

RCEE 2016

6th REGIONAL CONFERENCE ON
ENGINEERING EDUCATION 2016

in collaboration with

Research in Higher Education 2016 (RHEd)

7th Asia-Pacific Conference on Engineering
Technology Education 2016 (APCETE)

Asia & Australasia 1st Regional Research in
Engineering Education Symposium (REES)*

3rd International Innovative Practices in
Higher Education EXPO 2016 (I-PHEX2016)

DATE 9-10 AUGUST 2016

UTM KUALA LUMPUR VENUE

<http://tree.utm.my/conference/>

Organised by:



SOCIETY OF
ENGINEERING EDUCATION MALAYSIA



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Conference Greetings

from the Chief Secretary of Ministry of Higher Education Malaysia



Assalamu'alaikum and Sincere Greetings to all

First of all, I would like to congratulate the UTM Centre for Engineering Education (CEE), the Association of Taiwan Engineering Education and Management (ATEEM) and the Society for Engineering Education Malaysia (SEEM) for successfully organizing the **6th Regional Conference on Engineering Education 2016 (RCEE2016) and Research on Higher Education (RHEd)** in collaboration with the 7th Asia-Pacific Conference on Engineering and Technology Education 2016 (APCETE).

It gives me great pleasure to welcome all distinguished guests, invited speakers and participants to Universiti Teknologi Malaysia Kuala Lumpur for RCEE 2016. For some of you, this visit may probably be your first visit to Malaysia and I wish you SELAMAT DATANG. I hope your visit to Malaysia, in particular Kuala Lumpur will be a memorable and fruitful one.

The Ministry of Higher Education always encouraged educational research in Malaysia and we are proud to provide our supports to research universities like UTM in its endeavors to enhance research activities in engineering education. I do hope that this conference will achieve its objectives.

Attracting and educating students with the right aptitude in engineering in the face of all the pervasive distractions is a major challenge for engineering educators in the new millennium. It is also a challenge to produce competent graduates with qualities of ingenuity, creativity, business leadership, flexibility, life-long learning ability and industry readiness. Engineering education societies have the responsibility to improve the quality of engineering education globally and provide for continuing professional development of engineers around the world and address the challenges faced by the developing and developed world by strengthening each other. Universities need the vision to guide students to find solutions to existing local, national and global problems to aim at societal development.

Under these circumstances, it is indeed timely that efforts to initiate research and work, sharing and disseminating valuable information on engineering education towards the holistic engineering education system are actively being carried out at both local and international levels. I believe the RCEE 2016 Conference will be the bridge for our cooperation and communication on these issues amongst educational scholars, who shall be the policy makers, lecturers, teachers and industry players for our future generation. Let this be platform for all educational professionals to continue working together towards achieving a holistic engineering educational system.

Finally, I would to offer my heartfelt thanks to all the presenters and participants of RCEE 2016 who have shown encouraging support for this event. In addition, a vote of thanks must go to the organizing committee for their remarkable dedication and creativity in making this joint conference a success. Best wishes for a rewarding and fruitful conference.

Wassalam.



YBhg. Dato' Seri Ir. Dr. Zaini Ujang
Chief Secretary
The Ministry of Higher Education

Conference Greetings

from the Vice Chancellor of Universiti Teknologi Malaysia



Assalamu'alaikum wa rahmatullah and Sincere Greetings to All,

I would like to thank the Centre for Engineering Education (CEE) UTM for organizing this event. It is a great pleasure to welcome all participants from all over Malaysia and across the globe to be with us today in UTM Kuala Lumpur for RCEE 2016.

The conference, is held jointly by the Association of Taiwan Engineering Education and Management (ATEEM) and the Society for Engineering Education Malaysia (SEEM). It is a venue that will enable the practitioner leaders of engineering education and higher education in Malaysia and abroad an opportunity to interact and discuss with one another continuing and emerging issues relating to engineering education in general.

RCEE 2016 has the mission to promote and enhance progress in the fields of engineering education and higher education. All over world including Malaysia are facing the grand engineering education challenge to educate the new generation of engineers that are specifically equipped to tackle some of the most pressing issues facing society in the 21st century. Therefore, it is crucial that our education systems provide students with the appropriate opportunities to develop the critical set of 21st Century skills, knowledge and attitudes that will allow them to innovate and convey their creativity. I believe it is important to create the right conditions for the students to express their creativity, while at the same time being confronted to the realities of the world of work. This requires new methods of teaching and learning and certainly this is the greatest challenge that confronts educators, that is to create innovative ways for nurturing the future generation of engineers and educational leaders.

As such, universities must continue to undergo transformation in their efforts to address the challenges and meets current needs as well as the future. Holistic curricula, as well as effective teaching and learning of both undergraduate and graduate programs, must move with the needs of the time. Research must be beneficial and meaningful in advancing society, and not just archived in journals. Universities should play the role of solution provider in shaping future manpower that embrace a culture of innovation and humanity, ready to face challenges that awaits them. For that, academics must be bold, brave and innovative in changing higher education.

I hope that this conference will be the platform to promote and enhance collaboration, networking and continual exchange of ideas in a cross-cultural environment to foster and enhance research in engineering education in particular, and in higher education in general to build a better world for tomorrow's generation. I also hope it would be a rewarding and fruitful experience for all participants, especially for our foreign delegates. Last but not least, I wish you a successful and productive conference.

Best wishes,



Prof. Datuk Ir. Dr. Wahid bin Omar
Vice Chancellor
Universiti Teknologi Malaysia

Conference Greetings

from the President of Society of Engineering Education Malaysia



Ladies and Gentlemen,

On behalf of the organizing committee, Universiti Teknologi Malaysia (UTM), the Society of Engineering Education Malaysia (SEEM), the International Federation of Engineering Education Societies (IFEES), the Research in Engineering Education Network (REEN), the Association of Taiwan Engineering Education and Management (ATEEM), sponsors of this conference and all the colleagues and volunteers who have put their valuable time and effort, it is our great pleasure to welcome you to the 6th Regional Conference on Engineering Education and Research in Higher Education 2016 (RCEE & RHEd 2016), and the 7th Asia Pacific Conference on Engineering Technology Education!

This event has contributed to the field of higher education and engineering education for more than ten years in charting its progress and quality, especially for this region. From initially having mostly experience sharing papers in 2007, we have matured to scholarly and rigorous educational research papers. As a multi-disciplinary field, we encourage collaboration between engineering academics, as well as academics from the social sciences so that we can produce high quality practices and research not only at the national level, but also at the international level. In addition to the parallel paper sessions and the research in engineering education sessions, we have special sessions on interesting and important topics, such as Engineering Service Learning, Grand Challenges of the 21st Century, Student Centred Learning, Chemical Engineering Education and STEM Education for Developing the Talent Pipeline. We truly believe that this conference will enable all participants to network and form potentially productive collaboration.

Last but not least, I would like to thank the organizing committee from UTM and SEEM for their commendable efforts in making this event a success. It is a pleasure to welcome all of you to the conference and workshops. May it be a greatly productive and rewarding experience for all.

A handwritten signature in black ink, appearing to read 'Khairiyah'.

Professor Dr. Khairiyah Mohd. Yusof
Director,
Centre for Engineering Education, UTM
and
President
Society of Engineering Education Malaysia (SEEM)

Conference Greetings

from the President of International Federation of Engineering Education Societies



The International Federation of Engineering Education Societies (IFEES) is pleased to support the efforts of the Society for Engineering Education Malaysia (SEEM), the Association of Taiwan Engineering Education and Management and Universiti Teknologi Malaysia (UTM) in organizing the 6th Regional Conference on Engineering Education and Research in Higher Education 2016 (RCEE & RHEd 2016), and the 7th Asia Pacific Conference on Engineering Technology Education. These events bring together researchers and educators from diverse fields related to engineering and higher education.

As the leading organization in connecting those in engineering education for fruitful collaboration, IFEES is positive that the conference would provide a platform for greater cooperation and interaction among participants in disseminating knowledge and discussing innovative solutions to enhance engineering education, especially in the region. With five special sessions on interesting and important topics, such as Engineering Service Learning, Grand Challenges of the 21st Century, Student Centred Learning and STEM Education for Developing the Talent Pipeline, I am convinced that the knowledge gained and interaction among participants will be valuable for establishing quality academic programs at your institutions. I hope your discussions in this field will expand and open up many opportunities for future networking and collaboration.

Last but not least, I would also like to congratulate the organizing committee from UTM and SEEM for their tireless efforts in hosting this conference and promoting efforts to enhance the quality of engineering education.

A handwritten signature in black ink, appearing to read 'U. Cukierman', written in a cursive style.

Uriel Cukierman, PE, MS, Ing. Paed. IGIP h.c.

President

International Federation of Engineering Education Societies (IFEES)

Programme Schedule

	TIME	ACTIVITY	VENUE
8 August 2016			
Pre-Conference Workshop	8:30 am – 9:00 am	Workshop registration	Makmal Kejituan, MJIT
	9:00 am – 4:00 pm	Workshop on “ <i>Educational Research Design for Science, Technology, Engineering and Mathematics (STEM) Areas</i> ”	
	4:00 pm – 5:30 pm	Registration for RCEE & Reception	
9 August 2016			
RCEE 2016	8:00 am – 5:00 pm	Registration Engineering Education Showcase	Anjung Razak
	8:45 am – 9:00 am	Welcoming remarks	Dewan Utama
	9:00 am – 10:30 am	Special Track on Service Learning + Parallel session 1	Dewan Utama, Dewan Seminar, Bilik Ilmuan 1, Bilik Ilmuan 2
	10:30 am – 11:00 am	Break and networking session	Bilik Ilmuan 4
	11:00 am – 1:00 pm	Plenary Forum 1 “ <i>Current Status and Future Direction in Engineering Education: Overcoming the Challenges</i> ” Representative speakers from various countries in Asia and the UK	Dewan Utama
	1:00 pm – 2:00 pm	Lunch and networking, zuhr prayer	Bilik Ilmuan 4
	2:00 pm – 3:30 pm	Plenary Forum 2: Industry Forum	Dewan Utama
	3:30 pm – 5:30 pm	Special Track on Chemical Engineering Education + Parallel Session 2	Dewan Utama, Dewan Seminar, Bilik Ilmuan 1, Bilik Ilmuan 2
	5:30 pm – 6:15 pm	Break, networking & asr prayer	Bilik Ilmuan 4
	6:15 pm – 7:45 pm	Depart to Menara KL for conference dinner & Maghrib prayer	
7:45 pm – 10:00 pm	Visit to Observatory Deck, Dinner and Opening Ceremony	Kuala Lumpur Tower	
10 August 2016			
RCEE 2016 & I-PHEX 2016	8:00 am – 5:00 pm	Registration Engineering Education Showcase	Anjung Razak
	9:00 am – 10:15 am	Special Track on Grand Challenges + Parallel Session 3	Dewan Utama, Dewan Seminar, Bilik Ilmuan 1, Bilik Ilmuan 2
	10:15 am – 11:00 am	Keynote: Transformation in Engineering Education “ <i>Engineering Education Practice: What Needs to Change?</i> ” by Professor Dr. Jeffrey E. Froyd	Dewan Utama
	11:00 am – 11:15 am	Break and Networking	Bilik Ilmuan 4
	11:15 am – 1:00 pm	Special Track on Student Centred Learning + Parallel Session 4	Dewan Utama, Dewan Seminar, Bilik Ilmuan 1, Bilik Ilmuan 2
		Deans Academic Leadership Workshop (Visit IPHEX booths @Bilik Ilmuan 3)	Dewan Banquet
	1:00 pm – 2:00 pm	Lunch & Networking, Zuhr prayer	Bilik Ilmuan 4
	2:00 pm – 4:30 pm	Special Track on STEM Education + Parallel Session 5	Dewan Seminar, Bilik Ilmuan 1, Bilik Ilmuan 2
		Academic Leadership Workshop	Dewan Banquet
4:30 pm – 5:00 pm	Closing & IPHEX prize giving ceremony	Dewan Utama	
5:00 pm – 5:30 pm	Tea	Bilik Ilmuan 4	
11 August 2016			
Post-conference Workshop	8:30 am – 9:00 am	Workshop registration	Makmal Kejituan, MJIT
	9:00 am – 4:00 pm	Workshop on “ <i>How to Publish Scholarly Educational Based Article in Journal for Science, Technology,</i>	

		<i>Engineering and Mathematics (STEM) Areas</i>	
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Technical Program

Tuesday, August 9 (Day 1)

