamali, Y.I.N.S. Gunawardena, N.V. Chandrasekharan and R.S. Dassanayake
10. Synthesis of morphologically different nano and microstructured porous hydroxyapatite (HAp) matrices *via* facile synthetic approaches 246
C. Danushika, Rohini Manatunga, M. de Silva and K. M. Nalin de Silva
11. Synthesis of hollow microspheres of hydroxyapatite *via* the polymer-surfactant supramolecular system and its application in drinking water purification 247
A.K.D. Veromee, K. Wimal Siri, J.M.A. Roshan, B. Jayasinghe, Rohini M. de Silva, K.M. Nalin de Silva and Dhammike P. Dissanayake
12. Comparative adsorption studies for HAP bio polymer nano composites for the removal of Pb²⁺ and Cd²⁺ from polluted water 248
Shanika Fernando, Rohini M. de Silva, K.M. Nalin de Silva and Dhammike Dissanayake

13. A novel catalyst, meta-titanic acid synthesized from Pulmuddai Ilmenite 249
for photocatalytic mineralization of Methylene blue dye
*Nadeera Dilshan Wickramasinghe, H.D.A. Chathumal Jayaweera,
Rohini M. de Silva and K.M. Nalin de Silva*
14. Estimation of radiation dose around the Lakvijaya coal power plant due 250
to radionuclide concentrations in soil
D.R. Abeydeera, R. Hewamanna, M.P. Dias and P. Mahawatta
15. Ionization chamber based dosimetric model for small field photon beam 251
radiotherapy
*R.M.G.C.S.B. Jayatissa, S. Kulatunga, K.U.A.W. Kumara and
S. Sarasanandarajah*
16. Systematic modulation of band edge position of Cu₂O with deposition 252
bath pH for efficient photocatalytic water splitting
*K.D.R.N. Kalubowila, J.M.D.R. Jayasundara, K.M.D.C. Jayathilaka,
M.S. Gunewardene, D.P. Dissanayake and J.K.D.S. Jayanetti*
17. Performance of earth enhancing compound under high impulse voltage 253
and current conditions
*A.P.L. Chandimal, P. Hettiarachchi, S. Nanayakkara, N. Sapumanage,
V. Corray, M. Rahman and M. Fernando*
18. Simulation of the performance of Faraday's cage type direct lightning 254
protection system
N. Sapumanage, M. Fernando and V. Cooray
19. The effect of galaxy peculiar motion on the calculation of time delay 255
between gravitationally lensed images
Gihan Weerasekara, T. Wickramasinghe and K.P.S.C. Jayaratne

20. Swift XRT X-ray flux variability of the BL Lacertae object from 2005 to 2017 256
K.L.I. Gunawardhana, K.P.S.C. Jayaratne and A.U. Abeysekara
21. Light curve analysis of CC Andromeda 257
J. Adassuriya, K.P.S.C. Jayaratne and S. Ganesh
22. Design and construction of a two-wheeled robot with robot operating system (ROS) based navigational capabilities 258
R.A.D.D. Dharmasiri, D.D.C. Wickramarathna and M.K. Jayananda
23. Molecular dynamics simulation study of the rotational diffusion of liquid methane 259
W.A.M. Madhavi, Samantha Weerasinghe and K.I. Momot
24. Implications of a vector-host model on dengue vector control strategies 260
J.K. Ratnayake, M.S. Gunewardene and I.C. Perera
25. Exploring the factors driving e-learning adoption: Farmer satisfaction in e-learning 261
N.P. Vidanapathirana, K. Hirimburegama, S.A.P. Nelka and S.L. Nawarathn
26. Effect of host crop on mass propagation of vesicular arbuscular mycorrhizae 262
W.A.G.A.B. Chandrasena, C.M. Nanayakkara, H.A. Sumanasena and D.N. Samaraweera
27. Sri Lankan dairy yeasts: isolation, identification and production of single cell protein from whey 263
D.U. Rajawardana, C.M. Nanayakkara and I.G.N. Hewajulige

28. Physical inactivity among university students: A case study on first year undergraduates at the University of Colombo 264
K.Y.P.K. Weerasekara, R.V. Jayatillake and R.A.B. Abeygunawardana
29. Factors associated with the consumption of powdered and fresh milk: A case study in the Bandaragama Divisional Secretariat 265
P.L.J.U. Sampath and W.M.L.K.N. Wijesekara
30. Influencing factors to the number of other vehicles involved in light vehicle accidents in Sri Lanka: One-Inflated Poisson Regression approach 266
D.R.T. Jayasundara, S. Viswakula and C.H. Magalla
31. Selection of a support vector machine for the development of an artificial neural network for the identification of tiger beetles (Coleoptera, Cicindelinae) of Sri Lanka 267
D.L. Abeywardhana, Y.W. Mallawarachchi, C.D. Dangalle and A. Thotagamuwa
32. A comparison of genetic variability of dengue vectors using microsatellite and EPIC markers 268
M.D. Nirmani, K.L.N. Perera and G.H. Galhena
33. Characteristics of the vocal repertoire of *Dinopium* flamebacks in Sri Lanka 269
S.P. Fernando, D.E. Irwin and S.S. Seneviratne
34. Predicting the distribution of mixed species bird flocks using ecological niche modeling 270
J.N. Perera and S.S. Seneviratne

35. Population structure of free ranging Asian elephants in Udawalawa National Park, Sri Lanka 271
Ashoka D. G. Ranjeewa, Devaka K. Weerakoon and P. Fernando
36. Molecular detection of human papillomavirus infection in oral and oropharyngeal cancers in Sri Lanka 272
I. Wathupola, K.A. Perera and P.V. Udagama
37. Risk factors associated with oral and oropharyngeal cancers in Sri Lanka: Importance of human papillomavirus infection 273
I. Wathupola, K.A. Perera and P.V. Udagama
38. Effect of Sri Lankan wild type mature leaf concentrate of *Carica Papaya* on adipogenic differentiation of in house established human mesenchymal stem cells 274
V.L. Udalamaththa, P.M.S. Ratnayake, P. Soysa, S. Wijeratne and P. V. Udagama

**Variation of free amino acid profile among selected traditional rice varieties
(*Oryza sativa* L.) in Sri Lanka**

G.V.V. Liyanaarachchi¹, K.R.R. Mahanama², H.P.P.S. Somasiri¹, P.A.N. Punyasiri³,
J.D. Kottawa-Arachchi⁴

¹*Industrial Technology Institute, Colombo 07, Sri Lanka*

²*Department of Chemistry, University of Colombo, Sri Lanka*

³*Institute of Biochemistry, Molecular Biology and Biotechnology, University of
Colombo, Sri Lanka*

⁴*Tea Research Institute of Sri Lanka, Talawakelle, Sri Lanka*

The study was aimed at evaluating the variation of free amino acid (FAA) content in 7 selected traditional rice cultivars grown in Bathalegoda and Bombuwala. The rice cultivars were selected based on their health benefits and their different acceptability scores among the consumers. The sampling was conducted in Maha season during the year 2015. The FAAs in rice were determined by a validated method on an Agilent Zorbax Eclipse AAA column with pre-column derivatization with o-Phthaldialdehyde (OPA) reagent using high performance liquid chromatography (HPLC)-fluorescence detection. Results revealed that a significant variation was observed among the overall FAA profiles among the studied rice cultivars. Among the FAAs, relatively higher levels of aspartic acid, glutamic acid, asparagine and alanine were observed in all the cultivars while methionine was the least present FAA. According to the results of the discriminant analysis, based on the FAA profiles, among the seven rice varieties, Soodurusamba and Pachchaperumal were grouped in two distant clusters from the rest of the cultivars exhibiting unique FAA profiles while Suduheenati, Suwandasamba, Masuran, Dikwee and Godaheenati were closely clustered suggesting the possibility of similar genetic background. This significant variation of FAA profile indicates the possibility of using the FAA profile in characterization of traditional rice cultivars. Therefore, the present study, being the first comprehensive investigation ever in the country with respect to FAA profiling of rice, provides important reference in finding the relationship among FAA profile and authenticity, taste, health claims. Furthermore, the use of FAA profile in characterization of rice cultivars can be used to identify elite germplasm accessions to be popularized in future breeding programs.

Keywords: *Free amino acids profile, traditional rice, Sri Lanka*

**In-silico approaches to construct novel heavy metal sensing DNA cassettes:
Towards a potent biosensor capable of detecting minor levels of Cd²⁺ heavy
metals**

H.M.L.P.B. Herath¹, Y.I.N.S. Gunawardene², W.R.M. de Silva¹, K.M.N. de Silva¹,
Luis O.B. Afonso³, R.S. Dassanayake¹

¹*Department of Chemistry, University of Colombo, Sri Lanka*

²*Molecular Medicine Unit, Faculty of Medicine, University of Kelaniya, Sri Lanka*

³*Deakin University, Geelong, Australia. School of Life and Environmental Sciences,
Centre for Integrative Ecology, Warrnambool Campus, Australia*

In the recent past, the quality of life has been affected by heavy metal contamination of the water reservoirs and agricultural soils due to inappropriate agricultural practices. These heavy metals tend to accumulate down the food chains, causing major health issues to humans and other animals. In the Sri Lankan regions where the main agricultural paddy fields are under reservoir-based cascade irrigation, Chronic Renal Failure (CRF) has reached crisis proportions. Both acute and chronic exposures to heavy metals such as cadmium, lead, mercury and thallium have been associated with renal dysfunction. Under these circumstances, the demand for a reliable, cost effective and real-time detection method to appraise the bio-available level of heavy metal in Sri Lankan water reservoirs is increasing. In order to come up with an effective heavy metal biosensor, initial bioinformatics validations on the DNA cassette constructs are critical. Thus, the current study depicts a stepwise bioinformatics approach to construct three DNA cassettes that are capable of sensing the presence of minor Cd²⁺ quantities as absorbed into a biological system. The Zebrafish MT2 gene promoter, Zebrafish SmtB gene promoter and CadA/CadR operon system were used as heavy metal sensitive elements containing promoter regions. Out of three, 2 constructs (MT2 based and SmtB based) are compatible to be incorporated into Zebrafish while the CadA/CadR operon system based construct was designed to be transformed into either in *Escherichia coli* (BL21) or *Pseudomonas aeruginosa*. Taken together, the present biotechnological approach direct our future studies towards the use of Zebrafish and bacteria as biological tools that are genetically engineered to produce measurable signals when in contact with the bio-available metal ions.

Keywords: *Zebrafish, Escherichia coli, Pseudomonas aeruginosa, cadmium, biosensors*

***In vitro* tyrosinase, hyaluronidase inhibitory and antioxidant activities of
*Artocarpus heterophyllus***

G. D. Liyanaarachchi¹, R.Samarasekara¹, K.R.R. Mahanama², K.D.P. Hemalal³

¹*Industrial Technology Institute, Colombo, Sri Lanka*

²*Department of Chemistry University of Colombo, Sri Lanka*

³*Rocky Mountain Soap, Co., Canmore, Canada*

Reactive oxygen species (ROS) and free transition metal ions cause oxidative damage to various biomolecules resulting in aging and skin pigmentation. *Artocarpus heterophyllus* (Moraceae) has been used in traditional folk medicine against inflammation and malarial fever. This study looks at determining elastase, tyrosinase and hyaluronidase inhibitory activities of the ethanol extract of the Sri Lankan variety, along with antioxidant activity as there is a lacuna in the research. Ethanol extracts of air-dried and powdered bark, leaves, and fruits were evaluated *in vitro* for tyrosinase, hyaluronidase and elastase inhibitory activities and the antioxidant activity by DPPH (1, 1-diphenyl-2-picrylhydrazyl) free radical scavenging, ferric ion reducing antioxidant power (FRAP) activity, oxygen radical absorbance capacity (ORAC) assays, and total phenolic content (TPC), total flavonoid content (TFC) by following standard protocols. Ethanol extract of the bark showed better tyrosinase inhibitory activity having IC₅₀ value of 125.2±6.8 µg/mL compared to that of leaf (45% at 100 µg/mL) and fruit (IC₅₀ 1196 ±138 µg/mL). The positive control Kojic acid gave an IC₅₀ value of 76.6±0.8µg/mL. The bark exhibited good hyaluronidase inhibitory activity (52.7% at 500 µg/mL) comparative to the positive control tannic acid (90.3% at 500 µg/mL). Ethanolic extract of bark and leaves exhibited good DPPH free radical scavenging activity having IC₅₀ values of 46.7±0.4 µg/mL and 30.8±0.6 µg/mL compared to positive controls (green tea extract 6.7±0.1 µg/mL and trolox 5.3±0.1 µg/mL). Leaf extract showed an ORAC value of 418.7±36.7 mg TE/g extract and good FRAP value (778.2±27.4 mg TE/g of extract) compared to bark and fruit. *A. heterophyllus* showed good TPC values 20.2±2.6, 23.0±5.2, 21.7±1.3^amg GAE/g of extract for bark, leaf and fruit respectively, which are not significantly different. The fruit extract exhibited the highest TFC value compared to bark and leaf. Above results support the tyrosinase, hyaluronidase inhibitory and antioxidant activities, which support the use of *A. heterophyllus* as an ingredient in cosmetic products.

Keywords: *Tyrosinase, hyaluronidase, Artocarpus heterophyllus, antioxidant*

***piggyBac* mediated genetic transformation of dengue resistant genes into Sri Lankan *Aedes aegypti* strain - a step towards developing a dengue resistant transgenic *Ae. aegypti* strain**

H.P.B.K.D. Ramyasoma^{1,2}, R.S. Dassanayake¹, Y.I.N.S. Gunawardene², N.V. Chandrasekaran¹, M. Hapugda², W. Abeyewickreme²

¹*Department of Chemistry, University of Colombo, Sri Lanka*

²*Molecular Medicine Unit, Faculty of Medicine, University of Kelaniya, Sri Lanka*

Mosquitoes are highly abundant and unlikely to be eradicated from the lands using conventional methods that have been used for several decades. The microinjection-based germline transformation techniques developed efficiently transform genes via transposable elements such as *piggyBac*, *Hermes*, *Minos* and *Mariner* tools, thereby enabling researchers to study functional genomics as well as development of novel insect biological control applications. The objective of the study was to develop bio-manipulation techniques to transform genes to Sri Lankan wild-type *Aedes aegypti* strain and development of dengue virus resistant transgenic *Ae. aegypti* line using RNAi gene constructs mediated via *piggyBac* transposable elements. Wildtype *Ae. aegypti* were reared according to WHO guidelines. A healthy *Ae. aegypti* colony was fed with cattle blood and mosquito embryos collected were aligned on a straight line. Reporter gene and *piggyBac* transposase expression plasmids were dissolved in microinjection buffer and microinjected at the posterior pole of mosquito embryo using microinjector following optimized protocol for transformation of genes to *Ae. aegypti* mosquitoes. The embryos were hatched to obtain G₀ mosquitoes and the G₀ mosquitoes were crossed with wildtype; and G₁ mosquitoes were used to observe for DsRed fluorescent protein expression in ommatidium units of eyes of *Ae. aegypti* strain. Genomic integration of transgenic gene construct was determined by PCR using SV40 nested primers. DsRed fluorescence protein expression was observed in 7.9% (n=3) and genomic DNA integration of transgenic construct was observed in two out of seven G₁ transgenic *Ae. aegypti* line. Stable transformation of *piggyBac* elements to Sri Lankan wild-type *Ae. aegypti* mosquitoes were successfully achieved. This is the first report of genetic transformation of Sri Lankan *Ae. aegypti*, a key step towards developing a dengue resistant transgenic *Ae. aegypti* strain.

Keywords: *Aedes aegypti*, microinjection, *piggyBac*, gene transformation

Effect of the ratio between aryl halide and nucleophile on copper catalyzed modified Ullmann condensation reaction

M.A.L. Fernando, D.P. Dissanayake, D.T.U. Abeytunga
Department of Chemistry, University of Colombo, Sri Lanka

The 'Ullmann reaction' is used to synthesize aryl ethers, thioethers, and amines. The 'modified Ullmann reaction' refers to the use of ligands such as amino acids in the Ullmann reaction. In this study, different ratios of the aryl halide and the nucleophile were used to obtain an understanding about the mechanism. Two sets of experiments were carried out, one with benzylamine and the other with benzyl alcohol as the nucleophile; bromobenzene was used as the aryl halide in both sets of experiments. In each set of experiments 0.6, 1.0, 1.4, 2.0, 2.0, 2.0, and 2.0 mmol of bromobenzene were added separately to the seven test tubes. Thereafter, the same amounts of the respective nucleophile were added to the seven test tubes in reverse order. In all experiments 0.1 mmol of CuI, 0.1 mmol of proline, 1.0 mmol of K₂CO₃, and 0.6 ml of DMSO were used and the reaction was carried out at 80 °C for 3 hours in the oven. Same reaction was conducted with benzylamine as the nucleophile. Products were purified using a column and the weights of the product were recorded (Fig. 1). Products were purified using a column and the weights of the product were recorded. Results are presented in Figs. 2 and 3. In general, the product weights presented in Fig. 2 are much lower than the product weights presented in Fig. 3. Fig. 2 shows that an increase in bromobenzene concentration increases the amount of the product. However, increase in benzylamine caused an initial increase and further increase caused a reduction of the product. This suggests that benzylamine has some inhibitory effect on the reaction especially at high concentration. However, when benzylalcohol is used as the nucleophile (Fig. 3), such inhibition is not observed and the formation of the ether is favourable.

Keywords: *Ullmann reaction, Cu chelation, benzylamine, benzyl alcohol, bromobenzene*

**α -Amylase and protein glycation inhibitory activity of the aqueous extract of
*Flueggea leucopyrus***

V.S. Thrikawala¹, S.A. Deraniyagala¹, S.C.D. Fernando², D.N. Udukala³

¹*Dept of Chemistry, University of Colombo, Sri Lanka*

²*Dept of Molecular and Translational Sciences, Monash University, Australia*

³*College of Chemical Sciences, Institute of Chemistry Ceylon, Sri Lanka*

Plant based remedies are sought for the treatment of diabetes mellitus. Furthermore, non-enzymatic protein glycation results in the formation of advanced glycation end products (AGEs) which are a major cause of chronic diabetic complications such as retinopathy, nephropathy and cardiovascular diseases. Free radicals could also be involved in AGE formation. The objectives of this study were to investigate *Flueggea leucopyrus* (Sinhala- katupila) aqueous extract (FLAE) for its α -amylase inhibitory activity by 3,5-dinitrosalicylic acid method and also its protein glycation inhibitory potential by bovine serum albumin (BSA)-fructose fluorescence spectrometric assay. The 2,2- diphenyl-1-picrylhydrazyl radical scavenging activity (DPPH assay), total phenolic (as Gallic acid equivalents i.e.; GAE) and flavonoid contents (as Quercetin equivalents i.e.; QE) were also determined. FLAE was prepared according to the method of “kasaya” preparation in Ayurvedic medicine. The freeze dried powder was used for the investigations. FLAE showed 29%, 44%, 54%, 75%, 82%, 91% and 91% inhibition of α -amylase activity at concentrations of 2.5, 7.5, 10.0, 50, 100, 200 and 400 $\mu\text{g/ml}$ respectively. Acarbose, the positive control at 400 $\mu\text{g/ml}$ showed inhibition of 95%. FLAE at 15.6, 31.3, 62.5, 125.0, 250.0 $\mu\text{g/ml}$ inhibited AGE formation by 0.9%, 33%, 87%, 93% and 98% respectively after one week of incubation in the BSA–Fructose assay. The positive control, amino guanidine showed 94% and 99% inhibition at 250 and 750 $\mu\text{g/ml}$ respectively. FLAE caused percentage inhibition of 26%, 39%, 50%, 60%, 60% and 60% at 25, 50, 75, 100, 150 and 200 $\mu\text{g/ml}$, respectively in the DPPH radical scavenging assay, whereas butylated hydroxyl toluene gave the highest percentage inhibition of 76% at 200 $\mu\text{g/ml}$. Total phenolic content was 198.0 GAE mg g⁻¹ and the flavonoid content was 81.2 QE mg g⁻¹. The FLAE has the potential of being developed as an α -amylase inhibitor which would reduce the breakdown of polysaccharides to glucose as well as prevent diabetic complications arising due to AGE formation. Its potential as a radical scavenging agent is also highlighted.

Keywords: *Flueggea leucopyrus*, α -amylase inhibitory activity, antiglycation activity

A novel bio coagulant for efficient removal of acid dyes from textile dye solution

Nadeeka D. Tissera¹, Ruchira N. Wijesena¹, Harini Yasasri¹, Rohini M. de Silva²,
K.M. Nalin de Silva^{1,2}

¹*Sri Lanka Institute of Nanotechnology, Sri Lanka*

²*Department of Chemistry, University of Colombo, Sri Lanka*

A Merion wool (Mw) yarn derived bio coagulant was prepared for 100% removal of dyes from an acid dye-bath. Mw is a protein based material that gained researchers' attention due to its biocompatibility, easy decomposability and applicability in many fields. Wool which consists of amino acids linked together with peptide linkages is abundant in N, C, H, O and S. Due to the presence of N containing chemical compounds, wool and wool based protein structures have an affinity for acid dyes. Acid dyes are commonly used dyes for coloration of wool-based fabrics. This study focuses on improving the dye absorption of wool yarns by alkaline hydrolysis of the wool structure. The research introduces a Mw yarn derived novel bio coagulant for removal of dye in an acid dye bath. Compared to the wool yarns, partially alkaline hydrolysed wool yarns showed better absorption to its structure. SEM analysis and AFM analysis showed, with the alkaline hydrolysis, wool yarn opens its internal fibril structure. Evidently, alkaline hydrolysis has allowed the solubilisation of specific amino acids, de-crosslinking of disulphate bridges and opening of the internal fibril structure of the wool yarn. This may have allowed more dye molecules to get adsorbed to the wool yarn. Mw yarns were hydrolysed using NaOH and stirred in an acid dye bath for 40 minutes at room temperature. It showed 98%-100% colour reduction of the acid dye bath. Non hydrolysed wool yarns showed only 4% color reduction of the dye bath. During the alkaline hydrolysis 2 main proteins namely, alpha and beta-keratin will be subjected to chemical changes. The structural and chemical changes of the wool yarn were analysed using Raman and FT-IR spectrophotometry. Morphological changes of the wool yarn after alkaline hydrolysis were observed using SEM, AFM and HR-TEM. The mechanism of the alkaline hydrolysed wool yarn for total removal of dye from the acid dye bath was derived using the above analytical techniques. Controlled alkaline hydrolysis of wool yarn has allowed the protein based wool structure to perform as some bio adsorbents for efficient removal of dyes from an acid dye bath.

Keywords: *Wool, dye, absorption, hydrolysis*

Aggregation of chitin nanofibers and silver nanoparticles in *in-situ* medium

Ruchira N. Wijesena¹, Nadeeka D. Tissera¹, Rohini M. de Silva², K. M. Nalin de Silva^{1,2}

¹*Sri Lanka Institute of Nanotechnology, Sri Lanka*

²*Department of Chemistry, University of Colombo, Sri Lanka*

Chitin and chitin derivatives have gained significant research interest over the years due to their number of beneficial properties that can be exploited in various application fields. Interactions between their nanostructures and other nanomaterials are of great interest. Silver nanoparticles in chitin nanofiber aqueous dispersions resulted in significant loss of colloidal stability of both chitin nanofibers (CNF) and silver nanoparticles. To investigate this further, we investigated the interaction between CNF and nano silver/silver derivatives in aqueous medium. First, extraction of CNF was carried out using a locally available chitin source with mechanical defibrillation. Silver nanoparticles were prepared through photo-reduction of silver chloride in an *in-situ* medium with CNF to allow for possible interaction. The instability phenomena and the resulting material were then characterized using various techniques including spectroscopy, microscopy and scattering methods. UV-Vis spectroscopy was used to characterize the extinction profiles of silver nanoparticles and CNF containing aqueous medium over time. Increase of optical density: a result of increase of size of hydrodynamic aggregate size with the introduction of the CNF to the silver nanoparticle/ medium indicated the instability. High resolution TEM was used to characterize the resulted structures which will indicate the presence of an aggregated form of nanofiber and nanoparticles. The observations made in TEM suggested that CNF has silver nanoparticles that have accumulated in to a larger aggregate which explained the increase of optical density of the *in-situ* medium. Energy filtered TEM analysis and crystal lattice distance measurements with high resolution TEM was used to confirm the existence of both CNF and silver nanoparticles in the aggregate. FT-IR, revealed that the presence of interactions between Ag and CNF was through hydroxyl and carbonyl moieties of the CNF structure and was studied using FT-IR spectrophotometry. To further confirm this ¹³C solid state NMR studies were conducted. It was seen that the chitin in the aggregated structure showed a shift in the 6th carbon atom which pointed to the possibility of strong interaction between silver nanoparticles and hydroxyl group on the same carbon atom. The results obtained using the above analysis will be used to identify the mechanism of aggregate formation by wrapping of CNF around silver nanoparticles.

Keywords: *Nanofiber, chitin, aggregation, silver nanoparticles*

A novel set of primers for the sequencing-based typing of HLA-A, -B, -C, -DRB1 and -DQB1 loci of Sri Lankans

P.C.D. Perera¹, B.D.N. Upamali¹, Y.I.N.S. Gunawardena², N.V. Chandrasekharan¹,
R.S. Dassanayake¹

¹*Department of Chemistry, University of Colombo, Sri Lanka*

²*Molecular Medicine Unit, Faculty of Medicine, University of Kelaniya, Sri Lanka*

The human leukocyte antigen (HLA) complex is the most polymorphic region in the human genome, with more than 14,361 identified alleles. Success of an organ transplant depends on the compatibility of the HLA complex of both recipient and donor while incompatibilities lead to graft rejection. HLA complex produces glycoproteins for self and non-self-discrimination. Currently in Sri Lanka, HLA typing is carried out by low resolution, serology based methods. In this study, sequence-based typing (SBT) was employed to identify the HLA alleles at a high resolution. To type HLA-A, -B, -C, -DQB1 and -DRB1 alleles, a high resolution, DNA-based assay was optimized and developed with the use of novel primers designed in this study and primers reported in literature. Second, third and fourth exons of HLA-A, -B, -C, -DQB1 and -DRB1 were amplified using PCR. DNA was extracted from blood collected from ten healthy Sri Lankan individuals. To optimize PCR conditions and minimize ambiguities, touch-down PCR and hotstart PCR were performed. PCR fragments were sequenced by Sanger sequencing and the chromatograms were matched with the alleles curated in IMGT/HLA database, using SBTengine® software. The HLA alleles identified in the first sample are HLA-A*33:22-HLA-A*33:01:01, HLA-B*40:11:02-HLA-B*40:06, HLA-C*08:02:01-HLA-C*12:127, HLA-DRB1*15:01-HLA-DRB1*15:85 and HLA-DQB1*06:01:07-HLA-DQB1*06:209. These alleles could be identified at a higher-resolution level, using primers designed in study together with previously reported primers than the currently employed serology typing methods.