Tuesday, August 9, 09:00 - 10:30

D1S1A: Special Track Service Learning (Dewan Utama)- August 9, 09:00 - 10:30

Discussion leader: *Dr. Aznah Nor Anuar, Universiti Teknologi Malaysia*

- Integrating Service Learning in a Community-Based Participatory Research: A Case Study of Centre for Advancement in Rural Education Informatics
Assoc. Prof. Dr. Shahida Sulaiman, Univeriti Teknologi Malaysia
- Engineering Mapping system for Service Learning Project
Prof. Dr. O Kaung Lim, Pusan National University, Korea
- Instilling Global Attributes Among Engineering Undergraduates Through A Community-Based Service Learning
Dr. Aznah Nor Anuar, Universiti Teknologi Malaysia
- Cultivating Communication and Team-Working Skills to Undergraduates in Co-Curricular Service Learning
Assoc. Prof. Dr. Dayang Norhayati Abang Jawawi, Universiti Teknologi Malaysia

D1S1B: Parallel Sessions 1 (Dewan Seminar) - August 9, 09:00 - 10:30

Chair: *Dr. Zulfaa Mohamed-Kassim*

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| 9.00 am | The Development and Analysis of Concept Inventory for Electrical and Electronics Engineering Undergraduate Courses
Nurul Hazlina Noordin |
| 9.20 am | Investigation on the impact of laboratories subjects on BEEE and BEPE students in Universiti Tenaga Nasional
Fazrena Hamid, Farah Hani Nordin, Ungku Anisa Ungku Amirulddin and Miszaina Osman |
| 9.40 am | A Methodology on Assessing Program Educational Objectives for Undergraduate Engineering Programs
Alvin Chua, Andres Winston Oreta and Rosemary Seva |
| 10.00 am | Application of Mathematical Competencies among Engineering Students through Service Learning Program
Abdul Halim Abdullah, Aznah Nor Anuar, Mahani Mokhtar, Johari Surif, Nor Hasniza Ibrahim and Noor Dayana Abd Halim |
| 10.20 am | Outreaching and engaging students with STEM through AEROFAIR
Zulfaa Mohamed-Kassim and Noorfazreena Kamaruddin |

D1S1C: Parallel Sessions 1 (Bilik Ilmuan 1) - August 9, 09:00 - 10:30

Chair : *Dr. Mohd Fadzil Daud*

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| 9.00 am | The Use of Augmented Reality Learning Environment to Enhance Students' Mental Cutting Skills and 3-Dimensional Development Skills
Marlissa Omar, Dayana Farzeeha Ali and Mahani Mokhtar |
| 9.20 am | Engineering Student Motivation and Learning in Indonesia
Lisa Benson and Cheryl Allendoerfer |
| 9.40 am | Readiness of Civil Engineering Faculty Members in Implementing MOOC
Shahrin Mohammad, Yeong Huei Lee, Cher Siang Tan, Chang Sa'ar Chai, Mahmood Md. Tahir, Mohd Hanim Osman, Sariffuddin Saad, Yusof Ahmad, Baderul Hisham Ahmad, Mohd Yunus Ishak, Hidayah Abd Hassan, Che Ros Ismail and Mohd Nur Asmawisham Alel |
| 10.00 am | Emotional Intelligence of Engineering Undergraduate in a Service Learning Programme
Mohamad Norhakim Sahroni, Sharifah Kamilah Syed Yusof, Zaleha Binti Ismail and Yudariah Mohammad Yusof |
| 10.20 am | Contextual Knowledge Elements Utilization In 3D CAD Model Visualization From Practicing Engineers Perspective |

Mohd Fahmi Adnan, Mohd Fadzil Daud and Muhammad Sukri Saud

D1S1D: Parallel Sessions 1 (Bilik Ilmuan 2) - August 9, 09:00 - 10:30Chair : *Dr. Kamilah Radin Salim*

- 9.00 am Evaluation of Laboratory Facilities for Engineering Technology Programs in Malaysian Technical Universities
Kamilah Radin Salim, Kamsiah Ismail, Habibah Norehan Haron, Rozita Juliana, Rosmah Ali, Noor Hamizah Hussain, Morina Abdullah, Norhayati Mohamed Nor, Normah Mulop and Zainai Mohamed
- 9.20 am Engineering Undergraduates' Motivation in Learning Computer Programming
Nor Azlinda Azmi, Khairiyah Mohd-Yusof, Fatin Phang, Saharudin Haron, Nor Alafiza Yunus, Zarina Abdul Muis and Syed Ahmad Helmi
- 9.40 am Evaluating Knowledge Transfer Success in Personal Learning Environments in Higher Learning Institution
Nur Syafiqah Mohamad Sani and Noreen Arshad
- 10.00 am UTM Sustainable Living Laboratory Campus; Are the Implementations Effective?
Rozana Zakaria, Gamal Al Qaifi, Nur IzieAadiana Abidin, Mohamad Sukeri Khalid, Abdul Rahim Abdul Hamid, Shaiful Amri, Eeydzh Aminudin, Irina Safitri Zen and Masilah Bandi
- 10.20 am The Impact of Instructional Scaffolding in Social Collaborative Learning Environment on Engineering Students' Knowledge Construction
Tan May Ling and Jamalludin Harun

Tuesday, August 9, 11:00 – 13:00**Plenary Forum 1 (Dewan Utama)- August 9, 11:00 – 13:00**Moderator: *Professor Dr. Wan Mansor Wan Mohammad, Universiti Kuala Lumpur*

- 11.00 am Current Status and Future Direction in Engineering Education: Overcoming the Challenges
Prof. Dr. Manuel Bellino (Philippines)
Dr. Qaiser Hameed Malik (Pakistan)
Prof. Dr. Ray Yueh-Min Huang (Taiwan)
Dr. Eddie Ng (Hong Kong)
Prof. Dr. Sung-Jin Song (Korea)
Prof. Dr. Robin Clark (UK)
Dr. Yogesh Velankar (India)

Tuesday, August 9, 14:00 – 15:30**Plenary Forum 2: Industry Forum (Dewan Utama) - August 9, 14:00 – 15:30**Moderator: *Associate Professor Dr. Naziha Ahmad Azli, Universiti Teknologi Malaysia*

- 14.00 pm Engineering Education in Global Digital Economy and Its Impact on Developing Countries
Dato' Ir Dr. Lee Yee Cheon
Malaysian Chairman, Governing Council, International Science Technology and Innovation Centre for South-South Cooperation under the auspices of UNESCO (ISTIC), Malaysia
- 14.30 pm Future Direction and Challenges in Engineering Education in the 21st Century from Engineering Accreditation Viewpoint
Prof. Dato' Ir. Dr. Wan Hamidon Wan Badaruzzaman,
Director of Engineering Accreditation Department (EAD), Board of Engineers Malaysia

Tuesday, August 9, 15:30 - 17:30**D1S2A: Special Track on Chemical Engineering Education (Dewan Utama)- August 9, 15:30 - 17:30**Discussion leader: *Dr. Mohammad Tazli Azizan, Universiti Teknologi PETRONAS*

- Improving Students' Understanding Of Reaction Engineering Course Via Flipped-Coop Learning
Dr. Raihan Mahirah Ramli, Universiti Teknologi PETRONAS, Malaysia
- Implementing Authentic Learning in a Green Boiler Technology Chemical Engineering Elective Course: Experiences at the University of Santo Tomas, Manila, Philippines
Prof. Alberto A. Laurito, University of Santo Tomas, Philippines
- Using Problems In Teaching Difficult Chemical Engineering Content: An Example In Process Control
Dr. Mohd Kamaruddin Abd Hamid, Unlversiti Teknologi Malaysia
- 1st Year Orientation Programme: Sustaining Attendance And Interest Of The New Generation
Dr. Nurlidia Mansor, Universiti Teknologi PETRONAS, Malaysia
- Motivating Students Interest To Learn Using Active Learning Strategies For Separation Process II
Dr. Nurhayati Mellon, Universiti Teknologi PETRONAS, Malaysia
- Integrated Course Design of the Introduction to Engineering Course
Dr. Aziatul Niza Sadikin, Unlversiti Teknologi Malaysia

D1S2B: Parallel Sessions 2 (Dewan Seminar) - August 9, 15:30 - 17:30

Chair : *Assoc. Prof. Dr. Fatin Aliah Phang*

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| 3.30 pm | Enhancing Student's Problem Solving Skills in Technical and Vocational Education and Training
Sharifah Zainaf, Roselainy Abdul Rahman and Robiah Ahmad |
| 3.50 pm | Use Cooperative Group Learning in Improving the Problem Solving Performance in a Surveying Course of Civil Engineering Students
Maria Cecilia Paringit |
| 4.10 pm | A Framework for Learning Analytics Intervention in e-learning
Si Na Kew and Zaidatun Tasir |
| 4.30 pm | Authentic Learning Environment for the Implementation of Data Structure Subject through MOOC: A pilot study
Nor Bahiah Ahmad |
| 4.50 pm | What are Complex Engineering Problems in the Eyes of Engineering Lecturers?
Fatin Phang, Syed Ahmad Helmi, Khairiyah Mohd-Yusof, Aznah Nor Anuar, Azmahani Abdul Aziz, Yusof Ahmad, Noorzana Khamis, Mohd Fadzil Daud and Yudariah Mohammad Yusof |

D1S2C: Parallel Sessions 2 (Bilik Ilmuan 1) - August 9, 15:30 - 17:30

Chair : *Dr. Dereje Engida Woldemichael*

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| 3.30 pm | Adopting and Implementing Active Learning and Cooperative Learning Approaches in Lecture Based Engineering Class
Dereje Engida Woldemichael and Azman Zainuddin |
| 3.50 pm | Engineering Students' Pattern of Metacognition during Complex Problem Solving at Digital Signal Processing Laboratory
Narina A. Samah, Hadijah Jaffri, Ahmad Zuri Sha'ameri, Usman Ullah Sheikh, Naziha Ahmad Azli and Lokman Tahir |
| 4.10 pm | Assessing Students' Practical Intelligence in Hands-On Electrical Laboratory via Psychomotor Domain by using Engineers Automated Testing Kit
Mohd Hisam Daud, Zol Bahri Hj. Razali and Maizam Alias |
| 4.30 pm | Outcomes Assessment and Analysis using iOBE
Zulfaa Mohamed-Kassim and Noorfazreena Kamaruddin |
| 4.50 pm | Impact of an Introduction to Engineering Course on First year students' view on engineering
Nur Fazirah Jumari, Khairiyah Mohd-Yusof and Fatin Phang |
| 5.10 pm | A Conceptual Framework for Assessing Mathematical Competencies of Engineering Students |

Nur Izrah Mohd Puzi, Yudariah Mohammad Yusof and Naziha Ahmad Azli

D1S2D: Parallel Sessions 2 (Bilik Ilmuan 2) - August 9, 15:30 - 17:30

Chair : *Dr. Noor Dayana Abd Halim*

3.30 pm	Cognitive Conflict Strategies in Video-Based Learning Enhance Students' Conceptual Change Radhiah Ab Rahim, Norah Md Noor and Norasykin Zaid
3.50 pm	Awareness and Procedural Knowledge as Predictors of Students' Intention to Use BookMyne: An Exploratory Study Mohd Nihra Haruzuan Bin Mohamad Said and Zaleha Binti Ismail
4.10 pm	Meta-analysis on Interaction in Online Learning Noor Dayana Abd Halim and Masarraah Abdul Mutalib
4.30 pm	Towards Integrating GIS to the University's Educational Programme Stephanie Mae Salcedo and Rejen L Albores
4.50 pm	Open-Ended Malik & Naveed Interventions (OMNI) Techniques for Engineering Freshmen Qaiser Malik and Naveed Zafar
5.10 pm	MOOCs in Engineering Education - a literature review Azhar Rauf, Mohd Fadzil Daud and Mohd Nihra Haruzuan Bin Mohamad Said

Wednesday, August 10 (Day 2)

Wednesday, August 10, 09:00 - 10:15

D1S3A: Special Track on Grand Challenges (Dewan Utama) - 09:00 - 10:15

Discussion leader: *Professor. Dr. Sung-Jin Song, Sungkyunkwan University*

- Facilitating Learning and Teaching in a Common Core Course on Grand Challenges: A Blended Learning Approach
Dr. Eddie Ng, Hong Kong University of Science & Technology
- Grand Challenge Tech+ Innovator Program of Sungkyunkwan University Hub Center
Prof. Dr. Sung-Jin Song, Sungkyunkwan University, Korea
- Engineering a Holistic Education
Prof. Dr. Mushtak Al-Atabi, Taylor's University, Malaysia

D1S3B: Parallel Sessions 3 (Dewan Seminar) - 09:00 - 10:15

Chair : *Dr. Roselainy Abdul Rahman*

9.00 am	Student perception of use and level of implementation of logbooks in individual final year projects Sarah Junaid, Paul Gorman, Laura Leslie and Mark Prince
9.20 am	Teaching and Learning Intervention Strategy to Increase Students' Use of Deep Learning Approach Norsyarizan Shahri, Roselainy Abdul Rahman, Noor Hamizah Hussain and Yudariah Mohammad Yusof
9.40 am	An Innovative Approach to Develop Global Engineers by Supporting the Students via Diversity in Engineering Education Rutika Ghariya, Kalp Bhatt, Tosha Shukla and Juned Shaikh
10.00 am	Importance of Oral Communication Strategies to Engineering Students Hairuzila Idrus