Keywords: *HLA complex, alleles, PCR*

Synthesis of morphologically different nano and microstructured porous hydroxyapatite (HAp) matrices *via* facile synthetic approaches

Danushika. C. Manatunga¹, Rohini. M. de Silva¹, K. M. Nalin. de Silva^{1,2}

¹*Department of Chemistry, University of Colombo, Sri Lanka*

²*Sri Lanka Institute of Nanotechnology, Sri Lanka*

Hydroxyapatite (HAp) nanoparticles are well-known adsorbent materials due to their high sorption capacity and ion exchange property and have been employed in removal of heavy metals and other contaminants in water. This study was focused on determining the effect of different facile synthetic approaches on porosity, crystallinity and morphology of HAp nanoparticles. Five different HAp systems were synthesized using methods such as microwave irradiation HAp (M1), Zn doped HAp (M2), Mg doped HAp (M3), chitosan incorporated HAp (M4) and sodium alginate incorporated HAp (M5). The amount of the additive was set at 40% as and the reaction was carried out. Thereafter, they were extensively characterized using X-ray diffraction (XRD), Fourier transform infra-red spectroscopy (FT-IR), scanning electron microscopy (SEM), transmission electron microscopy (TEM) and Brunauer–Emmett–Teller (BET) analysis to identify the changes in size, shape and crystallinity, and surface area. Systems M1-M5 showed morphologies of coral shape, polymer like inter connected structures, sponge shapes and feathery mycelium. Further, they also gave rise to HAp with varied crystallinity. Using XRD and selected area diffraction (SAED) patterns crystallinity variations were observed for highest to lowest in the order of M5 > M1 > M4 > M3 > M2. Surface area studied using BET isotherm reflected the highest surface area for M3 and M1 > M2 > M5 > M4. Five systems of M1-M5 were identified as potential adsorbent materials for the removal of water contaminants such as textile dye stuff.

Keywords: *Hydroxyapatite, zinc, magnesium, chitosan, alginate, porous*

Synthesis of hollow microspheres of hydroxyapatite via the polymer- surfactant supramolecular system and its application in drinking water purification

A. K. D. Veromee, K. Wimalasiri, J. M. A. Roshan, B. Jayasinghe,
Rohini M. de Silva, K. M. Nalin de Silva, Dhammike P. Dissanayake
Department of Chemistry, University of Colombo, Sri Lanka

The hollow microspheres of hydroxyapatite crystals were successfully synthesized using ammonium monohydrogen phosphate and calcium nitrate through the wet chemical synthesis method at room temperature in the presence of polymer surfactant supramolecular system. Controlled synthesis of hydroxyapatite around the polymer surfactant micelles system has formed highly porous spherical shaped hydroxyapatite while nano rod shaped hydroxyapatite has been synthesized in the absence of the polymer surfactant supramolecular system. The size of the spherical particle is 0.8 μm . SEM micrographs, XRD and FTIR spectra confirm the formation of hollow microsphere of hydroxyapatite. The prepared porous hydroxyapatite particles were used for the removal of Pb(II) and Cd(II) ions. In this study, it was observed that hollow hydroxyapatite reached the equilibrium at 2 minutes and 60 minutes for Cd(II) and Pb(II) ions respectively. Also it was observed that at the equilibrium time, 60% of Cd(II) and 100 % of Pb(II) was removed by adding 1g/L of adsorbent at pH 6.5.

Keywords: *Adsorption, hollow microsphere of hydroxyapatite, micelles, supramolecular system*

Comparative adsorption studies for HAP bio polymer nano composites for the removal of Pb²⁺ and Cd²⁺ from polluted water

Shanika Fernando, Rohini M. de Silva, K. M. Nalin de Silva,
Dhammike Dissanayake
Department of Chemistry, University of Colombo, Sri Lanka

In this study hydroxyapatite/chitosan (HAP-CTS) and hydroxyapatite/carboxymethylcellulose (HAP-CMC) were synthesized. HAP-CTS1 was synthesized by dissolving CTS in 2% acetic acid while HAP-CTS2 was synthesized without using acetic acid but by direct dispersion of CTS in HAP precursors. HAP-CTS3 was synthesized in the same manner as HAP-CTS1 but by changing the aging temperature. HAP-CMC1, HAP-CMC2, HAP-CMC3 systems were synthesized by changing the CMC % of HAP to 20, 40 and 50 respectively. Batch adsorption studies for these systems and neat HAP for adsorption of Pb²⁺ and Cd²⁺ were carried out at 4000 ppm and 400 ppm respectively

Table 1: Adsorption capacities for HAP-CTS and HAP-CMC nano composites

	adsorbent	Adsorption capacity for Cd ²⁺ mg/g	Adsorption capacity for Pb ²⁺ mg/g
	neat HAP	99.9 ± 5.58	476.36 ± 17.74
HAP-CTS	HAP-CTS1	126.56 ± 3.82	667.16 ± 26.67
	HAP-CTS2	112.47 ± 6.00	425.51 ± 8.66
	HAP-CTS3	107.40 ± 6.96	582.66 ± 24.69
HAP-CMC	HAP-CMC1	112.08 ± 6.18	606.02 ± 26.20
	HAP-CMC2	105.72 ± 6.49	565.47 ± 17.35
	HAP-CMC3	113.12 ± 6.32	550.56 ± 16.13

The results of the adsorption studies in Table 1 indicate that both HAP-CTS and HAP-CMC systems show a greater affinity towards Pb²⁺ and Cd²⁺ than that of neat HAP. When considering the HAP-CTS systems, HAP-CTS1 shows a greater adsorption capacity for both Pb²⁺ and Cd²⁺. Higher percentage of HAP in HAP-CMC systems have resulted in increase in the adsorption capacity of Pb²⁺ ions. But this trend is not similar for Cd²⁺ and this could be due to the differences in the initial concentrations, adsorption mechanisms and the surface area of the nanocomposites.

Keywords: Adsorption, hydroxyapatite, biopolymer

A novel catalyst, meta-titanic acid synthesized from Pulmuddai ilmenite for photocatalytic mineralization of Methylene blue dye

Nadeera Dilshan Wickramasinghe¹, H.D.A. Chathumal Jayaweera¹, Rohini M. de Silva¹, K.M. Nalin de Silva^{1,2}

¹*Department of Chemistry, University of Colombo, Sri Lanka*

²*Sri Lanka Institute of Nanotechnology, Sri Lanka*

A wide variety of organic pollutants are released into natural water bodies including organic dyes from textile industries. Textile dyes are organic compounds with cationic, anionic or non-ionic groups. Most of these dyes have mutagenic activity, both acute and chronic to life forms, either directly or indirectly, due to bioaccumulation. Therefore, it is essential to eliminate dye materials and their degraded products from natural water bodies using proper purification methods. This research presents a cost effective, less time consuming and high pollutant degradable method for dye mineralization which nullifies the major drawbacks encountered in conventional purification methods. In our studies, a photocatalyst, meta-titanic acid (H_2TiO_3) was used successfully under ultraviolet (UV) radiation to degrade organic dye, methylene blue (MB). Synthesized meta-titanic acid was characterized using X-ray diffraction (XRD) measurements, Thermo Gravimetric Analysis (TGA), Scanning Electron microscopic (SEM) images and Fourier Transform Infra-Red (FT - IR) measurements. The effects of pH, catalyst concentration, purging gases and initial dye concentration, were monitored. In addition, kinetic studies on dye degradation were also investigated. Results indicated that the catalytic ability of the H_2TiO_3 to degrade dye was maximum at pH 3, 7 and 10. Kinetic studies revealed that the reaction is first order and there is no significant effect from the purging gas on the rate of the reaction. Therefore, this finding may provide a facile route to remove toxicity and color interference introduced by dye pollutants by various industries to natural water bodies.

Keywords: *Photocatalytic degradation, mineralization, meta-titanic acid, methylene blue dye*

Estimation of radiation dose around the Lakvijaya coal power plant due to radionuclide concentrations in soil

D.R. Abeydeera¹, R. Hewamanna², M.P. Dias³, P. Mahawatta⁴

¹*Department of Physics, The Open University of Sri Lanka, Nawala, Sri Lanka*

^{2,4}*Department of Nuclear Science, University of Colombo, Sri Lanka*

³*Department of Electrical Engineering, University of Moratuwa, Sri Lanka*

Radionuclides are released to the environment with fly ash from coal power plants, in trace amounts. Fly ash deposited on soil enhances its natural radioactivity. Specific activities of the radionuclides of ²²⁶Ra, ²³²Th and ⁴⁰K in soil collected from 61 locations in the vicinity of the Lakvijaya coal power plant-Norochcholai were measured using gamma spectroscopy and an HPGe detector. The results showed that the specific activities of ²²⁶Ra, ²³²Th and ⁴⁰K ranged from 11.2 to 145.2 Bq kg⁻¹, 16.4 to 325.9 Bq kg⁻¹ and 95.2 to 400 Bq kg⁻¹ respectively. The air absorbed gamma dose rate and outdoor annual effective dose rate corresponding to the above activity values were calculated to determine any potential radiological risk. The mean air absorbed gamma dose rate ranged from 30.81 to 282.73 nGy h⁻¹ compared to the world average value of 59 nGy h⁻¹ at locations in the vicinity of coal power plants. The calculated outdoor annual effective doses corresponding to an outdoor occupancy of 20% were in the range of 0.04 to 0.34 mSv y⁻¹. This is lower than the mean annual external background dose rate of 0.46 mSv y⁻¹ and the maximum permissible public dose rate of 1 mSv y⁻¹. Therefore, the radiological risk from the release of radionuclides from the Lakvijaya coal power plant can be considered to be extremely small.

Keywords: *Fly ash, radionuclides, radiological risk, soil*

Ionization chamber based dosimetric model for small field photon beam radiotherapy

R. M. G. C. S. B. Jayatissa¹, S. Kulatunga², K. U. A. W. Kumara³,
S. Sarasanandarajah⁴

¹*Department of Nuclear Science, University of Colombo, Sri Lanka*

²*Department of Radiography and Radiotherapy, University of Peradeniya, Sri Lanka*

³*Department of Radiotherapy, National Cancer Institute Maharagama, Sri Lanka*

⁴*Department of Physical Sciences, Peter MacCallum Cancer Institute, Australia*

Development of modern radiotherapy modalities has made it possible to treat small tumors with high precision using small field photon beams. Small field photon beam dosimetry is a challenging task as there are source occlusion, lateral charged particle disequilibrium, steep dose gradients and detector size and composition effects that are not present in standard photon dosimetry. The objective of this study was to produce an ionization chamber based dosimetric model for small field photon beam radiotherapy. A linear accelerator (Varian Clinac 2300CD) produced 6 MV photon beam was used to measure percentage depth dose (PDD), depth dose profile, total scatter factor ($S_{c,p}$), tissue phantom ratio ($TPR_{20,10}$), flatness, symmetry, penumbra and off axis ratio for square fields of side length 1 cm to 10 cm at dose maximum depth (d_{max}) and at 10 cm depth using an ion chamber of volume 0.01 cm^3 (CC01). PDD could be accurately measured with CC01 ion chamber in the buildup region and values were in agreement with the theoretical values (at 1.5 cm depth PDD is 100%). Measured penumbra has drastically deviated from the tolerance value of 2 mm. The ion chamber was suitable to determine the symmetry as values were within the tolerance limit ($<2\%$). Small fields failed to produce flatness within the tolerance limit ($<3\%$). Polynomial and logarithmic regression methods were used to predict the penumbra, symmetry, flatness and $S_{c,p}$ for small fields. Polynomial method was more accurate for flatness and penumbra. Logarithmic method was suitable only for $S_{c,p}$. Both methods were not suitable to predict the symmetry.