D1S3C: Parallel Sessions 3 (Bilik Ilmuan 1) - 09:00 - 10:15

Chair : *Mdm. Nur Ayuni Shamsul Bahri*

9.00 am	Development of Problem-solving Process Rubrics (PPR) in Assessing Problem Solving Skills
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9.20 am	Nur Ayuni Shamsul Bahri, Naziha Ahmad Azli and Narina A. Samah Perception of Lecturers on Problem Based Learning in Civil and Environmental Engineering Courses Filzah Amani
9.40 am	Activity Theory: Inculcating Fundamental Engineering skills and Attributes Through Mini-Project Laboratory Activity Md. Shahar Aftanasar, Norizah Mohamad and Ahmad Nazri Ali
10.00 am	Impact of Faculty Satisfaction and Student Feedback on Students' Performance- A Case Study of FAST-National University Farrukh Idrees, Waseem Ikram and Azhar Rauf

D1S3D: Parallel Sessions 3 (Bilik Ilmuan 2) - 09:00 - 10:15	
Chair : <i>Mdm. Azmahani Abd Aziz</i>	
9.00 am	Promoting ethical skills in first year engineering students through socially relevant experiments Yogesh Velankar, Gopalkrishna Joshi and Preethi Baligar
9.20 am	Evidence-Based Personas of First Year Engineering Students as Potential Pedagogical Tool Aisha Mahmood, Yudariah Mohammad Yusof and Mohd Fauzi Othman
9.40 am	Skills development among first year engineering students through "Introduction to Engineering" course Nur Shahira Samsuri, Khairiyah Mohd-Yusof and Azmahani Aziz
10.00 am	A response to the twenty-first century challenges to philippine engineering education: innovative and revitalized graduate programs in engineering education Manuel Belino

Wednesday, August 10, 10:15 - 11:00

Keynote: Transformation in Engineering Education (Dewan Utama) - 10:15 - 11:00	
Chair: <i>Prof. Dr. Khairiyah Mohd Yusof</i>	
10.15 am	Engineering Education Practice: What Needs to Change? <i>Professor Dr. Jeffrey E. Froyd, Texas A&M University</i>

Wednesday, August 10, 11:15 - 13:00

D2S1A: Special Track on Student Centred Learning (Dewan Utama) - 11:15 - 13:00	
Discussion leader: <i>Assoc. Prof. Dr. Yudariah Mohammad Yusof, Universiti Teknologi Malaysia</i>	
•	Student Centred Active Learning: Why and How <i>Assoc. Prof. Dr. Lisa Benson, Clemson University, USA</i>
•	Students' Participation in Student-Centred Learning: What are the most encouraging elements? <i>Dr. Alias Masek, Universiti Tun Hussein Onn Malaysia</i>
•	Transformation from Teacher Centred Learning: The UTP Experience <i>Dr. Mohammad Tazli Azizan, Universiti Teknologi PETRONAS, Malaysia</i>
•	Transitions of Teaching Conceptions from Teacher Centred to Student Centred <i>Prof. Dr. Khairiyah Mohd-Yusof, Universiti Teknologi Malaysia</i>

D2S1B: Parallel Sessions 4 (Dewan Seminar) - 11:15 - 13:00	
Chair : <i>Assoc. Prof. Dr. Naziha Ahmad Azli</i>	
11.15 am	Collaboration between University and Local Government Units on a National Flood Hazard Mapping Project

11.30 am	<p>Sim Joseph Fernandez, Alan Milano, Dave Charity Gambuta and Elizabeth Edan Albiento</p> <p>Preliminary Study on the Prominent Skills in the Entrepreneurial Skill Set in the Context of Civil Engineering Practice</p>
11.45 am	<p>Christie Entika, Shahrin Mohammad and Mohd Khata Jabor</p> <p>Using an analytic hierarchy process to develop Innovation DNA for Industry-oriented applications in mechanical design of vocational college students</p>
12.00 pm	<p>Dyi-Cheng Chen</p> <p>Civil Engineering Exit Test</p>
12.15 pm	<p>Yusof Ahmad</p> <p>Engineering Education at Kanazawa Institute of Technology: To Foster Engineers Who can Make Ethically and Professionally Appropriate Decisions</p>
12.30 pm	<p>Fumihiko Tochinai</p> <p>Collaboration between University and Local Government Units on a National Flood Hazard Mapping Project</p> <p>Sim Joseph Fernandez, Alan Milano, Dave Charity Gambuta and Elizabeth Edan Albiento</p>

D2S1C: Parallel Sessions 4 (Bilik Ilmuan 1) - 11:15 - 13:00

Chair : *Assoc. Prof. Dr. Zaleha Ismail*

11.15 am	<p>Harnessing Mathematical Thinking Powers of Engineering Students' in a Computer Support Learning Environment (CSLE)</p> <p>Fereshteh Zeynivandnezhad, Zaleha Binti Ismail and Yudariah Mohammad Yusof</p>
11.30 am	<p>Lessons in the implementation of Continuous Quality Improvement in the Civil Engineering program of De La Salle University</p> <p>Mario De Leon, Lessandro Estelito Garciano and Andres Winston Oreta</p>
11.45 am	<p>Enhancing the Employability of Engineering Graduates by Developing and Empowering the Faculties</p> <p>Prafulla Hatte and Yogesh Bhalerao</p>
12.00 pm	<p>Laboratory Practices for Formative Assessment in Undergraduate Microwave Engineering Education</p> <p>Kok Yeow You</p>
12.15 pm	<p>Desired Mathematical Competencies in Outcome Based Engineering Curriculum</p> <p>Soheila Firouzian, Zaleha Binti Ismail, Roselainy Abdul Rahman and Yudariah Mohammad Yusof</p>
12.30 pm	<p>Mathematical competencies among postgraduate students</p> <p>Nur Athirah Aziz, Yudariah Mohammad Yusof and Zaleha Binti Ismail</p>

D2S1D: Parallel Sessions 4 (Bilik Ilmuan 2) - 11:15 - 13:00

Chair : *Dr. Nurul Farhana Jumaat*

11.15 am	<p>Predicting Students' Performance based on Instructors' Pattern of Metacognitive Scaffolding</p> <p>Nurul farhana Jumaat and Zaidatun Tasir</p>
11.30 am	<p>Impact of Affirmative Action in Engineering Education: Case study of an affiliated private engineering college in India</p> <p>Suhasini Desai</p>
11.45 am	<p>Decision Support System for Awarding Shcolarship Using SAW and TOPSIS</p> <p>Ni Gusti Ayu Putu Harry Saptarini and Putu Indah Ciptayani</p>
12.00 pm	<p>Effectiveness of Using BizzApss in Enhancing Students' Achievement With Different Learning Styles</p> <p>Noor Dayana Abd Halim, Mahani Mokhtar and Abdul Halim Abdullah</p>
12.15 pm	<p>Measuring Critical Thinking In Online Discussion: Analysis Model</p> <p>Nurul Nadwa Zulkifli, Noor Dayana Abd Halim and Noraffandy Yahaya</p>
12.30 pm	<p>The Impact of Feedback Phase to the Development of ICT Product: Case Study Software Project Course</p> <p>Harry B. Santoso, Fauzan H. Sudaryanto and Wade Goodridge</p>
12.45 pm	<p>Video Learning Practices Enhancing Students Critical Thinking Skills</p>

Nurul 'Izzati Hamizan, Norasykin Zaid, Norah Md Noor and Mahani Mokhtar

Wednesday, August 10, 14:00 - 16:30**D2S2B: Special Track on STEM Education (Dewan Seminar) - 14:00 - 16:30**Discussion leader: *Assoc. Prof. Dr. Fatin Aliah Phang, Universiti Teknologi Malaysia*

- Strengthening STEM Education for Industry 4.0
Dr. Raslan Ahmad, Malaysian Industry-Government Group for High Technology (MIGHT), Malaysia
- Cultivate Living Skills through Young Innovate Program
Dr. Chew Yen Seng, Social Enterprise of Dream Catcher Sdn Bhd, Malaysia
- Education for Hire: Multi-Faceted Industry and Academia Collaborative Education Program in Building Sustainable Dynamic Workforce
Dr. NorAzmi Alias, Collaborative Research in Engineering Science & Technology Center, Malaysia
- Strengthening Sustainability of STEM Education through Smart Partnerships
Assoc. Prof. Dr. Zaleha Ismail, Persatuan Pendidikan Sains dan Matematik Johor (PPSMJ) Malaysia
- STEM Learning Activities at Centre for Engineering Education
Assoc. Prof. Dr. Fatin Aliah Phang, Universiti Teknologi Malaysia
- Cross-Border Learning for Developing International Perspectives on STEM Education
Dr. Suhaidah Tahir, Institut Pendidikan Guru Kampus Ipoh Malaysia
- STEM Education Experiences from Singapore: Harnessing the Formal and Informal Education Sectors for Synergy
Assoc. Prof. Dr. R. Subramaniam, Nanyang Technological University, Singapore.

D2S2C: Parallel Sessions 5 (Bilik Ilmuan 1) - 14:00 - 16:30Chair : *Dr. Muhammad Khair Noordin*

- | | |
|---------|---|
| 2.00 pm | Level of Non-Technical Skills Among Electrical Engineers in Malaysia: Perceptions from Fresh Engineers and Senior Engineers
<i>Muhammad Khair Noordin and Mohd Safarin Nordin</i> |
| 2.20 pm | Multimedia Instruction Applications for Engineering Education
<i>Ataollah Zarei, Khairiyah Mohd-Yusof and Mohd Fadzil bin Daud</i> |
| 2.40 pm | Enhancing Sustainability Knowledge using Problem among Engineering Students
<i>Azmahani Aziz, Khairiyah Mohd-Yusof and Amirmudin Udin</i> |
| 3.00 pm | From Classroom To Commercialisation of Interactive Pressure Vessel Design, iPVD
<i>Nur Kamarudin</i> |
| 3.20 pm | Measurement of Spiritual Quotient in the Student Holistic Development Programme
<i>Mohd Hanim Osman, Norazmallail Marni, Ajmain Saffar, Sarifuddin Saad, Shahrin Mohamad</i> |
| 3.40 pm | Enhancing High Order Thinking Skills (HOTS) and Improving Teamwork Skills among Chemical Engineering Students through the Development of Board Game Activity via Cooperative Learning
<i>Mohammad Tazli Azizan, Hairuzila Idrus, Nurhayati Mellon, Suzana Yusup, Raihan Mahirah Ramli, Haslinda Zabiri and Dzulkarnain Zaini</i> |

D2S2D: Parallel Sessions 5 (Bilik Ilmuan 2) - 14:00 - 16:30Chair : *Mr. Mohd Fadzli Ali*

- | | |
|---------|--|
| 2.00 pm | A Design Framework of Teachers' Professional Development in Indonesia
<i>Anton Subarno, Mei-Ying Chien and Wen-Fu Pan</i> |
| 2.20 pm | Developing Critical Thinking Skill Through The Use of Collaborative Asynchronous Online Discussion Based on |