Keywords: *Radiotherapy, small fields*

Systematic modulation of band edge position of Cu₂O with deposition bath pH for efficient photocatalytic water splitting

K.D.R.N. Kalubowila¹, J.M.D.R. Jayasundara¹, K.M.D.C. Jayathilaka²,

M.S. Gunewardene¹, D.P. Dissanayake³, J.K.D.S. Jayanetti¹

¹*Department of Physics, University of Colombo, Sri Lanka*

²*Department of Physics, University of Kelaniya, Sri Lanka*

³*Department of Chemistry, University of Colombo, Sri Lanka*

Electronic band edge positioning is considered critical for photocatalytic redox reactions to be thermodynamically favourable. Cuprous oxide (Cu₂O), a metal oxide semiconductor with a direct band gap of ~2.1 eV is an important material in the context of photocatalytic water splitting both due to its ability to harvest solar light and its favorable valance and conduction band positions compatible with water splitting redox potentials. An investigation was carried out to identify the band positions of Cu₂O and to understand the interfacial properties of Cu₂O when in contact with an electrolyte. Cu₂O thin films were electrodeposited on Ti substrates for 40 min. in a three electrode electrochemical cell containing an aqueous solution of 0.1 M sodium acetate and 0.01 M cupric acetate at an applied potential of -200 mV with respect to the reference electrode with deposition bath pH varied between 5.8 and 8.0. Mott-Schottky plots obtained by capacitance-voltage (*C-V*) measurements revealed that the extrapolated flat-band potentials were strongly dependent on the bath pH with conductivity type of these films transforming from *n*-type to *p*-type for bath pH values greater than 7.2. The onset potentials of dark and light current-voltage (*I-V*) measurements further confirmed the dependence of flat band potential on the bath pH. For a pH difference of 0.1, the measured change in flat band potential was 32.5 mV and 8.0 mV for *n*-type and *p*-type Cu₂O respectively. The flat band potential is a direct indicator of the modulation of conduction band edge of *n*-Cu₂O and valance band edge of *p*-Cu₂O with deposition bath pH. This ability is very useful in efficient photocatalytic water splitting.

Keywords: *Electrodeposition, cuprous oxide, Fermi level, Mott-Schottky plots, water splitting*

Performance of earth enhancing compound under high impulse voltage and current conditions

A.P.L. Chandimal¹, P. Hettiarachchi², S. Nanayakkara¹, N. Sapumanage¹, V. Corray²,
M. Rahman², M. Fernando¹

¹*Department of Physics, University of Colombo, Sri Lanka*

²*Division of Electricity, Uppsala University, Uppsala, Sweden*

Effectiveness of any lightning protection system strongly depends on the conductive nature of the grounding arrangement provided to the system. Consequently, properties of the material surrounding the earthing conductors play a crucial role in achieving such an efficient system. Among a few other methods, one of the most convenient mechanisms of achieving the desired conductivity level is by artificially modifying the soil by adding conductivity improving backfills. The research was aimed at finding the performance of such a commercially available earth enhancing compound (EEC) under lightning conditions. An experiment was carried out using a 10-stage Marx generator (Maximum charging voltage 1 MV) to understand and characteristics of 90 cm air gap breakdown (AG test) compared to air gap plus 12 cm EEC gap breakdown (AGM test). Impulse voltage, current and impedance curves were retrieved from the collected data and using MATLAB software. Based on the research results the selected material appears to perform impressively under lightning (1.2/50 μ s) conditions. In dry conditions the prepared mixture of selected EEC gives large DC resistance values (in the M Ω range) while giving low dynamic impedance characteristics for impulse voltages. Using V-I curves a time window was selected during the continuous and steady current discharge which appeared just after the current peak. Impedance values were calculated at these points while comparing them for both AG and AGM test. This comparison provides basic knowledge about the impedance value for the prepared EEC sample which was calculated to be in the region of 1 – 2 Ω .

Keywords: *Earthing, grounding, impulse impedance, earth enhancing compound (EEC)*

Simulation of the performance of Faraday's cage type direct lightning protection system

N. Sapumanage¹, M. Fernando¹, V. Cooray²

¹*Department of Physics, University of Colombo, Sri Lanka*

²*Department of Engineering Sciences, Division of Electricity, Uppsala University, Sweden*

The simulation was devised with 10/350 impulse having peak current 50 kA and the equivalent electrical model of the Faraday's cage type direct Lightning protection system (LPS) for 5 storied building. The study focused on the down conductor material cross sectional area, ground impedance and the number of down conductors in the LPS to establish which factor or factors have more influence on the LPS performances. The simulation concludes that under the transient conditions the voltage dissipation on the LPS can reach to several thousand volts and the peak branch current disbursements in the network are in the order of 3-4 kA. However, with a less number of down conductors, branch currents tend to share the current and magnitudes increased close to 12-15 kA. The study proved that the performance of the LPS and the magnitudes of the negative consequences of the associated secondary effects such as electromagnetic compatibility issues and risk associated with high step voltage issues have a close correlation with the ground impedance and the number of down conductors than that of the cross sectional area of the down conductors. Thus, the study emphasized that once the LPS members were selected with suitable sizes to overcome the influence of external factors such as environmental effects, mechanical damages and let through energy incident by the lightning, etc., true attention shall be made to improve the earth impedance and to place the maximum possible number of down conductors to improve the LPS performances in order to minimize the possible adverse effects under transient conditions. Moreover, the analysis also proves that under adverse conditions voltage on the LPS can elevate to alarmingly high values. This requires the sound ring system at the ground level to avoid dangerously high step voltage gradients.

Keywords: *LPS, direct lightning, mild steel, down conductors, Faraday's cage*

The effect of galaxy peculiar motion on the calculation of time delay between gravitationally lensed images

Gihan Weerasekara¹, T. Wickramasinghe², K.P.S.C. Jayaratne¹

¹*Department of Physics, University of Colombo, Sri Lanka*

²*Department of Physics, The College of New Jersey, Ewing, NJ 08628, USA*

An intervening galaxy acts like a gravitational lens and produces multiple images of a single source such as a more remote galaxy. Such sources and lenses have peculiar speeds in addition to the bulk motion arising due to the expansion of the universe. There is a difference in light arriving times from images of a single source, known as the time delay. In calculating such time delays, the peculiar motions are generally neglected. We calculate more realistic time delays when such peculiar motions are taken into consideration and show that peculiar motions contribute to measurable differences to the observed time delays. According to our theoretical model we observed a significant percentage difference of up to 40% in the time delays of the gravitationally lensed images when the peculiar motions are considered compared to the calculations without peculiar motions.

Keywords: *Gravitational lensing, peculiar speeds*

Swift XRT X-ray flux variability of the BL Lacertae object from 2005 to 2017

K.L.I. Gunawardhana¹, K.P.S.C. Jayaratne¹, A.U. Abeysekara²

¹*Department of Physics, University of Colombo, Sri Lanka*

²*Department of Physics and Astronomy, University of Utah, USA*

Blazars make a subclass of Active Galactic Nuclei (AGNs) that emits very high energy gamma-rays. They are known to have a highly variable flux from radio to TeV energies in the electromagnetic spectrum. The variability timescale of the flux is an important measurement to identify the location and the size of the emission zone. The BL Lacertae object (also known as 1ES 2200+420, TeV J2202+422 and 3FGL J2202.7+4217) is an example of such a Blazar. This paper describes the X-ray (0.3 keV – 10 keV) flux variability of the BL Lacertae object between 2005 and 2017. NASA-led satellite, Swift XRT has been used to measure the X-ray flux. Generally, it has a number of different operating modes depending on the brightness of the observing source. The Windowed Timing (WT) mode and the Photon Counting (PC) mode are used in this analysis. The WT mode data covers a one-dimensional region and the PC mode data covers a two-dimensional region. Daily binned X-ray light curve of the BL Lacertae has been obtained using the WT and PC modes data. The analysis has been performed using the HEASOFT v6.20. The Mean Fractional Variation (MFV) is obtained separately for the WT mode (0.38) and PC mode (0.54). The obtained MFVs are strong evidence to conclude that the BL Lacertae object has an X-ray flux that is variable in the daily scale.

Keywords: *Active Galactic Nuclei, Blazars, flux, light curve, variability*

Light curve analysis of CC Andromeda

J. Adassuriya¹, K.P.S.C. Jayaratne², S. Ganesh³

¹*Astronomy Division, Arthur C. Clarke Institute, Sri Lanka*

²*Department of Physics, University of Colombo, Sri Lanka*

³*Astronomy and Astrophysics Division, Physical Research Laboratory,
Ahmedabad, India*

CC Andromeda (SAO 36605) is a high amplitude Delta Scuti star, located at RA 00:43:48 and DEC +42:16:55.8 in the Andromeda constellation. CC And is F3 IV-V spectral type and has a magnitude variation in V band of 9.19 – 9.46. The photometric observations in V band were carried out using the 50 cm CDK reflector at Mount Abu Observatory, India. The bias-corrected and flat-fielded image frames of CC And were used for photometry. The obtained high temporal resolution light curves were subjected to periodic analysis to investigate the pulsation frequencies. The investigation of Fourier transformation and periodic analysis tool, VARTOOLS, confirmed that the fundamental period, f_0 , of CC and is 0.123 ± 0.002 day. In addition, four other oscillations were also detected with higher probability and high signal-to-noise ratio

Keywords: *CC and, pulsation, short period variables*

Design and construction of a two-wheeled robot with robot operating system (ROS) based navigational capabilities

R.A.D.D. Dharmasiri^{1,2}, D.D.C. Wickramarathna², M.K. Jayananda²
¹*Department of Physics, University of Sri Jayewardenepura, Sri Lanka*
²*Department of Physics, University of Colombo, Sri Lanka*

In this work, we report the construction of a two-wheeled robot controlled by ROS, which is an open-source software that provides extensive controlling and navigation capabilities with camera based vision, laser based localization etc. The robot consists of two wheels of 6.9 cm diameter controlled by a pair of NEMA17 stepper motors powered by 18650 batteries. The height of the chassis was 24 cm. Two arms were mounted at either side of the robot to perform useful tasks such as picking items. A Raspberry-Pi zero W module was used as the main controller due to its small size, low power consumption and wireless networking capability. The ROS kinetic was installed in the Raspberry-Pi under Raspbian Jessie distribution of Linux. ROS nodes that require high computing power were run in a PC connected to the Raspberry-Pi over WiFi. For odometry, a mouse mechanism from a USB optical mouse, mounted under the robot was used. A USB camera was connected to the Raspberry-Pi for vision capabilities. Because Linux is not a real time operation system capable of controlling hardware with a guaranteed latency, an Arduino Leonardo board, communicating with the Raspberry-Pi *via* serial port, was used for maintaining vertical orientation, with a combination of PD and PI controllers. The speed and direction of motion of the robot was also maintained by the Arduino, under the commands it receives from the Raspberry-Pi. The orientation of the robot was monitored by an MPU6050 chip which consists of a 3-axis accelerator and a 3-axis gyroscope. This arrangement allowed the overall navigation to be controlled by the Raspberry-Pi, while the stability of the robot was maintained independently by the Arduino. The two arms of the robot were controlled by the Raspberry-Pi *via* a PWM generator based on PCA9685. The robot was found to maintain its stability well, under various types of manoeuvres.

Keywords: *Self-balancing, two wheeled robot, Raspberry-Pi, ROS*

Molecular dynamics simulation study of the rotational diffusion of liquid methane

W.A.M. Madhavi^{1,3}, Samantha Weerasinghe², K.I. Momot³

¹*Department of Physics, University of Colombo, Sri Lanka*

²*Department of Chemistry, University of Colombo, Sri Lanka*

³*School of Chemistry, Physics and Mechanical Engineering, Queensland University of Technology, Brisbane, Australia*

In this paper we present a study of the rotational diffusive dynamics of liquid methane at 100 K temperature and 1 atm pressure using classical molecular dynamics. A single H-H vector was selected in each molecule within the simulation box, and the orientations of these vectors were traced at every 0.1 ps over 500 ps. The angular displacement (α) of a given H-H vector from its initial orientation was calculated by taking the dot product between the orientations of the corresponding vector at $t = 0$ and time t . The time evolution of the ensemble-averaged $\cos(\alpha)$ was calculated by averaging the values of $\cos(\alpha)$ over all the molecules in the simulation box at a given time. The resultant function was least-squares fitted with four popular models used to account for anomalous relaxation in liquids: the classical Debye continuous-time diffusion model (mono-exponential), a Debye-like bi-exponential model, stretched-exponential and Mittag-Leffler functions. The residual plots of the corresponding fits were examined, the sum of the squares of the residuals and the mean to the standard deviation ratio of the residuals were calculated to determine the quality of the fit. It was found that the classical Debye model was incapable of describing the reorientational dynamics of liquid methane. A combination of an exponential and Mittag-Leffler functions were better able to model the diffusion process. The stretched-exponential model and Mittag-Leffler functions gave similar results to those obtained from the bi-exponential model. The observations suggest that reorientation of methane could be due to several mechanisms of rotation rather than one and further investigations are required to determine the exact nature of these mechanisms.