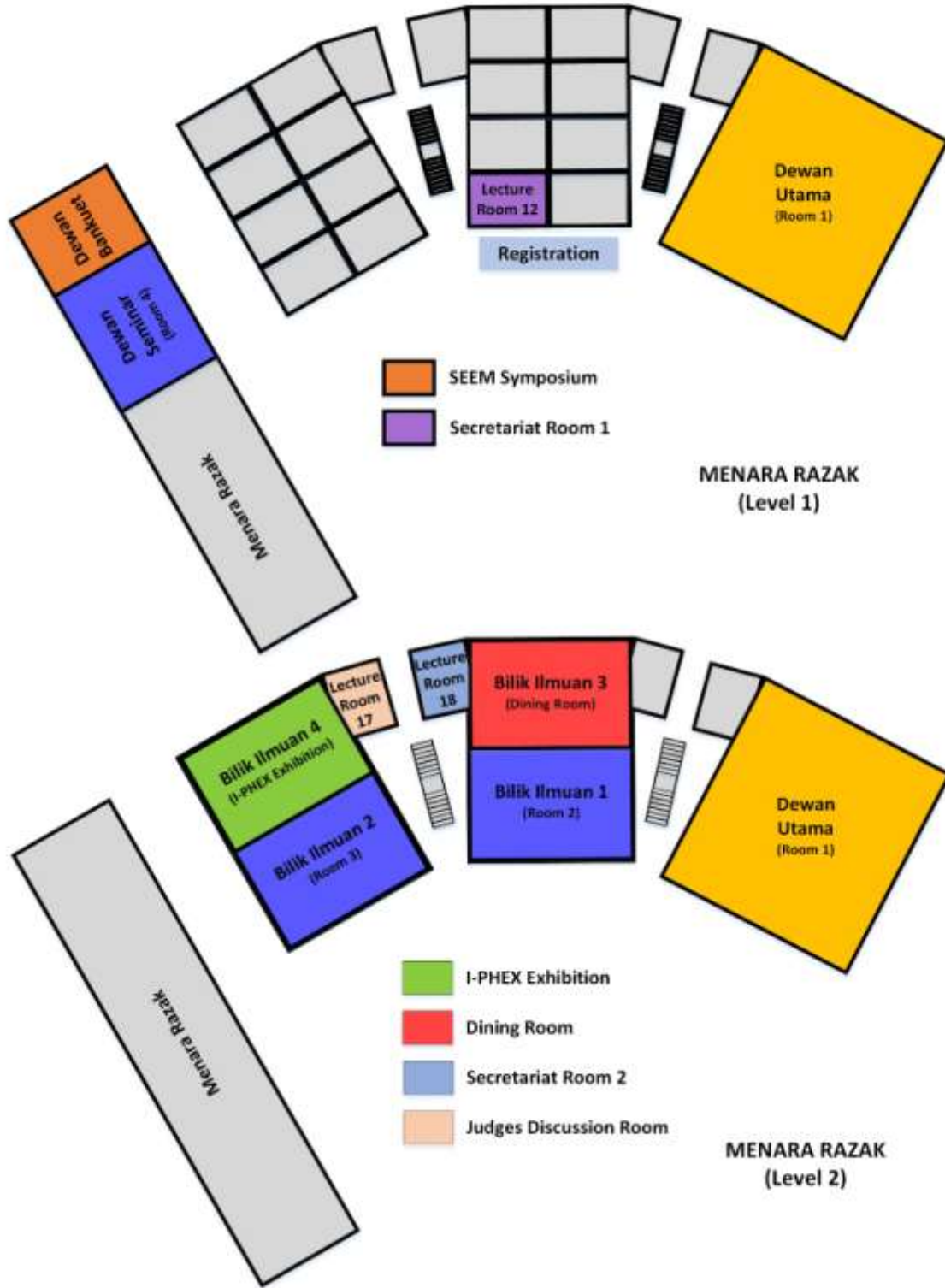
	Spod Model
	Mohd Fadzli Ali
2.40 pm	Reinforcing Teacher's Role in Retaining Students' Interests Discussing Online in their Learning Process at Malaysian Tertiary Institution
	Mohd Fadzli Ali
3.00 pm	Implementation of Group endeavours in Service Learning among teachers in Singapore
	Fatimah Zahra Abdul Mutalib, Mahani Mokhtar, Noor Dayana Abd Halim, Dayana Farzeeha Ali and Abdul Rahim Hamdan
3.20 pm	Conceptual Framework of Innovative Product Development through Problem Oriented Project Based Learning
	Sarimah Ismail, Nornazira Suhairom, Dayana Farzeeha Ali, Rohana Hamzah

Map & Location

UTM International Campus, Kuala Lumpur



RCEE 2016 ROOM LAYOUT



Keynote Session

Transformation in Engineering Education



Jeffrey E. Froyd, TEES Research Professor
Engineering Academic and Student Affairs
Dwight Look College of Engineering
Texas A&M University

Engineering Education Practice: What Needs to Change?

Extensive research has developed teaching approaches to improve student learning and multiple evaluation studies, both individual and synthetic (e.g., meta-analysis), have concluded that evidence-based teaching approaches can improve student learning when compared to traditional lecture. Even though studies have shown that engineering faculty members are aware of evidence-based teaching approaches and studies supporting their efficacy, an overwhelming majority of engineering faculty members have not adopted these approaches nor are they likely to in the near future. To change this trend, changes are needed in one or more of the following four areas.

1. The culture needs to change. In conversations about cultural change greater clarity is needed with respect to at least three things: (i) What is meant when the term culture is used? (ii) What culture is envisioned when calls for culture change are issued? and (iii) What strategies can be used to bring about cultural change?
2. Conversations about teaching need to change. More emphasis needs to be placed on desired student learning before conversation shifts to how teaching should be done.
3. Propagations plans for promoting adoption of instructional strategies and materials need to change. Shifts are needed from strategies focused on increasing awareness to strategies focused on increasing adoption.
4. Research on faculty development is needed. What organizational structures promote faculty development? What approaches (e.g., lectures, workshops, learning communities, communities of practice, individual consultations, etc.) promote change in teaching practices? How will effectiveness of faculty development strategies be evaluated? These and other questions need to be addressed to provide research on which future faculty development programs can be designed.

The presentation will address each of the four areas.

Invited Speaker's Biodata

Dr. Jeffrey E. Froyd is a TEES Research Professor in the Office of Engineering Academic and Student Affairs at Texas A&M University, College Station. He received the B.S. degree in mathematics from Rose-Hulman Institute of Technology and the M.S. and Ph.D. degrees in electrical engineering from the University of Minnesota, Minneapolis. He was an Assistant Professor, Associate Professor, and Professor of Electrical and Computer Engineering at Rose-Hulman Institute of Technology. At Rose-Hulman, he co-created the Integrated, First-Year Curriculum in Science, Engineering and Mathematics, which was recognized in 1997 with a Hesburgh Award Certificate of Excellence.

He served as Project Director for a National Science Foundation (NSF) Engineering Education Coalition in which six institutions systematically renewed, assessed, and institutionalized innovative, integrated undergraduate engineering curricula. He has authored over 70 journal articles and conference papers and offered over 30 workshops on faculty development, curricular change processes, curriculum redesign, and assessment. He has served as a program co-chair for three Frontiers in Education Conferences and the general chair for the 2009 conference. He also serves on the IEEE Curricula and Pedagogy Committee, which is part of the University Resources Committee, which is part of the Educational Activities Board.

Prof. Froyd is a Fellow of the IEEE, a Fellow of the American Society for Engineering Education (ASEE), an ABET Program Evaluator, the Editor-in-Chief for the IEEE Transactions on Education, a Senior Associate Editor for the Journal of Engineering Education, and an Associate Editor for the International Journal of STEM Education.

Plenary Forum

Plenary Forum 1

Moderator: Professor Dr. Wan Mansor Wan Mohammad (Universiti Kuala Lumpur)

Current Status and Future Direction in Engineering Education: Overcoming the Challenges

Speakers: Prof. Dr. Manuel Bellino (Philippines),
Dr. Qaiser Hameed Malik (Pakistan),
Prof. Dr. Ray Yueh-Min Huang (Taiwan),
Dr. Eddie Ng (Hong Kong),
Prof. Dr. Sung-Jin Song (Korea),
Prof. Dr. Robin Clark (UK),
Dr. Yogesh Velankar (India)

Plenary Forum 2: Industry Forum

Moderator: Assoc. Prof. Dr. Naziha Ahmad Azli (UTM)

Engineering Education in Global Digital Economy and Its Impact on Developing Countries

Speaker: Dato' Ir Dr. Lee Yee Cheong
Malaysian Chairman, Governing Council, International Science Technology and Innovation Centre for South-South Cooperation
under the auspices of UNESCO (ISTIC), Malaysia

Future Direction and Challenges in Engineering Education in the 21st Century from Engineering Accreditation Viewpoint

Speaker: Prof. Dato' Ir. Dr. Wan Hamidon Wan Badaruzzaman
Director of Engineering Accreditation Department (EAD), Board of Engineers Malaysia

Pre-conference Workshop

Educational Research Design for Science, Technology, Engineering and Mathematics (STEM) Areas

8 August 2016 (Full day)

This workshop is suitable for educators, administrators and policy makers in STEM areas at higher education level who intend to start venturing into educational research to improve their practice or to contribute to the body of knowledge in STEM education. The participants will be introduced to the essential elements of education research in STEM higher education. They will be able to learn how to design and conduct research for academic programmes and practice in their classroom. This will be an advantage for the participants in writing proposals application for education research funding and solve meaningful educational problems.

Post-conference Workshop

How to Publish Scholarly Educational Based Article in Journal for Science, Technology, Engineering and Mathematics (STEM) Areas

11 August 2016 (Full day)

The workshop will be facilitated by internationally recognized scholar, researcher and experienced reviewers such as Prof. Dr. Jeff Froyd and Prof. Dr. Khairiyah from the field of engineering education and higher education who will share their vast knowledge of the academic publication process with participants. The workshop provides a great opportunity for participants to gain the necessary skills, knowledge, strategy and self-confidence needed to publish academic articles in well-known established journals. Publishing is a fundamental part of academic activity and publication in such journals can increase the relevance, quality and the impact of your research.

SPECIAL TRACK

ABSTRACT

Service Learning

Integrating Service Learning in a Community-Based Participatory Research: A Case Study of Centre for Advancement in Rural Education Informatics

Shahida Sulaiman
Faculty of Computing, Universiti Teknologi Malaysia, Malaysia

Current needs in higher learning institutions lead to the evolution of academia's role from only focusing on teaching to actively involved in research and professional service that includes services to the community. The diversity in key performance index encourages academicians to be creative and innovative in order to link their research with a community's needs through community-based participatory research (CBPR). Simultaneously, a CBPR has a potential to be incorporated with a service learning as part of teaching and learning strategy for a dedicated course. The case study of Centre for Advancement in Rural Education Informatics (iCARE), a project under the MoU between Universiti Teknologi Malaysia (UTM) and South East Johore Development Authority (KEJORA) provides an insight on the possibility to integrate service learning in a CBPR as part of university social responsibility (USR) to support rural education informatics. The case study involves a programme that adopts information and communication technology (ICT) to promote the interest and confidence in English communication among rural learners. The findings of the case study show the possibility of the integration with some challenges that researcher-cum-academician could ponder. This outcome reflects how academicians can integrate service learning in their CBPR related projects in order to share and transfer their knowledge, expertise and research at universities together with their students for the benefit of local community.

Engineering Mapping system for Service Learning Project

O Kaung Lim, Young Bong Seo, Ji In Eom, Min Jeong Jeong
Innovation Center for Engineering Education, Pusan National University, Korea

We have made various engineering service learning programs for undergraduate students of engineering major since 2009. Project BEE is one of them and BEE stands for beyond engineering education. Creativity Station' is the creative convergence design education which involves engineering services based on different majors. The basic structure of service learning is divided into five parts based on topics with 29 detail missions. Participants should find problem and define solving issue to serve in local site. Students can refer to the schedule book to get information about various missions each project requires. Each team found out the most crucial issue of local village and defined the problem by themselves. Main design process of each team can be checked in real time on website named 'Engineering Mapping'.

Instilling Global Attributes Among Engineering Undergraduates through a Community-Based Service Learning

Aznah Nor Anuar
Centre for Engineering Education, Universiti Teknologi Malaysia, Malaysia

In the 21st Century, globalization and the growth of multinational companies throughout the world today means that the need for global workers or professionals is rising. People in different cultures may have different ways of thinking, norms, working, etc. Some language or behaviour may be considered perfectly acceptable in one culture, but inappropriate in another. As such, since the end of the 20th Century, there is an increasing trend for engineers to work in multi-cultural and multi-nation environments. There are several attributes reported under the brand of "Global Engineers" as early as 1997 under the Manifesto for Global Engineering Education, stated that global engineers not only have a good grasp of engineering knowledge and understanding but also have multidisciplinary perspective and understanding of interrelatedness of their expert area with others. They need to be able to appreciate other culture and the diversity, flexible, dynamic, have good communication and team-working skills. To develop global attributes of engineering graduates, four institutions from three Asian countries (Malaysia, Indonesia and Korea) had collaborated in service learning program in communities around Indonesia and Malaysia. Students from different countries were grouped together to identify local issues in the community. They then create and implement the solution. This paper presents the results of the study undertaken by University Teknologi Malaysia to investigate

the impact of the program, with respect to the attainment of global engineers attributes. The research based on check-list survey and results comparison between participation of UTM students from 2013 to 2015, indicated that this intensive program, using the concept of a multi-cultural team for engineering service learning, can be implemented to instil global engineer attributes among students.

Cultivating Communication and Team-Working Skills to Undergraduates in Co-Curricular Service Learning

Dayang Norhayati Abang Jawawi
Faculty of Computing, Universiti Teknologi Malaysia, Malaysia

Co-curricular Service Learning (CSL) is one of the approaches that used community service experience in cultivating generic skills among undergraduate students. This paper describes an implementation of CSL approach. The experience of undergraduates involved in the CSL project was studied by analyzing their reflection on communication and teamwork skills after their involvement in the CSL programs. The findings of this study suggested that CSL has an impact on the cultivation of communication and teamwork skills among the undergraduates involved.