Keywords: *Rotational diffusion, methane, molecular dynamics, Debye model*

Implications of a vector-host model on dengue vector control strategies

J.K. Ratnayake¹, M.S. Gunewardene², I.C. Perera³

¹*Department of Mathematics, University of Colombo, Sri Lanka*

²*Department of Physics, University of Colombo, Sri Lanka*

³*Department of Zoology and Environment Sciences, University of Colombo, Sri Lanka*

A vector-host model was used with its parameters tuned to analyze two dengue disease control scenarios. The model assumes a constant host population with infected hosts allowed to recover after a predefined period, resembling a setting similar to an urban space situated in a limited geographical area with constant but limited human population such as schools, and office spaces. The vector population was allowed to follow a variant of the Logistic Growth model which includes a carrying capacity and provisions for reproduction. Numerical simulations were carried out under different carrying capacities for a total of 60 days with an initial vector population of 100 of which only one being infected and a total host population of 2000 non-infected individuals. As expected, the model predicted a steady growth of both infected host and vector populations with characteristic jumps in the infected vector population due to emergence of new offspring. To control the dengue vectors, firstly, vectors were removed during the time interval mimicking the effect of fumigation or spraying insecticides, but leaving eggs intact. A sharp decline of infected vectors was observed soon after the intervention. However, the infected vector population recovered sharply. Therefore, efforts similar to fumigation may become futile for controlling epidemics unless applied in more frequent intervals. Alternatively, a remarkably contrasting behavior was observed in the second strategy where vectors were removed at a continuous constant rate in addition to the natural death rate. A phase transition like behavior was observed in the number of infected hosts and vectors after a critical vector removal rate was adopted. It is also worth noting that this trend was correlated with a non-zero probability to pass the dengue virus to the eggs laid by infected vectors. These findings not only highlight the importance of natural predators in controlling vector population, hence the spread of the disease, but also predict a higher risk for dengue in urban settings with subdued levels of biodiversity and potential reasons for the ineffectiveness of currently adopted strategies to control dengue in Sri Lanka.

Keywords: *Mathematical biology, vector-host model, dengue spreading*

Exploring the factors driving e-learning adoption: Farmer satisfaction in e-learning

N.P. Vidanapathirana¹, K. Hirimburegama², S.A.P. Nelka¹, S.L. Nawarathna¹

¹*Institute for Agro-technology and Rural Sciences, University of Colombo, Sri Lanka*

²*Department of Plant Sciences, University of Colombo, Sri Lanka*

The development of Internet and web technologies has made it possible to “reach the unreached” and facilitate learning among farmers. Farmers require information at all stages of the farming life cycle to make optimal decisions. Although the farmer is the most important stakeholder in agriculture, there has not been much effort to provide the essential knowledge and information to farmers in a timely manner. E-learning is a new approach in education which integrates appropriate information and communication technologies, for advancing student-oriented, active, flexible learning, and life-long teaching-learning processes. However, there are still some failures in adoption of e-learning because of the difficulties in ensuring learner satisfaction. Previous studies in different target environments have suggested that a variety of factors affect user satisfaction with e-learning. However, there are few studies carried out with users in the agriculture field to determine factors affecting their satisfaction with e-learning. Therefore, there is a need for an improved understanding of factors that influence learner satisfaction of those using internet-based learning in the agriculture field. This research was carried out to document the factors that influence user acceptance and satisfaction of internet-based learning for users in agriculture. This study validated twelve e-learning satisfaction factors under six dimensions among student farmers. Nine out of the twelve hypotheses were supported, having critical relationships with learner satisfaction with p-values less than 0.05. Those factors were proper assistance by online tutors and mentors, quality of learning materials, flexibility of course, usefulness of the course, multimedia introduction, language of instruction and language of LMS, satisfaction with online discussion forums, interactivity of learning activities and updated information. This instrument can be used for testing e-learning satisfaction among different target groups and the findings can provide more insights into how to implement successful e-learning systems within target groups such as farmers.

Keywords: *E-learning, satisfaction, farmer*

Effect of host crop on mass propagation of vesicular arbuscular mycorrhizae

W.A.G.A.B. Chandrasena¹, C.M. Nanayakkara¹, H.A. Sumanasena²,
D.N. Samaraweera²

¹Department of Plant Sciences, University of Colombo, Sri Lanka

²Department of Export Agriculture, Sri Lanka

Vesicular arbuscular mycorrhizae (VAM) are important biofertilizers that form symbiotic associations with most of the plants. As they are obligate symbionts, a host plant is required for mass propagation if it is to be used as a biofertilizer. Therefore, steps were taken to identify a suitable host crop for mass propagation. Three plant species: maize (*Zea mays* L.), sorghum (*Sorghum bicolor* L.) and finger millet (*Elusine corcana* L.) were included in the investigation. Pots were filled with sterilized top soil and an inoculum of native *Glomus* sp. was incorporated into the pots. Subsequently, the surface sterilized seeds of host crops were planted. The initial spore density was 3 black spores and 13 brown spores per 100 g of potting medium. Only the brown spores are considered to be viable. Five replicates and randomised block design was used. Spore density was counted at 8, 10 and 12 weeks after planting. Mycorrhizal root infection was observed prior to counting the spores and the roots of all three host crops were infected with VAM showing successful colonization. Data were statistically analyzed using SAS 9.0. The black spore densities in all host crops were significantly increased from week 8 to week 10 and declined at week 12 ($p < 0.05$). The destructive sampling data of brown spore densities were not significantly different among three hosts at both week 8 ($p = 0.0576$) and week 10 ($p = 0.401$). The mean brown spore density was highest in maize (20 ± 2.86) at week 8 and highest in sorghum (26.6 ± 6.17) at week 10. At week 12 the mean brown spore densities of sorghum (32.2 ± 0.19) and finger millet (32.4 ± 0.045) were significantly high ($p < 0.05$) when compared to that of maize (15.2 ± 0.31). Mean brown spore densities of finger millet and sorghum increased with time while in maize it decreased after the 10th week. Accordingly, both finger millet and sorghum can be used as host crops for the mass propagation of native *Glomus* sp.

Keywords: Vesicular arbuscular mycorrhizae, host crop, finger millet, sorghum

Sri Lankan dairy yeasts: Isolation, identification and production of single cell protein from whey

D.U. Rajawardana¹, C.M. Nanayakkara², I.G.N. Hewajulige¹

¹*Industrial Technology Institute, Colombo, Sri Lanka*

²*Department of Plant Sciences, University of Colombo, Sri Lanka*

Meeting the demand for proteins worldwide has become one of the priorities of world food development programmes. Against such a backdrop, production of single cell proteins (SCP) from waste organic materials is an attractive solution, especially for developing countries. SCP produced from microorganisms has various benefits over the plant or animal sources due to their wide amino acid spectrum, low fat content and higher protein: carbohydrate ratio. The isolation and identification of yeasts with SCP production abilities from under-investigated niches could have several industrial advantages. As Sri Lankan dairy microflora are poorly characterized in these aspects this study was carried out to select and identify SCP producing yeasts from dairies. Yeast -Peptone- Dextrose Agar (YPDA), Malt extract-Eeast extract-Peptone-Glucose Agar (MYPG) and Potato Dextrose Agar (PDA) supplemented with 0.1 g L⁻¹ chloramphenicol (Sigma, USA) were used for the enumeration of yeasts. Yeast isolates obtained were phenotypically characterized by morphological and physiological properties using the standard taxonomic key outlined by Kutzman and Fell, 1998. Yeasts were further identified using several biochemical tests including fermentation of sugars, liquid assimilation of carbon and nitrogen compounds, growth at 37 °C and 45 °C, growth in 50% glucose, and their oxidase and urease activities. Isolates were screened for their potential for producing SCP from whey and the most promising isolates were identified using molecular biological techniques. Out of 190 isolates a greater part could be considered as candidates for producing SCP. However, isolates Y005 (12.43 ± 0.74g/L), Y006 (12.65 ± 0.59 g/L) and Y039 (11.51 ± 0.88 g/L) were able to produce significantly higher (p<0.05) amounts of SCP from whey compared to the rest. Their SCP production ability was higher than that of the reference strain, *Kluyveromyces lactis* (11.65 ± 0.15 g/L) though the difference was not significant. Since the isolates Y005, Y006 and Y039 were identified as efficient lactose fermenters, these 3 isolates may have a close relationship to the genus *Kluyveromyces*. Results of the molecular level identifications to the closest relatives of the isolates revealed that the isolates Y005, Y006 and Y039 are *Kluyveromyces marxianus* which has a great potential to be used in SCP production.

Keywords: Yeast, single cell proteins, lactose, *Kluyveromyces*

Physical inactivity among university students: A case study on first year undergraduates at the University of Colombo

K.Y.P.K. Weerasekara, R.V. Jayatillake, R.A.B. Abeygunawardana
Department of Statistics, University of Colombo, Sri Lanka

Adult physical inactivity is directly linked to chronic non-communicable diseases. Studies on the physical activity level (PAL) of Sri Lankan university students are deficient. This study assessed the physical activity level of first year students of University of Colombo using International Physical Activity Questionnaire (IPAQ). A cross sectional study, involving 205 first year students of University of Colombo, (excluding students of two faculties, Sri Pali Campus and Faculty of Medicine, situated out of the main university complex) was conducted. Students were recruited by stratified sampling with proportionate allocation to number of students enrolled to each faculty. Logistic regression methods were used to find the factors associated with inadequate PAL by fitting a binary logistic model. Students were in the 21-24-year age range with nearly equal gender distribution. PAL was inadequate in 36.6% (CI 30.3-43.3) of students. PAL did not vary significantly based on gender ($p=0.605$) and socio-economic conditions ($p=0.203$). Of the five faculties involved, the Faculty of Science had the highest percentage of students with inadequate PAL followed by the Faculty of Arts. However, the difference noted among faculties was not significant ($p=0.290$). PAL was independent of the time spent on university academic activities ($p=0.524$), accessing information technology equipment for non-academic activities ($p=0.736$), accessing common-communication channels (radio/television), ($p=0.336$), body mass index ($p=0.252$) and usage of university sports resources such as playground ($p=0.994$) and gym ($p=0.406$). Awareness and utilization of available university sports resources (playground -26% non-users; play instruments - 20% unaware; gym -50% non-users) was low. Sleep time ($p=0.053$) and weekly sitting time ($p=0.052$) were identified as predictors of inadequate PAL at 10% significance level. However, multiple logistic regression analysis did not yield any of the variables to be significant at 5% significance level. The findings emphasize the need for active interventions to improve PAL with greater utilization of available university resources.

Keywords: *Physical activity, university students*

Factors associated with the consumption of powdered and fresh milk: A case study in the Bandaragama Divisional Secretariat

P.L.J.U. Sampath, W.M.L.K.N. Wijesekara
Department of Statistics, University of Colombo, Sri Lanka

The dairy industry in Sri Lanka is an important sector for rural populations in order to develop their livelihood. In Sri Lanka, milk is consumed as fresh milk and powdered milk. However, the fresh milk consumption is considerably low compared to powdered milk. The literature has shown that the low consumption of fresh milk is due to lack of availability, negative beliefs in health problems, storage issues and cost. Therefore, this study was conducted to identify the product attributes and demographic & socio-economic factors associated with fresh milk and powdered milk consumption in the Bandaragama Divisional Secretariat. Data were collected through a survey from the Bandaragama Divisional Secretariat. A random sample of 606 household units was selected by using a multi stage sampling method. Among 59 Grama Niladari (GN) divisions, 40 were chosen randomly at the stage 1 and the household units were chosen randomly according to the proportional allocation method at the second stage. A detailed descriptive analysis was carried out for the demographic data and the data regarding product attributes. Advanced analysis was done by using Chi squared Automatic Interaction Detection (CHAID) to identify the relationship between milk consumption and demographic & socio-economic factors. Moreover, factor analysis was conducted through Principle Component Analysis with varimax rotation to identify the major product attributes and the strength of those factors was analyzed through logistic regression with factor scores. The results revealed that the *purchasing place* and *purchasing frequency* of milk were the significant factors associated with milk consumption among the socio-economic factors considered. Moreover, *sensory factor*, *nutritional factor*, *marketing factor*, *consistency factor*, *health & safety factor* and *cost factor* were the product attributes which were significantly associated with milk consumption. The study concluded that the improvement of availability, reduction of price and proper marketing strategies can be used to increase the fresh milk consumption among households.

Keywords: *Fresh milk, powdered milk, consumption, product attributes, socio-economic factors*

Influencing factors to the number of other vehicles involved in light vehicle accidents in Sri Lanka: One-Inflated Poisson Regression approach

D.R.T. Jayasundara¹, S. Viswakula², C.H. Magalla²

¹*Department of Mathematics, University of Moratuwa, Sri Lanka*

²*Department of Statistics, University of Colombo, Sri Lanka*

An economic development is expected in a country by controlling the number of traffic accidents, the number of vehicles getting involved in accidents, and the damage to human lives and property. Thus, recognizing the reasons for the current situation in the country regarding the number of other vehicles involved in traffic accidents where at least one light vehicle driver is at fault is intended by the study. A One-Inflated Poisson regression model is estimated treating “the number of vehicles other than the vehicle found with a faulty driver crashed in the accident” as the response variable for light vehicle accident data during 2010 to 2011 collected by Traffic Police Sri Lanka. Since One-Inflated Poisson regression provided the best true prediction rates of the accident frequencies, its estimates of parameters are used to interpret the associations revealed between the explanatory variables and the response. In instances of having a primary collision due to a vehicle going onto the wrong side of the road, the tendency of having a secondary collision with another vehicle is greater. Further, collision of vehicles coming from opposite directions and from the same direction also contribute to an increment in the number of other vehicles getting crashed. A reduction in the number of other vehicles involved has been shown when the driver at fault was found in the above 64-year age category, while an increment in the number was found when the faulty driver was in the 45 to 64-year age category compared to drivers in the 18 to 24 year one.