Chemical Engineering Education

Improving Students' Understanding of Reaction Engineering Course via Flipped-Coop Learning

Raihan Mahirah Ramli
Chemical Engineering Department, Universiti Teknologi PETRONAS, Malaysia

The attribute as a long-life learner has been documented as the eleventh out of twelve program outcomes outlined by Engineering Accreditation Council (EAC) [1], alongside with other soft skills required for a future engineer. Development of the attribute are ideally being embedded into teaching and learning activities so that students are able to relate their acquired skills with the technical knowledge. Unfortunately, the current traditional teaching method of one-way communication with the educators being the dispenser of the facts still rules in most of chemical engineering classes. The challenges faced by the educators are to design active learning activities and facilitate students through the changes in learning experiences. It is well known that students' preparation before coming to the class has huge impact towards their understanding and participation in class on the topic. The use of audio and video technology as a tool to prepare teaching materials for students before the class could be one of the method. The flipped classroom was first introduced by Jonathan Bergmann and Aaron Sams back in 2007 to help their students who were missing from class due to other commitments [2]. Lage et al. [3] defined flipped (or inverted) classroom as "events that have traditionally taken place inside the classroom now taken place outside the classroom and vice versa". In the flipped classroom model, students are given the lecture materials prior to the class for them to learn at their own time and pace, and the schedule class is used to do problem solving which normally be given as homework in the traditional method. The key ingredient in the flipped approach is often the video lectures, which is created by the instructors and posted online for ease of viewing. Students are instructed to view the video prior the class. Pierce and Fox [4] implemented flipped classroom for their renal pharmacotherapy topic module and students were given case study during scheduled class for interactive discussion. Prior knowledge provided in the flipped materials helped the students to be prepared for class discussion. The end semester results showed that performance of their students improved as compared to the previous year under traditional instructional. Students' feedback of the new implemented instructional method were positive. Cooperative learning strategies promote active participations of students and student centered learning. There are three keys of cooperative learning; (1) students working together in small team to achieve common goal, (2) responsibilities for each sub-goal are divided among the members, and (3) individual contributions are combined into one product to ensure the goal is achieved [5]. Meta-analysis conducted by Johnson and Johnson [6] to analyse the impact of cooperative learning on student achievement reported of significant higher performance compared to their peers in individual learning environment.

Implementing Authentic Learning in a Green Boiler Technology Chemical Engineering Elective Course: Experiences at the University of Santo Tomas, Manila, Philippines

Alberto A. Laurito
Faculty of Engineering, University of Santo Tomas, Philippines

This paper shall share with the RCEE 2016 participants the experiences of the author in the design, training of trainers, and implementation of an outcomes based course in Green Boiler Technology. The author was commissioned in 2012 as a UNIDO educational expert to design the course for delivery in five East South East Asia (ESEA) countries, the Philippines, Thailand, Indonesia, Mongolia, and Cambodia. The course shall serve as a continuing training course for promoting awareness on Best

Available Techniques (BAT) and Best Environmental Practices (BEP) in fossil fuel fired boilers in the ESEA Region, focusing on the elimination of unintentionally produced dioxins and furans during industry boiler operations. After piloting the course in his Chemical Engineering department, several professors from the participating institutions were trained by the author for further implementation of the course. The Green Boiler Technology (GBTech) Course is currently delivered as an Energy or Environmental track specialization to graduating B.S. Chemical and Mechanical Engineering students at the University of Santo Tomas. The course is implemented to provide authentic learning by the students, as case study presentation and reports on the analysis of industrial boilers in actual operation shall serve as the final requirement. The GBTech class is divided into groups of four to six members, and each group is tasked to connect with companies with industrial boilers for the purpose of energy audit and environmental impact assessment.

The lecture modules focus on the types and operations of boilers, boiler fuels, and environmental impacts of boilers with focus on the potential release of dioxins and furans, two of the deadliest Persistent Organic Pollutants (POPs), and the existing BAT and BEP as identified in the ESEA UNIDO boiler project. The lectures are supported with computing sessions on the direct and indirect methods for determining the boiler thermal efficiency. After these sessions, the groups are deployed to their assigned boilers in order to review results of in house boiler efficiency calculations as it connects boiler fuel type and characteristics, percentage excess air supplied flue gas analysis, and the presence of waste heat recovery equipment such as economizers and air preheaters.

In the final month of the course, the students are trained to use FireCAD, a boiler design software provided by UNIDO, in order to simulate the effects of making changes in fuel type and composition, excess air, use of various designs of air preheater and economizer on improving the current operating efficiency of their case boilers. The student groups are then asked to prepare a report to their assigned companies giving recommendations on further "greening" their case boiler, as derived from the results obtained using the FireCAD software. Each group is then given 20 minutes each to share with the other groups their boiler case study before the end of the semester and all of their gained experiential learning are also summarized in a final written team report or journal.

The author shall also narrate on how the same course has been shared with faculty members from other chemical and mechanical engineering departments in Metro Manila, through the Philippine Institute of Chemical Engineers (PIChE) Academe Chapter for the purpose of expanding its offering to other institutions.

Finally, the author has redesigned the university based course into a one week Continuing Professional Development (CPD) course for practicing engineers and this new course has been offered to practicing engineers coming from a local glass and petroleum companies.

Using Problems in Teaching Difficult Chemical Engineering Content: An Example in Process Control

Mohd. Kamaruddin Abd. Hamid
Faculty of Chemical and Energy Engineering, Universiti Teknologi Malaysia, Malaysia

Chemical Engineering content are well known for abstract concepts that are difficult to visualize. Teaching chemical engineering program requires lot of effort in understanding not only the fundamental of the chemical engineering such as mass and energy balances, thermodynamics, process transport etc., but also require the application of mathematics such as calculus, numerical analysis and statistics. Too often, students become lost in the concepts and calculations, that they cannot visualize the larger picture of the actual applications and context of the knowledge that they are learning.

Process control has the notorious reputation of being one of the most difficult courses in an undergraduate chemical engineering program. The course and how it is taught is a controversial subject that generate lively discussions among control academics, control practitioners, and chemical engineering faculty who do not teach process control. Curriculum trends such as the new emphasis on biological engineering, sustainability, safety are influencing how process control is taught, and clearly there is difficulty in squeezing more content into an already full course.

Content in the process control class usually required students to have good understanding of calculus and differential equations. Students find it difficult to understand the fundamental of process control since they need to derive and solve mathematical models which represent the behaviors of dynamic processes. Consequently, they fail to relate the meaning of abstract concepts and models to the real world. This paper describes efforts use realistic (and sometimes real) problems from industry to help students learn process control and dynamics at a deep level in the context of the real world applications.

1st Year Orientation Programme: Sustaining Attendance and Interest of the New Generation

Nurlidia Mansor
Chemical Engineering Department, Universiti Teknologi PETRONAS, Malaysia

Orientation programs at Institutions of Higher Learning (IHL) are a common event, mostly held to allow new students to familiarize themselves with the academic requirements, course offerings, and registration procedures. Apart from that, providing 1st year students with an opportunity to understand the expectations of the institution and allowing them to connect with the resources that are available allows them to swiftly settle in their new environment [1]. Over the years, orientation programs have taken a new outlook or even new names to give it a refreshing take, such as 'Welcome Program', 'Kick-off Program', '1st Year Bootcamp' to name a few. The programs would sometimes be a one-day event or may even stretch to a week.

Recognizing the challenges that students may face at the start of their program, the Department of Chemical Engineering at University Teknologi PETRONAS began an orientation program in 2015 to welcome their 1st year students. The objectives of the program known as '1st Year Chemical Engineering Bootcamp', are to conduct early engagement with the students, to inspire them to perform extraordinarily and to motivate them to endure their four- year undergraduate program. The organizing committee fashioned a well-rounded event which touched on academic matters, engaging activities with seniors and staff, outdoor and indoor team building with peers as well as challenging activities and competitions. Senior students were also engaged as co-organizers and assisted with the facilitation of the events.

Motivating Students Interest to Learn Using Active Learning Strategies for Separation Process II

Nurhayati Mellon

Chemical Engineering Department, Universiti Teknologi PETRONAS, Malaysia

Active learning is viewed as one of the tools that helped to increase the motivation in learning through the incorporation of activities that promotes discussion and thinking among learners. As opposed to traditional lecture where information are merely transmitted from the instructor to the learner without requiring any thinking, active learning involved the elements of "involving students in doing things and thinking about the things they are doing" [1]. Learners use mental pattern and existing knowledge in interpreting new knowledge, and new information that are assimilated to existing knowledge, are more easily understood, learned and retained [2-3]. This is one of the reasons why science and engineering teaching requires more than the traditional lecturing approach. To quote Volpe [4]: "Public understanding of science is appalling. The major contributor to society's stunning ignorance of science has been our educational system. The inability of students to appreciate the scope, meaning, and limitations of science reflects our conventional lecture-oriented curriculum with its emphasis on passive learning. The student's traditional role is that of a passive note-taker and regurgitator of factual information. What is urgently needed is an educational program in which students become interested in actively knowing, rather than passively believing."

As the famous quote by Benjamin Franklin, "Teach me and I forget, tell me and I remember, involve me and I learn", it is realized that the best way to improve students motivation in learning is through the implementation of active learning instructions incorporating various activities and peer discussions that effectively promotes student learning in class [5] in class as part of the delivery method as opposed to traditional 50 minutes lecture. Traditional lecture has failed to motivate students learning [6] as activities that promotes learning i.e. actively seeking new information and constructing the information in a meaningful way [7] is lacking.

Integrated Course Design of the Introduction to Engineering Course

Aziatul Niza Sadikin

Faculty of Chemical and Energy Engineering, Universiti Teknologi Malaysia, Malaysia

As part of the effort to enhance students' first year experience, Chemical Engineering students in Universiti Teknologi Malaysia are required to take the Introduction to Engineering course. The course is designed to stimulate students' passion and strengthen their motivation for further engineering studies as well as enhancing their technical knowledge and relevant professional skills. This paper describes the design and implementation of Introduction to Engineering course which aims to introduce engineering and inculcates sustainability awareness among students. To attain the course outcomes, student-centered teaching and learning approaches are implemented, starting with cooperative learning leading up to problem based learning. Real problems based on sustainability related issues are designed with input and cooperation with industries or related agencies. The ITE course was integrated with a one-credit seminar course to support the inclusion of stakeholders by inviting them to give presentations and bringing students for related site visits.

Grand Challenges

Facilitating Learning and Teaching in a Common Core Course on Grand Challenges: A Blended Learning Approach

Eddie Ng

Center for Engineering Education Innovation, School of Engineering,
Hong Kong University of Science & Technology, Hong Kong

With the growing awareness of engineering grand challenges that we are facing in the 21st century, there is an increasing interest in developing new courses to nurture professionals for dealing with these challenges. Grand challenges are complex problems which often require multi-disciplinary knowledge. To prepare the next generation of professionals for the challenges, a common core course is designed to develop students' abilities to identify relevant issues and explore engineering solutions collaboratively in solving these open-ended problems. As a common core course, students from different academic disciplines will be enrolled in the course and to work in teams to formulate solutions that address the challenges through making use of the diverse expertise from their disciplines of study. In the meantime, however, students from different disciplines naturally have different learning styles and levels of understanding on a challenge topic. To facilitate learning and teaching in this course, a blended learning approach is adopted. In addition to guest lectures, online learning resources, face-to-face teaching, and peer learning, a learning approach called structured controversy is also adopted to enable students to be engaged in interactive learning experiences. Furthermore, a peer learning model is applied to facilitate face-to-face teaching. Pre- and post-course surveys are conducted. The results of the course surveys are good resources to evaluate the effectiveness of the proposed approach

Grand Challenge Tech+ Innovator Program of Sungkyunkwan University Hub Center

Sung-Jin Song
Sungkyunkwan University Hub Center for Innovative Engineering Education,
Sungkyunkwan University, Korea

Engineering a Holistic Education

Mushtak Al-Atabi
School of Engineering, Taylor's University, Malaysia

Student Centred Learning

Students' Participation in Student-Centred Learning: What are the Most Encouraging Elements?