Keywords: *Traffic accidents, faulty drivers, number of other vehicles, One-Inflated Poisson*

Selection of a support vector machine for the development of an artificial neural network for the identification of tiger beetles (Coleoptera, Cicindelinae) of Sri Lanka

D.L. Abeywardhana¹, Y.W. Mallawarachchi², C.D. Dangalle¹, A. Thotagamuwa¹
¹*Department of Zoology and Environment Sciences, University of Colombo, Sri Lanka*
²*Sri Lanka Institute of Information Technology, Malabe, Sri Lanka*

Tiger beetles are predators of order Coleoptera, family Carabidae, sub-family Cicindelinae that consists of 120 genera, of which 12 are found in Sri Lanka. These genera include 56 tiger beetle species of which 35 are endemic to the island. However, current investigations have only recorded 20 tiger beetle species, 8 species being endemic. Locations of occurrence, habitat types, climate and soil preferences, morphometric measurements were recorded and mitochondrial DNA sequences were elucidated. Identifications were based on taxonomic keys for the tiger beetles of the Indian subcontinent based on morphological characters. The use of morphometric measurements to identify taxa have been shown to be more accurate than morphological characters and as accurate as molecular characters. The limited use of morphometric measurements and the need of expertise on morphological characters of insects when using taxonomic keys for identification of tiger beetles has been challenging. Therefore, this study intended to select a machine learning based technique for the development of an artificial neural network (ANN) for identification of tiger beetle species. Data on tiger beetle species collected from 195 locations were used to construct the dataset that consisted of 290 records and 20 attributes for 20 species of ground-dwelling tiger beetles. Since the created dataset had limited number of data and the classification task was regarding more than 2 classes (species), Support Vector Machine (SVM) algorithm and sklearn.multiclassofscikit-learn library were selected for the construction of ANNs. Due to the high accuracy of 97.4%, sklearn.svm.SVR method was selected for the development of an ANN. ANNs will be built, trained and evaluated and the network with the lowest mean square error and lowest misclassification rate will be selected as the optimal network for tiger beetle species identification. As this method integrates morphological, morphometric, ecological data and images of species it will be a more effective identification tool that will alleviate the “taxonomic crisis” in the near future.

Keywords: *Tiger beetles, identification, support vector machine, artificial neural networks*

A comparison of genetic variability of dengue vectors using microsatellite and EPIC markers

M.D. Nirmani¹, K.L.N. Perera², G.H. Galhena¹

¹Department of Zoology & Environment Sciences, University of Colombo, Sri Lanka

²Genetech Molecular Diagnostics & School of Gene Technology, Colombo, Sri Lanka

Many genetic markers have been used in population genetic studies of dengue vectors to quantify and explain the genetic variability, which in turn reflect their ecological plasticity. The most widely used marker, microsatellites, lag in their capacity to detect functionally indicative polymorphisms, and fail in inter-species transfer. Exon-Primed Intron-Crossing (EPIC) markers allow to overcome limitations. This study estimates the genetic variability of the dengue vectors, *Aedes aegypti* and *Aedes albopictus* using microsatellites and EPIC markers. Mosquito larval samples were collected from Colombo (N=32), Galle (N=30) (for *Ae. aegypti*), Gampaha (N=20) and Kalutara (N=30) (for *Ae. albopictus*). Genomic DNA was extracted and PCR amplified for EPIC (RpS20b and RpL30a) and microsatellite (AC7 and BbH08 for *Ae. aegypti* and Alb-tri 20 and Alb-tri 45 for *Ae. albopictus*) markers followed by allele scoring on 6% PAGE. Allelic data were analysed for the allele number (A_N), allelic richness (R_A), private alleles (A_P), Effective number of alleles (A_E), observed (H_O) and expected (H_E) heterozygosities using GenAlex 6.503. When analysed within species, *Ae. aegypti* showed significantly higher diversity indices for microsatellite markers in terms of average A_N ($A_{Nmicro}:3.75; A_{NEPIC}:2.5$), R_A ($R_{A-micro}:3.749; R_{AEPIC}:2.498$) and H_O ($H_{Omicro}:0.434; H_{OEPIC}:0.121$) compared to EPIC markers. However, *Ae. Albopictus* showed no significant difference between the two marker types for the above parameters ($A_{Nmicro}:4.33; A_{NEPIC}:7$; $R_{Amicro}:3.667$; $R_{AEPIC}:6.244$; $H_{Omicro}:0.558; H_{OEPIC}:0.339$). When analysed between the 2 species, EPIC markers showed a significantly high H_O for *Ae. Aegypti* (0.339) compared to *Ae. Albopictus* (0.161). This difference was not reflected in microsatellite markers ($H_{Oaegypti}:0.558; H_{Oalbo}:0.446$). Generally, both species showed high and comparable genetic diversity parameters with the 2 markers. In conclusion, microsatellites were more sensitive in capturing genetic variability within species while EPIC markers successfully captured intra-species variability indicating different characteristics of the 2 marker types analysed in this study.

Keywords: *Ae. aegypti*, *Ae. albopictus*, EPIC markers, microsatellite markers, genetic diversity

Characteristics of the vocal repertoire of *Dinopium* flamebacks in Sri Lanka

S.P. Fernando¹, D.E. Irwin², S.S. Seneviratne¹

¹*Avian Evolution Node, Department of Zoology and Environment Sciences, University of Colombo, Sri Lanka*

²*Biodiversity Research Centre, Department of Zoology, University of British Columbia, Canada*

Acoustic signals have been used as a species signature to infer evolutionary relationships. Closely related species differ in the signals used for communication, and these differences might play a central role in reproductive isolation. *Dinopium* is an Asian genus of six woodpecker species, commonly known as flamebacks. Of them, the endemic *D. psarodes*, a widespread *D. benghalense*, and their hybrids are found in Sri Lanka. We characterized vocal repertoires to determine the functional significance of vocalization in flamebacks. Vocal recordings were made in sympatric (n=11) and allopatric zones (n=20 per parental form). Spatial and temporal properties in vocalization were analyzed using RavenPro software. We identified 4 types of vocal and a single non-vocal (drumming) sounds in the repertoire. Vocal signals did not vary significantly between the sexes. A loud contact call, made of short series, with a grating quality was termed as ‘Staccato Kree’, while its shorter version was termed ‘Short Staccato Kree’. ‘Whinnying Kree’ call is preceded by an introductory call note. A call made by juveniles and sub-adults while feeding was called a ‘Squeak’. In *D. psarodes*, the number of notes, inter-note duration and note duration between Staccato Kree call and the Whinnying Kree differed significantly, while the total duration remained the same. A similar pattern was observed in *D. benghalense*. In the multivariate analysis, the PC1 and PC2 captured spatial (frequency) and temporal (duration) properties respectively. Similar patterns were observed in Whinnying call. Drumming frequency among the two species is not different, which is about 80 blows/minute in both species. Our results suggest that the acoustic signals are used primarily for vocal communication, not individual recognition. Reproductive isolation is the key determinant for speciation. Acoustic differences in flamebacks are not contributing towards reproductive isolation, indicating that acoustics may not have contributed towards speciation in flamebacks in Sri Lanka.

Keywords: *Dinopium psarodes*, flameback woodpeckers, reproductive isolation, speciation, vocalization

Predicting the distribution of mixed species bird flocks using ecological niche modelling

J. N. Perera, S.S. Seneviratne

*Avian Evolution Node, Department of Zoology and Environment Sciences,
University of Colombo, Sri Lanka*

Mixed species bird flock (MSBF) is a unique ecological phenomenon found in the wet zone forests of Sri Lanka. Assuming that the co-distributed species are exposed to similar environmental conditions, here we developed ecological niche models (ENMs) of MSBFs using two modeling approaches to study how the fundamental niche differs in the two approaches. The two approaches were “Cumulative species map” approach and “Sympatric species locality” approach. The challenge was to use the ENM to predict the distribution of a species interaction rather than as species itself. Six bird species, with the highest flock occupancy were used for modeling. Maxent software was used as the ENM algorithm. Using 55 locality records and 19 bioclimatic data layers of the current climate, fundamental niche of MSBF was predicted. The results obtained from the “Cumulative species map” and “Sympatric species locality” approaches were similar indicating that the use of climate in localities, where interactions are present, allows the prediction of potential areas of the interaction. Our results show a significant reduction (28-35%) of the fundamental niche available for mixed species bird flocks as forest habitats were lost during the past few decades. Here we stressed the need for more studies incorporating the changes in vegetation cover and the composition of the forest to test the effects of the change in climate and changes in land use patterns on forest faunal assemblages.

Keywords: *Cumulative species map, fundamental niche, Maxent, niche modeling.*

Population structure of free ranging Asian elephants in Udawalawa National Park, Sri Lanka

Ashoka D.G. Ranjeewa¹, Devaka K. Weerakoon¹, P. Fernando²

¹*Department of Zoology and Environment Sciences, University of Colombo, Sri Lanka*

²*Centre for Conservation and Research, Tissamaharama, Sri Lanka*

The population structure of free ranging Asian elephants in the Udawalawa National Park (UWNP) Sri Lanka was investigated based on individually identified elephants. The population structure, sex ratio and group size of elephants was assessed from June 2016 to January 2017 based on opportunistic observations conducted from 7.00 am – 12.00 noon and 3.00 pm - 6.00 pm on 60 days from a four-wheel drive vehicle. A total of 511 elephants were individually identified, which comprise half of the estimated total population of UWNP. These elephants can be categorized into nine size classes. Nearly fifty percent (48.8%) of the elephants in the population were adults. Recruitment was very low (2%). The population was biased towards females with a 1:1.35 male/female ratio. These results are consistent with previous data reported for UWNP. Group sizes of the elephants were large (mean 5.1) similar to group sizes reported for other National Parks. The park vegetation is changing drastically due to succession and spread of invasive plants, which may explain the low recruitment rate observed. Our findings underline the importance of closely monitoring the elephant population and conducting adaptive habitat management in the UWNP for the long-term conservation of elephants.

Keywords: Asian elephant, population structure, sex ratio, group size

Molecular detection of human papillomavirus infection in oral and oropharyngeal cancers in Sri Lanka

A.I. Wathupola¹, K.A. Perera², P.V. Udagama¹

¹*Department of Zoology and Environment Sciences, University of Colombo, Sri Lanka*

²*National Cancer Institute, Maharagama, Sri Lanka*

Infection with high-risk genotypes of human papillomavirus (HPV) is a major cause of oral and oropharyngeal cancer (OOPC). Molecular based techniques such as polymerase chain reaction (PCR) and DNA sequencing is used to detect the positivity and types of HPV involved in OOPC. This study aimed to evaluate the association of HPV infection in OOPC patients in Sri Lanka. The case-control study used 50 each of OOPC patients and age and gender matched non-cancer healthy control subjects. DNA was extracted from exfoliated oral cells and formaline fixed paraffin embedded (FFPE) tumour tissue samples and amplified by PCR that targeted the conserved L1 open reading frame of HPV. NCBI BLAST service was used to analyse HPV DNA sequences. Odds ratios (ORs) at 95% confidence interval were calculated to estimate the magnitude of the risk factor for developing OOPC. Of tested OOPC patients, 19 (38%) were positive for HPV while the control group screened negative. A statistically significant difference was detected between OOPC cases and HPV compared to controls ($P=0.00$). High-risk HPV genotypes of the alpha- papillomavirus 9 group were detected in all HPV positive cases; HPV 16 (89.5%), HPV 18(5.3%) and HPV 31(5.3%) were associated with OOPC in Sri Lanka. HPV DNA was detected in 38% (19/50) of FFPE tissue and in 28% (14/50) of oral rinse samples ($p>0.05$) evidencing higher fidelity of using the former for HPV screening. HPV positivity of FFPE tumour tissue resulted in a 5-fold risk factor while such oral rinse samples resulted in a 3-fold risk for OOPC ($P>0.05$). This limited case control study provides the evidence on the plausible current burden and the role of HPV infection in OOPC in Sri Lanka; 38% of OOPC patients were infected with HPV, a majority with the HPV16 high risk type.

Keywords: *Human papillomavirus, oral and oropharyngeal cancer, high-risk HPV types, PCR*

Risk factors associated with oral and oropharyngeal cancers in Sri Lanka: Importance of human papillomavirus infection

A. I. Wathupola¹, K. A. Perera², P. V. Udagama¹

¹Department of Zoology and Environment Sciences, University of Colombo, Sri Lanka

²National Cancer Institute, Maharagama, Sri Lanka

The aetiology of oral and oropharyngeal cancer (OOPC) is multifactorial; the main etiopathological factors are considered to be tobacco smoking, alcohol use, betel quid chewing and infection of high-risk human papillomavirus (HPV) genotypes. This study aimed to determine the association of HPV genotypes and other major risk factors for OOPC in Sri Lanka. The case-control study was based on 50 each of OOPC patients, and age and gender matched healthy non-cancer controls. Logistic regression was used to calculate odds ratios (OR) at 95% confidence intervals (CI). The percentage of OOPC patients and controls with respect to each risk factor was disparate. Of OOPC patients, 19 (38%) were positive for HPV by PCR and sequencing while the control group scored negative inferring HPV positivity may increase the risk of OOPC occurrence by 77 folds (OR=77.42; 95% CI= 5.216-1276.89) sans other confounding factors. Among OOPC patients, 80% were habitual smokers, 76% alcohol users while 48% and 44% of the control group were also included in these respective categories (P=0.231). Smokers showed a 5-fold unadjusted risk in developing OOPC while this risk in alcohol users and betel chewers was 3-fold and 2-fold, respectively. HPV posed a 58-fold risk considering other confounding factors (OR= 58.28; 95% CI= 3.427 – 963.362) while that of smoking was 5-fold (OR= 5.16; 95% CI= 2.204-11.849). Of all significant risk factors considered, HPV infection and smoking showed significant risk of developing OOPC (P<0.05). This study suggests that both HPV infection and smoking may pose a significant risk of causing OOPC when adjusted for alcohol use and betel chewing. Gender and self-reported oral sex history showed a significant association with HPV in OOPC cases.

Keywords: *Human papillomavirus infection, oral and oropharyngeal cancer, risk factors, smoking, alcohol use, betel quid chewing*

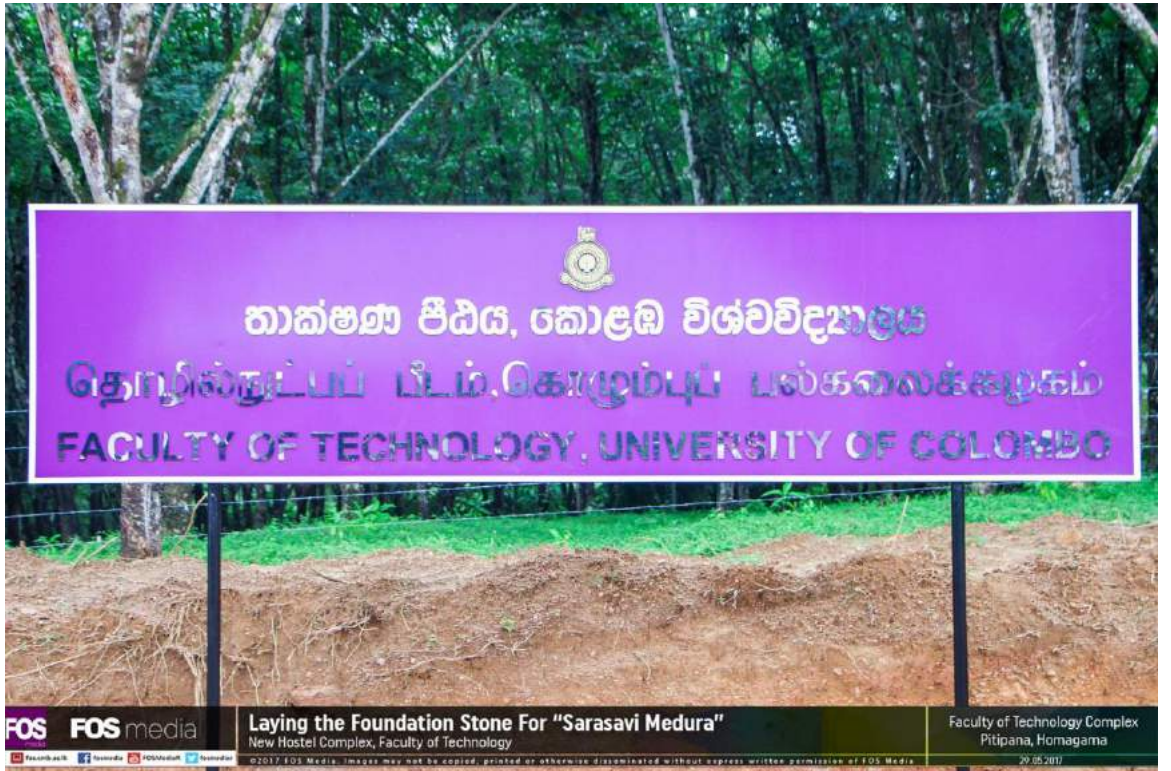
Effect of Sri Lankan wild type mature leaf concentrate of *Carica Papaya* on adipogenic differentiation of in house established human mesenchymal stem cells

V.L. Udalamaththa¹, P.M.S. Ratnayake¹, P. Soysa², S. Wijeratne³, P.V. Udagama¹
¹*Department of Zoology and Environment Sciences, University of Colombo, Sri Lanka*
²*Department of Molecular Biology and Biochemistry, University of Colombo, Sri Lanka*
³*Department of Obstetrics and Gynaecology, University of Colombo, Sri Lanka*

Obesity is a global health issue. Adipocyte differentiation and fat accumulation plays a major role in obesity. The suppression of adipocyte differentiation is important. Different synthetic and natural products are being investigated as potential anti-adipogenic drugs. Human mesenchymal stem cells (hMSCs) can be easily differentiated into adipocytes using a chemical cocktail within 14 days and they are widely used to study adipogenic and anti-adipogenic effects. The present study investigates anti-adipogenic capacity and genotoxicity effects of the mature leaf concentrate of *Carica papaya* (MLCC) of the Sri Lankan wild type cultivar, on umbilical cord tissue derived in house established hMSCs. hMSCs were isolated from cord tissue by the explant method and functionally characterized by their differentiation ability into osteocytes, chondrocytes and adipocytes. The karyotype of 46, XY of hMSC chromosome spreads confirmed the genetic stability of this cell line. Adipogenesis was induced in hMSC using incomplete and complete adipogenic medium with 5 different concentrations of MLCC (0.2% to 1%). Non-cytotoxic concentrations of MLCC were selected using the MTT assay for cell viability prior to the adipogenic assay. MLCC at 0.6% concentration exhibited significant anti adipogenic activity under complete adipogenic stimulation compared with the control ($P < 0.05$). The incompletely induced adipogenic assay showed a significantly lower adipogenic differentiation activity of hMSCs for 0.2%, 0.4%, 0.6% and 0.8% MLCC treated wells than the control ($P < 0.05$), where 0.6% MLCC concentration recorded the lowest adipogenicity. Comet assay for all 5 concentrations of MLCC showed significantly lower comet scores than the positive control (hMSCs treated with H_2O_2) which established that DNA damage in hMSCs by MLCC treatment was insignificant ($P > 0.01$). This prototype study states that MLCC at specific concentrations has the potential to be used with further standardization and validation as a prospective anti-adipogenic agent, with no genotoxic effects.

Keywords: *Human mesenchymal stem cells, mature leaf concentrate of Carica papaya, anti-adipogenic effect, genotoxicity*

FACULTY OF TECHNOLOGY



Technology for Environmental Sustainability

16 November 2017

**MESSAGE FROM THE DEAN,
FACULTY OF TECHNOLOGY**

Professor J. K. D. S. Jayanetti



It is with immense pleasure that I write this message for the proceedings of the Annual Research Symposium, 2017, of the University of Colombo, one of the most important events organized by the University. This year's theme, "Research for Development: Challenges and Opportunities", is a timely one that emphasizes the need for research in development, and the associated challenges and opportunities for the sustainable development of the country.

As a newly established Faculty in the University of Colombo, the Faculty of Technology, with its four academic departments (Department of Agricultural Technology, Department of Environmental Technology, Department of Instrumentation and Automation Technology and Department of Information and Communication Technology) is dedicated to providing students who qualify for university entrance from the technology stream with a strong foundation in the respective disciplines and competencies that will serve them well in the future to become innovative. In this context, the Faculty of Technology looks forward to fostering a research and innovation culture of high quality through national and international collaborations. This, in turn, would provide a means for the technological advancement of the country where the emerging challenges could be successfully addressed.

The Faculty of Technology recognizes that active participation in the Annual Research Symposium of the University of Colombo is a key contribution that enables the University to sustain its academic excellence at the highest level. Therefore, I would like to extend my profound gratitude to the organizing committee for their commitment and dedication in organizing this key event. On behalf of the Faculty of Technology, I wish to express my good wishes for a gratifying and productive event. Further, I congratulate the presenters and wish them all the best in their future endeavours.

INTRODUCTION TO THE KEYNOTE SPEAKER

Dr. Punyavana Vishaka Hidellage

*Assistant Country Director, Sri Lanka Country Office
United Nations Development Programme*



Dr. Punyavana Vishaka Hidellage is the Assistant Country Director of the United Nations Development Programme (UNDP), Sri Lanka Country Office, and has been holding several managerial positions in the Intermediate Technology Development Group, a multinational organization, for more than 15 years. She has been involved in a number of projects with national and international significance, including Post Disaster Needs Assessment which was conducted for the first time in Sri Lanka by the Ministry of Disaster Management and the Ministry of National Policies and Economic Affairs with the support of the United Nations, the World Bank and the European Union. Dr. Hidellage has been serving as a resource person in a number of international and national conferences and has several publications to her credit including book chapters. Further, she has served as the editor of the *Disaster and Development in South Asia: Connects and Disconnects; South Asia Disaster Report 2008*.

Dr. Vishaka Hidellage obtained a Doctor of Philosophy degree in Food Science and Technology in 2002 and a Master's degree in Food Science and Technology in 1992 from the Postgraduate Institute of Agriculture, University of Peradeniya, Sri Lanka. She graduated in process engineering from Astrakhan Technical Institute of Fisheries, Astrakhan, USSR in 1981. Dr. Hidellage is also a diploma holder in Managing Voluntary and Non Profit Enterprises from the Open University, UK.

Technology-based society for sustainable future

Dr. Punyavana Vishaka Hidellage

*Assistant Country Director, United Nations Development Programme,
Sri Lanka Country Office*

Innovation is almost always a function of technology, and staying abreast of technological trends is key to survival and for a sustainable future. Innovation is not just concerned with adjustment, advancement and improvement. It concerns reinvention, rebellion, and revolution. Therefore, true innovation is core change.

Some of the best examples from agriculture and environmental technology for innovation might be the material in seat cushions for cars, as well as bio-diesel from soybean. The University of Illinois has developed an automated robot called the 'AgAnt' that can assess and detect stress, disease, weeds, soil status, and pests in crop fields. At Edith Cowan University, scientists are working to develop a 'photonic weed detection system.' It aims a series of laser pulses at the field, analyzes the information and provides instruction to a spray cylinder and valve on where to apply treatment. Another very well-known example from Information and Communication Technology is the conversion of electronic typewriters into modern day computers. Improvements to typewriters did not matter, as the advent of computers annihilated the market. In the era of exponential science, no idea is too small! However, what is significant is to use technology for a sustainable future.

Technology involved in environmental, agricultural, Instrumentation and Automation transformation, as well as Information and Communication, are interconnected most of the time. In a country like Sri Lanka, there are enough resources, as well as skilled and knowledgeable people that can assist a transformation towards a technology-based society within a sustainable future.

List of Abstracts

1. A case study of surface water pollution due to hazardous waste with special reference of chromium ions from leather tanning industry in Colombo District 280
S.J.S. Bandara and Ranjana.U.K. Piyadasa
2. An assessment of groundwater pollution vulnerability using DRASTIC method: A case study in Ja-Ela Divisional Decretarial Division 281
M.D.C. Fernando and Ranjana U.K. Piyadasa
3. Threat of salt water contamination of coastal shallow aquifer in Sri Lanka: A case study in the Kalpitiya peninsula, Sri Lanka 282
H.M.M. Sonali D. Herath and Ranjana U.K. Piyadasa
4. Visually impaired navigation in indoor environments: A framework for sensor-based and landmark-based obstacle detection 183
Chathurika S. Silva and Prasad Wimalaratne
5. Analysis of protein profiles of plasma cells in patients with multiple myeloma 184
A.I. Katuwawala, L.V. Gooneratne, S.S.S.B.D.P. Soysa, D.U. Kottahachchi and G.A.U. Jayasekera

A case study of surface water pollution due to hazardous waste with special reference of chromium ions from leather tanning industry in Colombo District

S.J.S. Bandara¹, Ranjana U.K. Piyadasa²

¹*Central Environmental Authority, Battaramulla, Sri Lanka*

²*Department of Environmental Technology, University of Colombo, Sri Lanka*

The study is based on data found in the industrial hazardous wastes which are generated by Chromium base leather tanning industry in the Colombo District, where animal hides and skins are converted into leather. Chromium salt sulphates are the most widely used tanning substances and high concentration of chromium is toxic, mutagenic, carcinogenic, and teratogenic and thus is categorized as a hazardous waste. Statutory limits have been set for chrome discharge and disposal and relevant guidelines have been drawn up by the Central Environmental Authority (CEA), Sri Lanka. According to CEA database 2015, only two Chrome-based tanneries are in operational level in the Colombo District as others are closed or suspended due to non-compliance of CEA regulations. Selected tanneries discharge their wastewaters through one discharging point to the Kelani River at Mattakkuliya area. These are located nearby and use common chromium recovering facility to recover Chromium ions from the wastewater before discharge. Accordingly, the main pollutants identified during the leather processing include, NaCl₂, pesticides, strong alkalines, sulphides, inorganic residual compounds, dissolved matter and chromium salts. Total Chromium in untreated wastewater was detected as 10.32 mg/l average and 15.81 mg/l as maximum levels although Chromium was detected as 0.028 mg/l maximum level in discharging effluent after the Chrome recovery. This proves that the common chrome recovery plant of selected tanneries shows 99.24% efficiency on Cr⁺³ ions recovery. Furthermore, Chromium ions were not detected in the wastewater at the discharge point and also in the Kelani River. This is solely because of Chromium recovery has been given the top priority due to its economic value and benefits and ignored total treatment for other pollutants in tanning wastewaters. Though only Chromium concentration is within the expected limits, all other parameters (pH, DO, EC and COD) exceed the tolerance limits which are laid down by CEA, SLSI and WHO considerably.