Alias Masek
Department of Engineering Education, Universiti Tun Hussein Onn, Malaysia

Student-centred learning (SCL) is a strategy to encourage students' participation during teaching and learning processes. In this context, students are actively involved in and in control of their own learning; thus, learning can occur in a more meaningful and effective manner, while the lecturer acts as a facilitator who guides students' learning and problem-solving process. However, students' involvement and participation during SCL sessions are typically less encouraging in theoretical subjects, especially for engineering education students. It seems like an uphill climb for the facilitator to get students into active participation in discussion sessions. As a result, the facilitator would feel discouraged and students' learning rate is at too low a level to reach a targeted learning outcome. Therefore, the purpose of this paper is to investigate students' participation and elements that will spur them into active discussions during SCL sessions. A survey study was conducted that involved a random group of 257 undergraduate students in the Faculty of Technical and Vocational Education, in the Universiti Tun Hussein Onn Malaysia (UTHM). Data were collected using a questionnaire comprising three main parts: Part A-- students' participation in SCL; Part B-- main attractive elements in SCL; and Part C-- attractive SCL environment. All the items and constructs of the questionnaire were adapted from several previous studies. Data were analysed descriptively using frequency, percentage, mean score and standard deviation. The results indicate that students are more inclined to writing activities during SCL rather than questioning, listening and discussing. Students' active participation mostly depends on learning objectives and delivery strategy adopted by a facilitator. It is recommended that realignment of students' facilitator-dependent mind set is necessary; and at the same time, facilitators must strengthen their roles in promoting critical discussions when handling SCL sessions, especially for theoretical subjects.

Student Centered Active Learning: Why and How

Lisa Benson

Department of Engineering and Science Education, Clemson University, South Carolina

Transformation from Teacher Centred Learning: The UTP Experience

Mohammad Tazli Azizan
Centre for Excellence in Teaching & Learning (CETaL), Universiti Teknologi PETRONAS, Malaysia

Transitions of Teaching Conceptions from Teacher Centred to Student Centred

Khairiyah Mohd Yusof
Centre for Engineering Education, Universiti Teknologi Malaysia, Malaysia

STEM Education

Strengthening STEM Education for Industry 4.0

Raslan Ahmad
Malaysian Industry-Government Group for High Technology (MIGHT), Malaysia

Meeting Global & National Challenges

The world is currently at the beginning of a Fourth Industrial Revolution specifically in new emerging areas such as genetics, artificial intelligence, robotics, nanotechnology, 3D printing and biotechnology. Thus 'Science' becomes more relevant and substantial at the core development of an industry, business, government or country. Various efforts are being crafted and implemented by many stakeholders to ensure smooth transition and adaptation by corporations, governments and individuals.

Through MIGHT's experience in high tech sectors, we have produced several industry planning and provide policy recommendations as follows;

1. Future Rail 2030
2. Annual Report Ship Building & Ship Repair (Maritime)
3. Malaysian Aerospace Blueprint
4. Malaysian Solar Industry Report
5. Malaysian BIOMASS Industry Action Plan
6. National Biotechnology Policy and
7. 11th Malaysia Plan

A national study, S&T Human Capital: A Strategic Planning Towards 2020 (2012) confirms that Malaysia needs at least 1.0 million S&T human capital by 2020 based on a 6% annual economic growth and the emergence of EPPs (Entry Point Projects) under the NKEAs as well as the emergence of new technology-driven sectors such as nanotechnology and biotechnology.

Industry involvement in STEM Education

In support of strengthening STEM Initiative, a number of strategies, initiatives and programs were undertaken by various parties i.e. professional bodies, NGOs, and industry to strengthen interest in STEM subjects among school children. Among the initiatives are carnival of science, science camp, and the competition such as

1. KLESF - Kuala Lumpur Engineering Science Fair & KLESF Challenge
2. Penang International Science Fair
3. PETROSAINS Science Festival
4. School Lab - Science Communicator

These programs are able to provide 'hands-on' learning opportunities for students and parents, where they can have further understanding of science and mathematics that impact their everyday life, and able to enrich students' knowledge. The carnival is also design to expose teachers on hands-on teaching techniques and skills of STEM subjects.

Science to Action: The Smart Partnership for the Future

In 2013, the Prime Minister of Malaysia has launched an initiative known as Science to Action or S2A. This initiative has three key pillars, namely S2A Science for Governance, Science for Industry and Science for Well-being.

Through S2A, the Malaysian government are able to promote smart partnership between the government, private sector and the academia to enhance STEM education. Science for Wellbeing is aimed to intensify the use of S&T on all aspect of life and on the importance to STEM subjects in the country's development. Therefore, MIGHT will continue to cooperate and support the efforts of various parties to realize STEM program in the country.

Cultivate Living Skills through Young Innovate Program

Chew Yen Seng
Dream Catcher Consulting Sdn. Bhd, Malaysia

Young Innovate Program is a national competition for secondary school students based on the embedded system platform. The objectives are to inspire passion in STEM, develop living skills and inspire life-long learning. The secondary school students are mentored by Undergraduates to solve real-life problem.

This program has seen how the students developed their living skills especially in the area of tenacity, social and thinking skill. Students spent uncountable hours to get their prototype to work. They research and self-learn through Mass Online Open Course (MOOC). The students have to apply computational thinking and problem solving skill in order to solve the real-life problem within their community. They also have to collaborate and communicate with their peers as this program emphasises on teamwork.

Through the Young Innovate program, students learn that education and learning do not stop at school but is a continuous process even after school. They have shown more appreciation towards the importance of learning and the real life application of it. They've come to realization that learning is more than just to perform well academically.

Parents of the students have also seen a positive change in their children's living skills. They noticed their child has a changed mind set towards technology especially among the girls.

As conclusion, Young Innovate program will improve living skills of the students which will help them in their future learning.

Education for Hire: Multi-Faceted Industry and Academia Collaborative Education Program in Building Sustainable Dynamic Workforce

NorAzmi Alias
Collaborative Research in Engineering Science & Technology Center, Malaysia

Starting my career as R&D manager in a chemical company in late 1990's get me startled to the fact that how can a graduate in Polymer Chemistry with CGPA more than 3.6 could not even articulate what differentiates a monomer from a polymer. Thereupon my interest and later became part of my career is to understand how do we close the gap between what do kids learn in classroom to what they will be doing or expected to do when the step into that 1st job in the industry. Learning is all about acquiring knowledge on specific skills and able to demonstrate the mastery of the taught skills and enhance what one learns through creativity. Company hires individual for his or her ability to execute what is expected of him or her, and the potential of the individual to grow in the job and perhaps to outgrow the job being applied to.

In this paper we will elaborate our journey on ensuring effective learning at multi levels of engagement with the talents involving collaborative effort by industry and academia surface interesting facts, gaps and opportunities for us to co-educate anyone irregardless of their age. We will share living examples of industry-driven project-based blended learning in the industry and in the classroom and building network of community of educators, mentors, coaches, trainers, educators with the single purpose of developing marketable graduates.

Strengthening Sustainability of STEM Education through Smart Partnerships

Zaleha Ismail
Faculty of Education, Universiti Teknologi Malaysia, Malaysia

Smart Partnerships have been recognized as collaborations linking the assets and initiatives of institutions with community assets and interests for powerful, long-term impact. For many years PPSMJ together with Faculty of Education, Universiti Teknologi Malaysia has moved forward to establish partnerships with schools, institutions and industries towards improving mathematics and science education. PPSMJ has successfully involved university lecturers and school teachers to work together for the benefit of the community. Recently, across the country, there is a persistent call for improving the quality of education through STEM education, for reasons of economic stability, international competitiveness and scientific innovation. The need

for promoting the new pedagogical strategy create an urgency for us to play important roles through smart partnerships. In this presentation, the concept of integrated STEM education will be demonstrated. The various efforts of partnerships with school, organizations and institutions through research, knowledge sharing sessions, service learning and workshops will be shared. Finally, reflections on sustainability and effectiveness of STEM education through smart partnerships will be addressed.

STEM Learning Activities at Centre for Engineering Education

Fatin Aliah Phang
Centre for Engineering Education, Malaysia

Established in 2010, Centre for Engineering Education (CEE) Universiti Teknologi Malaysia (UTM) is not only a research centre in STEM Education but also a centre of excellence in promoting STEM Education in the country. Research on STEM Education is translated into actions and programs that involved different level of participants such as school students, university students, science communicators and lecturers. In this presentation, STEM learning activities organized by CEE will be presented together with some small scale research to assess the effectiveness of the activities. The STEM learning activities for school students and teachers include Problem-Based Learning for Low Carbon Education at secondary schools, Johor Sustainable & Low Carbon Schools Exhibition, TRIZ workshop for secondary school students; for university students include Low Carbon project for first year engineering students, International Engineering Service Learning and TRIZ workshop; for science communicators include inquiry and higher order thinking skills for Petrosains science communicators and assessing science communicator competency; and for lecturers include training on TRIZ, active learning, cooperative learning and problem-based learning.

Cross-Border Learning for Developing International Perspectives on STEM Education

Suhaidah Tahir
Institut Pendidikan Guru Kampus Ipoh, Malaysia

STEM Education brings varying goals and objectives such as to improve the overall students' mathematics, science and technological literacies, increase the interest of students to pursue careers in STEM related disciplines, and develop highly literate 21st century workforce and eventually would create economic benefit to the country. As such educational institutions need to provide young people opportunities to engage in inquiry; logical reasoning and collaboration so that they can adapt and respond to their-fast changing world, participate actively in shaping a better future for themselves, their families and communities where they live. Under the APEC project on energy efficiency, the 10th APEC-Tsukuba International Conference: Innovation of Mathematics Education through Lesson Study Challenges to Energy Efficiency on STEM and Cross-border Education was held on 12-15 February, 2016. Tsukuba. Two groups of students were involved in the lesson study demo class; Grade 6 students from SK Minden and Grade 7 students from Junior High School attach to University of Tsukuba. This paper shares some experiences garnered in the process from preparation stage, conducting the lesson study demo class and the after lesson reflection activity.

STEM Education Experiences from Singapore: Harnessing the Formal and Informal Education Sectors for Synergy

R. Subramaniam
National Institute of Education, Nanyang Technological University, Singapore

Science, Technology, Engineering and Mathematics (STEM) are increasingly being recognized by countries as great enablers for economic development. Significant initiatives are underway in many countries to foster STEM education at the school level. Singapore has made significant strides in imbuing its students with competencies in science and mathematics. The performances of her students in international competitions such as TIMSS and PISA is an indication of how far its school science education has been effective. In more recent times, efforts at the informal sector level, driven mainly by the science center and also in collaboration with schools, have also been initiated. These initiatives are also playing an important role in promoting STEM in its multi-faceted representations among students. This presentation will elaborate more on the Singapore experience with STEM education, including best practices.

SPEAKERS BIO

Shahida Sulaiman
Associate Professor
Faculty of Computing
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Shahida Sulaiman is an associate professor of the Faculty of Computing, UTM since 2011. Formerly, she had served at Universiti Sains Malaysia (USM) for seven years. She holds a Ph.D. degree in Computer Science and M.Sc. degree in Computer Science. Her research interests include software design, software maintenance and knowledge management. She has published and co-authored numerous technical papers, as well as general reading books and newspaper articles.

Dr Shahida's contribution to local community started at USM with the adoption of a knowledge portal to support learners mainly in English communication through the programme called Care for Second Language (C4SL). The effort has continued at UTM through a community project known as Centre for Advancement in Rural Education Informatics (iCARE) that has been receiving the funds from a rural agency, South East Johore Development Authority (KEJORA) that aimed to supports the strategic planning in human capital development at rural areas under KEJORA region.

She is a recipient of Community Service Award of Citra Karisma, UTM in 2013 for her contribution in community service and community-based participatory research (CBPR) Industry Involvement Award of Citra Karisma, UTM in 2015, and also the third place in Ministry of Higher Education Innovation Award (AIKPT) under the social innovation category for the programme in 2015.



O Kaung Lim
Professor
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Pusan National University, Korea

Lim O Kaung received his B.S. degree in Mechanical Engineering from Seoul National University in 1972 and M.S. degrees in Mechanical Engineering from KAIST in 1976, respectively. He then received his Ph.D. degree from University of Iowa in 1982. He served as a head of the School of Mechanical Engineering in Pusan National University. Dr. Lim is currently a chair of Office for Education Accreditation in Pusan National University. Dr. Lim's current research interests include education methodology for engineering design and nonlinear optimization.



Aznah Nor Anuar
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Dr. Aznah Nor Anuar is Senior Lecturer at Department of Environmental Engineering, Universiti Teknologi Malaysia (UTM). She obtained her B.Eng (Civil-Environmental) in 2000, M.Eng (Environment) in 2001, and Ph.D (Environmental Engineering) in 2009 from UTM. Currently, she serves as Research Fellow of Centre for Engineering Education (CEE-UTM) mainly as Programme Coordinator of Engineering Service Learning. Prior to her attachment at CEE, she served as an active Research Member at the Institute of Water Resource and Environmental Management, UTM 2005 – 2014. Her published materials include water and wastewater treatment particularly in Advanced Biological Wastewater Treatment (Granular Activated Sludge Technology), sustainable environmental management and community-based learning in engineering education.

Every year, CEE will commit to coordinate an International Service Learning Programme, known as Creativity Station in-collaboration with Pusan National University, Korea and several universities from Indonesia; Politeknik Elektronika Negeri Surabaya, Telkom University, Surabaya and Institute Technology of Bali. She served as UTM coordinator since 2013 until now. This programme was aimed to inculcate "Global Skills" among multi-disciplinary engineering students through service learning activities. She was also appointed as Ambassador for Community-Based Participatory Research (CBPR) on Southeast ASEAN

Water Challenge, a collaborative initiative between UTM Community and Industrial Networking Centre (CCIN) and Global Knowledge Initiative (GKI).



Alberto A. Laurito
Professor
Chemical Engineering Department
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Engr. Alberto “Abet” Laurito is a full professor of the Chemical Engineering Department at the Faculty of Engineering of the University of Santo Tomas. His academic background is in the fields of Chemical, Environmental, and Energy Engineering and he has been passionately teaching junior and senior B.S. Chemical Engineering students for more than 40 years now. His educational management experience comes from 15 years of serving as the Dean of the UST Faculty of Engineering (1985-2000), 6 years as Assistant to the UST Rector for Planning and Development (2001-2007), and 4 years as Director of the UST Educational Technology Center (2002-2006), during which he initiated and established the university’s e-learning access program (e-LeAP).

Prof. Laurito has acquired special training locally and abroad in educational total quality management, strategic planning, web-based teaching, active and collaborative training, and lately, in outcomes-based education (OBE). He was the president of the Philippine Association for Technological Education (PATE), the national organization of engineering schools for 3 terms or six years during the 1990s. He is currently a member of the Philippine Commission on Higher Education Technical Panel for Engineering and Technology (CHED-TPET), concurrently the Chair of the CHED Technical Committee on Chemical Engineering, and a member of the CHED Task Force on Outcomes and Typology Based Quality Assurance. He has also served as the National President of the Philippine Institute of Chemical Engineers (PIChE) and was inducted into the first batch PIChE College of Fellows. He was also the founding president of the PIChE Metro-Manila Academe Chapter.

His current passion is to provide consultancy to educational institutions in building their own e-learning and outcomes-based management system and conducting faculty training on OBE and OBTL, Active-Collaborative Teaching and Learning, and elearning delivery via the Moodle system. He is now also a UNIDO International Expert for Outcomes-Based Education, assisting in the development of training and university courses connected with UNIDO projects using the OBE model, which is the focus of his RCEE 2016 paper under the Chemical Engineering Education track.



Eddie Ng
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Center for Engineering Education Innovation (E2I)
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Dr. Eddie Ng obtained his PhD degree in the discipline of Systems Engineering. He is a Chartered Environmentalist and a corporate member of the Society of Environmental Engineers. His recent research focuses include product and process design, design for environment, product life cycle assessment, and engineering education.

Dr. Ng has engaged in engineering education for over 10 years, through which he has taught in various higher education institutions in Hong Kong for engineering-related subjects at the undergraduate level. He is now a member of the Center for Engineering Education Innovation (E2I) under The Hong Kong University of Science and Technology, which aims to promote quality and innovative learning experiences in the engineering arena.



Sung-Jin Song
Dean, College of Engineering
Director, Sungkyunkwan University Hub Center for Innovative Engineering Education, Korea

Professor Sung-Jin Song received a B.S. degree in Mechanical Engineering from Seoul National University, Seoul, Korea in 1981, a M.S. degree in Mechanical Engineering from Korea Advanced Institute of Science and Technology (KAIST) in 1983, and a Ph.D in Engineering Mechanics from Iowa State University, Ames, Iowa, USA in 1991. He has worked at

Daewoo Heavy Industries, Ltd., Inchoen, Korea for 5 years from 1983. He has worked at Chosun University, Gwangju, Korea as Assistant Professor for 5 years from 1993. Since 1998 he has been at Sungkyunkwan University, Suwon, Korea and is currently Professor of Mechanical Engineering.

Currently, He is serving as Dean of College of Engineering, Director of Center for Innovative Engineering Education, and Director of Sungkyunkwan University Hub Center for Innovative Engineering Education, Sungkyunkwan University. He has served as the Founding President of Korea Association for Innovative Engineering Education. He organized the Annual International Workshop on Innovative Engineering Education since 2010 and Engineering Education Festival (E2 Festa) 2012 in Korea. He also served as Vice President for Planning and Budget, Sungkyunkwan University, and Vice President of Korean Society for Engineering Education.



Mushtak Al-Atabi

Professor
Dean of School of Engineering
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Professor Mushtak Al-Atabi is currently the Dean of School of Engineering at Taylor's University, Malaysia. His research interests include thermofluids, renewable energy, biomechanical engineering, engineering education and academic leadership. He is an Honorary Chair at the School of Mechanical Engineering of the University of Birmingham (UK) and the Editor-in-Chief of Journal of Engineering Science & Technology. Professor Al-Atabi published two books, "Think like an Engineer" and "Driving Performance" and he has numerous research publications, awards, and honours. He is a Fellow of the Institution of Mechanical Engineers (FIMechE) and a member of the Global Engineering Deans Council.

Professor Al-Atabi is an innovative educator; he pioneered the CDIO (Conceive, Design, Implement, Operate) and delivered the first MOOC (Massive Open Online Course) in Malaysia. He trains executives from Multinational Corporations including banks and energy Companies.



Lisa Benson

Associate Professor
Engineering and Science Education
Clemson University, South Carolina

Lisa Benson is an Associate Professor of Engineering and Science Education at Clemson University, with a joint appointment in Bioengineering. Her research focuses on the interactions between student motivation and their learning experiences. Her projects involve the study of student perceptions, beliefs and attitudes towards becoming engineers and scientists, and their development of problem solving skills. Other projects in the Benson group include effects of student-centered instruction and undergraduate research on students' self-regulation and learning, and incorporating engineering into secondary science and mathematics classrooms. She is the Deputy Editor of the Journal of Engineering Education. Her education includes a B.S. in Bioengineering from the University of Vermont, and M.S. and Ph.D. in Bioengineering from Clemson University



Khairiyah Mohd Yusof

Director
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Professor Dr. Khairiyah Mohd-Yusof is the Director of Universiti Teknologi Malaysia (UTM) Centre for Engineering Education (CEE), which promotes research and scholarly practices in engineering education. She has been an invited speaker in conferences and workshops in Asia, Europe and North America and had co-chaired international conferences, such as the 2013 Interation Research Symposium on Problem Based Learning (PBL) and the 2013 Research in Engineering Education Symposium (REES). Dr. Khairiyah is the Editorial Board of the ASEAN Journal of Engineering Education, the Journal of Engineering Education, IChemE Journal on Education for Chemical Engineers and the Journal of PBL in Higher Education. She is also a Master Trainer for the Malaysian Ministry of Education Higher Education Leadership Academy, the President for the Society of Engineering Education Malaysia (SEEM), and a board member of the Research in Engineering Education Network (REEN).



Raslan Ahmad
Senior Vice President
Malaysian Industry-Government Group for High Technology

Dr. Raslan Ahmad is currently Senior Vice President of MIGHT (Malaysian Industry-Government Group for High Technology) and Head of MIGHT International. MIGHT was established as an independent, industry-driven non-profit organisation in 1993 and was formally incorporated as a company limited by guarantee on 15th October 1994. Prior to joining MIGHT, Raslan was Chief Executive Officer (CEO), Yayasan Inovasi Malaysia (YIM) or Malaysia Innovation Foundation, an entity under the purview of Ministry of Science, Technology and Innovation (MOSTI).

Prior to joining YIM, he was undersecretary of ICT Policy Division, MOSTI from 2006-2009. Throughout his service, he had covered major areas of ICT policy planning, implementation and monitoring. He was entrusted to coordinate and manage ICT Cluster includes supervised ICT agencies (i.e. Multimedia Development Corporation, MIMOS, Cyber Security Malaysia and .my Domain) and its programs (i.e. MSC Malaysia, Knowledge Grid Malaysia, ICT for All Program etc.), lead National ICT Council Secretariat, managed e-Content and Demonstrator Application Grant Scheme (DAGS)/fund, monitor the implementation of National ICT Roadmap and National Cyber Security Policy and coordinate the ICT international cooperation. As undersecretary of ICT Policy, Raslan chaired several National ICT Committees i.e. ISC G - Industry Standards Committee on Information Technology, Telecommunications and Multimedia, e-Content and DAGS Evaluation and Disbursement Committee.

Raslan gained a B.A. (Hons.) Degree in Southeast Asian Studies and Master of Philosophy in Human Development at the University of Malaya in 1987 and 1991 and Ph.D in Science Policy and Technology Management at Policy Research in Science, Engineering and Technology (PREST), an institute of the University of Manchester in 1999.

Raslan started off his career 20 years ago as Coordinator for Corporate Planning Division of MIMOS (Malaysian Institute of Microelectronic Systems) and grew with the government R&D powered house through its corporatization process along the years. With over 16 years of experience in MIMOS, Raslan brings with him a wealth of experience in corporate planning, R&D management, government and universities alliances services having served various positions in the organization. His last position at MIMOS was Director, Government and Universities alliances.



Chew Yen Seng
Technical Consultant
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Dr. Chew Yen Seng is the technical consultant since 2014 for Chumbaka Sdn Bhd which is the Social Enterprise of Dream Catcher Sdn. Bhd. He graduated with Ph.D. in Paper Science from UMIST, UK in 2003. He was working with local paper and packaging industry immediately after graduation.

Dr. Chew is a great believer in hands-on learning and training. He is the Secretariat for Young Innovate National Competition and MDeC e-Aspirasi Mobile App Hackathon National Competition. Both competitions are opened to secondary school students where they prototype embedded system projects in Young Innovate and Mobile App in e-Aspirasi Hackathon. These competitions involved self-learning and peer learning among the students.



NorAzmi Alias
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Research Management
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Dr NorAzmi Alias is the Sr. Vice President, Research Management at Collaborative Research in Engineering Science & Technology Center. His recent focus is on developing immediate and long term solutions to growth of key clusters in electrical and electronic sector in Malaysia; initiating pilot activities to drive cluster development programs covering developing

innovative R&D relevant talent in design, development and research at undergraduate and postgraduate level, targeted research programs in new and emerging fields through cross-sector collaboration.

Dr NorAzmi Alias has more than 20 years industrial R&D experience, in technical and management roles ranging from semiconductor packaging, electronic chemicals, electrochemical applications, and telecommunication product design and components technology. He received his graduate school experience in electrochemical impedance spectroscopy method for characterization and prediction of failures of metals and composite in marine environment.

He has more than 30 publications in international journal and talks in national and international conferences. He obtained his BSc, MSc and PhD in Chemical Engineering from the University of Rhode Island, specializing in the field of corrosion science and technology.



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Zaleha Ismail is currently an associate professor at the Department of Educational Science, Mathematics and Multimedia Creative at Universiti Teknologi Malaysia. She also holds the position of deputy chairperson for Persatuan Pendidikan Sains dan Matematik Johor (PPSMJ). Her research interests include teaching and learning of mathematics, mathematical thinking, statistical reasoning, mathematics teacher education, technology integration in mathematics education, STEM and engineering education. She has worked as a researcher, primary and secondary teacher educator, supervisor of graduate research and as a consultant to the Malaysian Ministry of Education for the STEM education and HOTS (high order thinking skills) projects. She is the chairperson for Geogebra Institute of Johor Bahru and directly involve with the training of teachers and researching in using Geogebra for improving mathematics teaching and learning.



Fatin Aliah Phang
Associate Professor
Centre for Engineering Education
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Fatin completed her PhD at University of Cambridge, UK in 2009 and was appointed as a lecturer at the Faculty of Education, Universiti Teknologi Malaysia (UTM). She was the Academic Manager of the Centre for Engineering Education (CEE), UTM and now one of the Academic Fellows at the centre. She is actively involved in research and training in Engineering Education as well as other research areas such as Science Education and Environmental Education.



Suhaidah Tahir
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Suhaidah Tahir is currently a Mathematics senior lecturer at Institut Pendidikan Guru Kampus Ipoh, Perak. She has presented research papers at conferences and seminars at national and international levels. Recently she was invited as a keynote speaker at STEMfest 2015, Saskatoon, Canada on "Skilling a Nation's Future: Aligning STEM Education to a State's Future Human Resource Needs. She was invited as speaker and as a demo teacher in the lesson study demo class during the 10th APEC-Tsukuba International Conference: Innovation of Mathematics Education through Lesson Study Challenges to Energy Efficiency on STEM and Cross-border Education on February 13, 2016.



R. Subramaniam
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Dr R. Subramaniam is an Associate Professor at the Natural Sciences & Science Education Academic Group at the National Institute of Education in Nanyang Technological University in Singapore. He has previously held the administrative appointments of Associate Dean (Educational Research) and Associate Dean (Graduate Academic Programs), concurrent with his academic position.