Keywords: *Tannery, Pollutants, Wastewater, Chromium ions, Kelani River*

**An assessment of groundwater pollution vulnerability using DRASTIC method:
A case study in the Ja-Ela Divisional Secretarial Division**

M. D. C. Fernando¹, Ranjana U.K. Piyadasa²

¹ Faculty of Graduate Studies, University of Colombo, Sri Lanka

² Department of Environmental Technology, University of Colombo, Sri Lanka

The main objective of this study is to assess the pollution vulnerability of the groundwater in Ja-Ela DSD using the most commonly used overlay and index method; the DRASTIC Method which is developed by United States Environmental Protection Agency (USEPA). Assessment of groundwater vulnerability was done using a modified DRASTIC model. The most important factors that regulate the groundwater potential are depth of water, net recharge, aquifer media, soil media, topography, impact of vadose zone and hydraulic conductivity of the aquifer. Assessment of DRASTIC Index involves multiplying each parameter weight by its rating corresponding to its study area and summing the total. DRASTIC indexes ranged from 70 to 195 and the mean DRATIC index value was 147. According to the obtained vulnerability map: negligible vulnerable zones <80 was exhibited by 0.047% of geographical area; low vulnerable zones ranging from 80 to 120 with 19.6% geographical area; moderate vulnerable zones ranging from 120 to 160 with 46.4 % geographical area; high vulnerable zones ranging from 160 to 200 with 33.2 % geographical area; and extreme vulnerable zone with greater DRASTIC index value higher than 200 with 0.6% area from total land extend of Ja-Ela DSD. Generally, this showed a higher potential for pollution. The water quality assessment was done using 30 sample points. The pH, COD, PO₄⁻³ level, SO₄⁻² level and NO₃⁻¹ level were analyzed. The validation of DRASTIC method was done by comparing water quality values with DRASTIC index value. According to the validation of DRASTIC method using statistical analysis, measurements of the pH level, SO₄⁻² level and NO₃⁻¹ level were identified as good indicators. The PO₄⁻³ SO₄⁻² and NO₃⁻¹ concentrations of 30 sample points varied from 0 to 1.5mg/L, 0- 64mg/L 0.4-4.4mg/L respectively. The pH level was acidic and it ranged from 3.5 to 6.3. The COD levels are very less among all points. The DRATIC index value showed a positive strong relationship with the above-mentioned parameters.

Keywords: Groundwater, Soil, pH, DRASTIC, Aquifer

**Threat of salt water contamination coastal shallow aquifer in Sri Lanka:
A case study in the Kalpitiya peninsula, Sri Lanka**

H.M.M. Sonali D. Herath¹ and Ranjana.U.K. Piyadasa²

¹*Department of Geography, University of Colombo, Sri Lanka*

²*Department of Environmental Technology, University of Colombo, Sri Lanka*

There exists a potential that global warming will result in a rise in sea level in the Indian Ocean. As an island, this could have a number of physical impacts on Sri Lanka. One of the major consequences is the depletion of coastal ground water resources due to salt water intrusion leading to potential devastating impacts on humans, coastal ecosystems and coastal infrastructure. The Kalpitiya Peninsula is one of the major threatened coastal regions. It comprises of shallow aquifers on coastal sands and recharges only with the seasonal rainfall mainly during the South-Eastern Monsoon. It was selected for an in-depth study in order to identify whether the ground water table of Kalpitiya Peninsula is facing salt water intrusion at present. To assess the salt water intrusion, Electrical conductivity (EC) measurement, which measures the capability of water to transfer electric current, was used. The ‘conductivity’ of water differs with the change in temperature and it is relative to the dissolved mineral matter content of water. Using the Average EC value from the data collection carried out from December 2013 to June 2015 in 85 dug-well sampling locations, the level of possible Salt water intrusion of the Kalpitiya area was modelled using the inverse distant weighted (IDW) interpolation tool in Arc GIS. According to the results of the study more than 70% of the area falls within the category of ‘areas with higher Range EC values’. ‘Higher Range’ indicates areas that were detected with $<5000\mu\text{S}/\text{cm}^3$ where commonly freshwater is considered as suitable for human consumption if EC value is between 0 and 1,500 uS/cm. Hence, Kalpitiya peninsula can be named as an area with a ground water table already impacted by the risk of a rise in the sea level as it shows induced shallow aquifer salt water contamination.

Keywords: *Electrical Conductivity, Salt Water Intrusion, Shallow Aquifer*

**Visually impaired navigation in indoor environments:
A framework for sensor-based and landmark-based obstacle detection**

Chathurika S. Silva¹, Prasad Wimalaratne²

¹*Department of Instrumentation and Automation, University of Colombo, Sri Lanka.*

²*Department of Communication and Media Technologies, University of Colombo, Sri Lanka*

This work presents a multi-sensor integration approach for electronic navigation of the blind and visually impaired. Inputs taken from the heterogeneous sensors such as sonar, vision and inertial sensors are used for object detection, recognition and classification. The proposed approach entails visual marker recognition where visual markers are incorporated to identify the known locations of the indoor environments. This improves the walking experience of the visually impaired by making them more independent. This framework facilitates both audio and tactile feedback on the obstacles in the close proximity of the visually impaired people. The experiments using five blindfolded subjects show that the obstacle detection accuracy in left, right and front directions as 89%, 86% and 98% respectively. Future research to address focus on both indoor and outdoor environments and to identify both stationary and moving obstacles. Improvement of the independent navigation of the visually impaired people by using sensors and visual tags is the key contribution of this research.

Keywords: *Obstacle detection, Vensor fusion, visual tag, Audio and tactile feedback, Assistive technology*

Analysis of protein profiles of plasma cells in patients with multiple myeloma

A.I. Katuwawala¹, L.V. Gooneratne², S.S.S.B.D.P. Soysa³, D.U. Kottahachchi⁴,
G.A.U. Jayasekera⁵.

¹*Faculty of Science, University of Colombo, Sri Lanka*

²*Department of Pathology, Faculty of Medicine, University of Colombo, Sri Lanka*

³*Department of Biochemistry and Molecular Biology, Faculty of Medicine,
University of Colombo, Sri Lanka*

⁴*Department of Medical Laboratory Sciences, General Sir John Kotelawala
University, Sri Lanka*

⁵*Department of Plant Sciences, Faculty of Sciences, University of Colombo,
Sri Lanka*

Multiple myeloma is a neoplasm of plasma cells, characterized by the proliferation of clonal plasma cells and a subsequent overabundance of monoclonal paraproteins. The main objective of the present research was to analyze the membrane protein profiles of plasma cells in both multiple myeloma patients and healthy individuals. The bone marrow aspirates were obtained from multiple myeloma patients and non-myeloma controls. The plasma cells were separated from the aspirates using the RosetteSep™ Human multiple myeloma enrichment cocktail which consists of a mixture of different antibodies that is designed to enrich multiple myeloma cells. The number of separated plasma cells were amplified through culturing to produce the sufficient number of cells required for cell membrane isolation and protein analysis employing 1D SDS PAGE gel electrophoresis. The cellular properties of malignant plasma cells were determined based on basic cell culturing and kinetic assays. The cell lineages of the cultured cells were confirmed through flow cytometry analysis. The membrane protein extractions were done according to the standard aggregate isolation protocols. SDS PAGE analysis of the membrane protein profiles of multiple myeloma patients and non-myeloma controls showed a clear difference in both high molecular weight region and in low molecular weight region. The LC MS/MS analysis of the protein profiles revealed that multiple myeloma patient samples contained three distinct proteins that were not detected in the non-myeloma control group.

Keywords: *Multiple myeloma, bone marrow, SDS PAGE, cell membrane, protein profiles*

SRI PALEE CAMPUS



The Role of the Humanities in Research and Development

21-23 November 2017

**MESSAGE FROM THE RECTOR,
SRI PALEE CAMPUS**

Professor. R. C. K. Hettiarachchi



It is my great pleasure to provide this message on the occasion of the Annual Research Symposium 2017 of the University of Colombo. The theme of this year highlights the importance of research for development. The prime goal of the university is to create new knowledge and contribute to the sustainability of society. It is through rigorous investigation that this knowledge can be presented in a systematic way. Invention of theories can be made to propose explanation for how a set of natural phenomena will occur, capable of making predictions about the phenomena for the future, and capable of being falsified through empirical observation. It is essential to build theory to present the world and to understand the world. Universities should lead the process of invention of theories and ensure the safety of the present generation and the generations to come.

The attributes of the University of Colombo as the leading university of the country very clearly indicate the priority given to research. The Annual Research Symposium of the university is remarkable in a sense that it provides all academics an equal opportunity to engage in research and present their research. The University of Colombo is visible globally, not just because it is the metropolitan university but also because of the high caliber of academia it has produced in the world.

This research symposium is a platform for all academia to showcase their research ability to the world. With the research publications coming out of this conference, the University will be able to keep its position as the number one in Sri Lanka and secure a good position among world universities. The university comprises a campus, seven faculties, institutes and a school of computing, thus serving the aspirations of a diversified community. All activities of the university comply with its mission, and the research conference can be considered one of the key performance indicators to realize its mission. I am proud to be a part of the organization committee and I offer my best wishes for the success of the conference.

SRI PALEE CAMPUS

List of Abstracts

1. Prevalence of South Indian dance traditions in Sri Lanka during the 11th to 17th centuries 288
S.A.N. Perera

2. Motivation for reading in English among Cambodian ESL Learners 289
K.V. Dhanapala

Prevalence of South Indian dance traditions in Sri Lanka during the 11th to 17th centuries

S.A.N. Perera

Department of Performing Arts, Sri Palee Campus, University of Colombo, Sri Lanka

The South Indian dance tradition was established in Sri Lanka in early 11th century with the invasion of Chola Empire. They made Polonnaruwa city their capital and built many Hindu Shrines which are today displayed as ruins. When examining the early South Indian dance, two different developing paths could be identified: temple dance and court dance. The aim of this research was to examine the prevalence of former South Indian dance traditions in Hindu/non- Hindu temples in early Sri Lankan dance as well as its development as a court dance. Several archaeological sources, including stone sculptures, bronze figures, wood and ivory carvings and metallic images which belonged to the early 11th – 17th centuries; together with written evidences such as those found in inscriptions, famous treatises, poetical messages and traveler's records were studied through field visits to Sri Lankan Hindu temples located in Polonnaruwa and Kandy. The results showed that South Indian dance tradition had prevailed very strongly in ancient Sri Lanka: The concept of worshipping God through dance and music was clearly recognized in those Hindu temples and their priests usually had employed young girls called "Devadasi" (temple dancers) to entertain the God by dancing, singing and playing instruments. Similarly, many archaeological ruins found in the kingdom of Polonnaruwa included illustrations of several dancers and musicians. These were first attached to the Hindu temples in Polonnaruwa and had gradually spread to other Hindu and non-Hindu temples. As a result, this "temple dance tradition" had influenced Sri Lankan dance traditions that later developed as a court dance and was performed in the royal courts in ancient Sri Lankan kingdoms.

Keywords: *South India, Hindu culture, Temple dance, Court dance, Devadasi*

Motivation for reading in English among Cambodian ESL Learners

K.V. Dhanapala

Department of Languages, Sri Palee Campus, University of Colombo, Sri Lanka

Motivation on second language reading continues to be an underdeveloped research area in ESL context, though there exists a large body of research on motivation on second language (L2) learning in general. Reading experts claim that cognitive, affective, and social/cultural factors may impact reading motivational behavior among both L1 and L2 learners in different ways. Therefore, the main objective of this research was to conceptualize the constructs of reading motivation among 440 Cambodian learners and the relationship between reading motivation and their text comprehension. A reading comprehension test and a reading motivation questionnaire (RMQ) were used to assess participants' L2 text comprehension and their reading motivation respectively. The categories of RMQ were based on self-determination theory (SDT) that distinguishes intrinsic and extrinsic motivation and students' attitudes and beliefs on L2 reading engagement. The Principal Componential Analysis identified three constructs of intrinsic motivation and four constructs of extrinsic motivation. The confirmatory factor analysis (CFA) was used to examine the hypothesized two-factor model of reading motivation that described the relationship of intrinsic and extrinsic motivation and text comprehension. The final model indicates that only intrinsic motivational constructs positively contribute to text comprehension indicating that intrinsic motivation is fundamental to successful L2 text comprehension among Cambodian students. Consistent with the previous findings, results also showed that Cambodian students possess both intrinsic and extrinsic motivation simultaneously for their engagement in reading L2 materials demonstrating that they are motivated in reading for multiple reasons. The findings of this study also supported the claims made by the proponents of self-determination theory that reading motivation among learners is associated with and shaped by constant (re)appraisal and balancing of the various cognitive, social, and cultural influences embedded in the local context.

Keywords: *Reading Motivation, Self-determination theory, intrinsic motivation, Extrinsic Motivation, Confirmatory Factor Analysis*