His research interests are in the areas of science education, physics education, chemistry education, STEM education, primary science education, informal science education, science communication and ICT in science education. Publications number over 100, and this comprises research papers in peer-reviewed international journals, peer-reviewed chapters in edited books of international publishers, books by international publishers, and guest-edited issues of international journals. He has successfully graduated 15 Master's and PhD students in various areas in science education.

Abstract

Work-in-Progress in Engineering Education

The Development and Analysis of Concept Inventory for Electrical and Electronics Engineering Undergraduate Courses

Nurul Hazlina Noordin, Amran A. Hadi, Zuraina Ali

Abstract: This paper presents the result of identifying the misconception in the topic of State Machine in the subject BEE 3233 of Electronic System Design, Universiti Malaysia Pahang. This subject is the sequel of Digital Electronics and the topics covered are State Machines, Logic Implementation Technologies, Hardware Description Language and FPGA Implementation Technologies. This work is divided into three stages; interview, multiple choice questions and laboratory assessments. It was shown that students has issues in the topic of state encoding, state transition, relating between transition table and logic circuits, relating between states and flip-flop as well as differentiating between Mealy state machine and Moore state machine. Students also tend to overlook these concepts as they depends on the behavioral instruction of the state machine.

Keywords: Concept Inventory, Electrical Electronics Engineering, Education

Investigation on the Impact of Laboratories Subjects on BEEE and BEPE Students in Universiti Tenaga Nasional

Fazrena Hamid, Farah Hani Nordin, Ungku Anisa Ungku Amirulddin and Miszaina Osman

Abstract: Laboratory courses are important components in any engineering degree curriculum as this is where the practical aspect to important theories are being applied. The labs sessions serve as complement to the theory learnt in the classroom to develop the related psychomotor skills. Furthermore, exposure to fundamental electrical instruments, apparatus and devices/components and techniques are done in labs. This paper reports the effectiveness of laboratory courses on students' improvement in understanding and exposure to communication and teamwork-leadership skills according to year of study and type of degree. The study was done through surveys to 216 students from the 1st year through the 4th year undertaking the BEEE (Bachelor of Electrical and Electronic Engineering) and BEPE (Bachelor on Electrical Power Engineering) programmes in Universiti Tenaga Nasional (UNITEN). The survey results are also compared to the PO (Programme Outcome) attainment of the related skills. This study reveals that the laboratory courses help to give good exposure to develop communication and teamwork-leadership skills in the laboratory courses.

Keywords: Communication skills, Engineering education, Laboratory, Team-working skills, Programme outcomes

A Methodology on Assessing Program Educational Objectives for Undergraduate Engineering Programs

Alvin Chua, Andres Winston Oreta and Rosemary Seva

Abstract: In implementing Outcomes-Based Education in engineering programs, it is important to identify appropriate Student Outcomes (SOs) and Program Educational Objectives (PEOs). PEOs are expected graduate attributes three to five years after graduation. This paper describes a methodology for developing PEOs of different engineering programs as well as the design of an Alumni tracer survey form as assessment tool that matches the PEOs adapted. As a first step in the methodology, there is a need to identify PEOs that are aligned to professional specializations. These objectives will be critical in choosing the correct educational strategies to be implemented within the program. Second, the questions in the Alumni Tracer Study (ATS) were developed to measure the attainment of the PEOs. The questions targeted the evidences to attain the PEOs. The ATS was initially administered to some alumni to determine the effectiveness of the proposed survey form. Results from a mock study showed that there is a need to improve some of the questions to effectively assess PEOs of the engineering programs.

Keywords: Engineering Education, Outcomes-Based Education, Program Educational Objectives

Enhancing Student's Problem Solving Skills in Technical and Vocational Education and Training

Sharifah Zainaf Abu Seman, Roselainy Abdul Rahman and Robiah Ahmad

Abstract: The study aimed to examine the approach that introduced in teaching and learning in the classroom to support students' problem-solving skills. Two groups are selected as subjects in this study to investigate the effectiveness of interventions in their final year projects. The participants consist of the treatment group and the control group. Students'

problem-solving skills will be assessed before the module intervention and after module intervention. Furthermore, this study also uses the methods of "Experiential Learning Theory Model" by David Kolb as a framework. The Experiential Learning Cycle (ELC) begins with the concrete experience that is the basis for observations and reflections. The reflections and observations then lead to abstract concepts that create new ideas and thinking. The new thinking promotes active experimentation that applies the new learning and serves as a guide in creating new experiences. The project requires the students to use all their knowledge and skills in solving a problem and thus can provide an indicator of students' understanding of the knowledge and acquisition of the skills taught in the program. Furthermore, it can give students experience in problem solving by a systematic or structured way. The module is designed for Diploma Programme at Kolej Kemahiran Tinggi MARA with the scope of study focus on the Final Year Project (FYP) course that conducted for third-year students. The module designed in this research refers to the system approach concerning problem-solving skills learning that is associated with the experiential learning theories in defining the learning outcomes, teaching strategies and assessment strategies.

Keywords: Final Year Project, Problem Solving Skills, Technical Education, Vocational Training

Use Cooperative Group Learning in Improving the Problem Solving Performance in a Surveying Course of Civil Engineering Students

Maria Cecilia Paringit

Abstract: Outcomes-based Education (OBE) in engineering program focuses on achievement of student outcome. Current engineering students belong to millennial generation wherein their ideal learning environment includes less lecture, use of multimedia and collaborating with peers. Usage of traditional approach in teaching seems not effective in improving student performance in problem-solving as shown by decreasing exam scores. This study aims to share the experience in employing cooperative group learning technique to address the learning needs of the millennial students and improve their problem solving performance. The course faculty employed the "think-pair-share" type of cooperative learning and assigned the random pairing. Each pair was given with a 5- sided lot traverse data with unique pair of unknown parameters to solve during a class meeting. As an assessment, the long exams scores corresponding to the topics (where cooperative learning were introduced in the later year) in both school year term offerings were compared. An improvement of the class average score was observed. A nine-question online survey was conducted to obtain the learners' feedback on the activity. The survey results show that students recognize the positive benefits of cooperative grouping. A cooperative grouping technique reveals positive result in enhancing millennial students' learning of an effective problem-solving strategy in a surveying course in Civil Engineering.

Keywords: cooperative learning, millennial learner, student-centered learning, think-pair-share

A Framework for Learning Analytics Intervention in e-learning

Si Na Kew and Zaidatun Tasir

Abstract: As the role of technology becomes more significant in higher education institution and the volume of data generated by students in e-learning is progressively increasing, a growing field research, Learning Analytics, is emerging to assist students to perform optimally and enable teaching practices to meet students' need in their learning process. Nonetheless, intervention in Learning Analytics is still a not known area that only fewer studies have focused in this field. Hence, in this paper, a framework for Learning Analytics Intervention in e-learning to cater students with different learning styles is presented with an aim to enhance students' motivation, cognitive engagement, cognitive retention and academic performance in e-learning. In conjunction with this, the proposed framework is embedded in e-learning and integrated with learning style model and motivational model so as to detect students at risk and provide them a proper intervention.

Keywords: Learning Analytics Intervention, E-learning, Learning Style, Motivation, Cognitive Engagement, Cognitive Retention

A Conceptual Framework for Assessing Mathematical Competencies of Engineering Students

Nur Izrah Mohd Puzi, Yudariah Mohammad Yusof and Naziha Ahmad Azli

Abstract: The aim of this paper is to uncover the conceptual framework that will be used to assess mathematical competencies among engineering students. Being mathematically competent, one should be able to comprehend, determine, perform and apply mathematical knowledge in any circumstances. Engineering students that have taken several mathematics courses before going into further engineering courses are expected to be equipped with sufficient competencies in order to be able to do well in engineering course that uses high mathematics knowledge. However, the information that have been obtained referring to the study of mathematical competencies that are demonstrated by engineering students during the learning of an engineering course is very limited. Therefore, it is crucial to investigate how engineering students demonstrate their mathematical competencies in the class. Hence, this paper aims to provide a brief literature on mathematical competencies among

engineering students and the findings will be used to propose a conceptual framework that can be used to assess mathematical competencies during the learning of engineering course. The results obtained will impact towards the improvement of mathematics curriculum suitable for future engineers.

Keywords: Constructive Alignment, Mathematical Competencies, Mathematics in Engineering Education

Student Perception of Use and Level of Implementation of Logbooks in Individual Final Year Projects

Sarah Junaid, Paul Gorman, Laura Leslie and Mark Prince

Abstract: At Aston University the CDIO pedagogical framework (Conceive-Design-Implement-Operate) is primarily implemented in four major team projects over the first two years of the mechanical engineering BEng degrees. Logbook keeping is emphasised and assessed during each team project as an essential professional skill in engineering through the process of active learning. Methods: The final year cohort for 2015-16 were given a questionnaire at the start (week 3) and end of the project (week 25) to gauge project planning, use of logbooks, ownership of work, use of resources and confidence in their skillsets that they will require as engineers. Focus groups will also be conducted to explore actual use of logbooks and level of engagement in logbook keeping. Results: The first questionnaire, completed by 80 % (n=64) of the cohort, found more than 60 % of students took ownership of work including research, ideas, development and implementation aspects of the project with few students suggesting it was solely the advisors role for aspects of the project. The second questionnaire, completed by 41 % (n=33) of the cohort, found more student than planned made use of the CDIO framework (79 %). Ninety-two percent (59/64) of students planned to use logbooks as some form of recording their work and retrospectively 91 % (31/33) of students had actually used a logbook during their project. Discussion: There is a good perception and application of the CDIO framework in engineering projects by the majority of the cohort. There is also strong evidence to suggest the active learning exercises during year 1 and 2 in logbook keeping is being retained and carried forward by students to their final year projects. Conclusion: The study shows good retention of logbook keeping skills and use of the CDIO framework to engineering projects. This study is on-going to improve training of good logbook keeping skills for the workplace.

Keywords: Logbooks, CDIO, student perception, professional skills development

Teaching and Learning Intervention Strategy to Increase Students' Use of Deep Learning Approach

Norsyarizan Shahri, Roselainy Abdul Rahman, Noor Hamizah Hussain and Yudariah Mohammad Yusof

Abstract: Students face some difficulties in the learning of programming courses such as Programmable Logic Controller (PLC) [1-3]. The same issues arisen in the courses of Programming Technique and Micro controller which are the core technical courses in MARA High Skill College Penang (KKTm), Malaysia. Hence, this study aims to examine Students' Approach to Learning (SAL) in the PLC course. The samples of the study were students taken PLC in Industrial Mechatronics Engineering Technology Program. In this research, these issues will be examined in a real college context. Generally, students use two learning approaches; either surface or deep learning approaches in various degrees during their learning process. Thus, the aim of this work-in-progress is to identify how to support students' engagement with deep learning approaches. Two phases of interventions were used namely phase 1 and phase 2 with corresponding teaching and learning strategies. Phase 1 intervention was used to overcome students' misconception and to help them grasp their self-interest towards the course. PLC's concept inventory questions and PLC programming exercises were implemented by using informal cooperative learning think-pair-share and jigsaw method. Phase 2 intervention was used to enhance students' thinking and reasoning that leads to deeper learning approach. The open ended questions used were design by incorporating both engineering thinking and reasoning concept. In the second phase, think aloud method was used where students were asked to video recorded their project assignment by using audio video screen captured software. Students' approaches to learning and learning progression were then assessed using SOLO's and Bloom's taxonomy map.

Keywords: Student Approach to Learning (SAL), concept inventory, thinking and reasoning, SOLO's and Bloom's taxonomy map, PLC programming

Collaboration between University and Local Government Units on a National Flood Hazard Mapping Project

Sim Joseph Fernandez, Alan Milano, Dave Charity Gambuta and Elizabeth Edan Albiento

Abstract: Philippines is a typhoon-prone country which had been hit by a series of alarming disastrous calamities since 2011. The Philippine government led to the creation of the Phil-LiDAR 1 program, a national flood hazard mapping program, which were assigned as projects to Higher Education Institutions (HEI's) and State Universities and Colleges (SUC's). Among the project's objectives is the extraction of building features representing the flood-susceptible inhabitants. Mindanao State University – Iligan Institute of Technology, one of the SUC's, initiated an approach to address the concern on budget, personnel

and time resources of the building feature extraction activity. The university came into a mutual agreement with the Local Government Units so that the latter will provide the personnel and free conduct of activity in exchange for the technology and knowledge shared by the former as deemed essential by the latter. The agreement involves a method of extensive trainings and communications of the two parties. The mutual collaboration between the two bodies resulted to a partnership that has benefitted both.

Keywords: Flood, Geographic Information System, Local Government Unit, Software, University

Preliminary Study on the Prominent Skills in the Entrepreneurial Skill Set in the Context of Civil Engineering Practice

Christie Entika, Shahrin Mohammad and Mohd Khata Jabor

Abstract: The changing needs of workforce and technology in the global knowledge economy has dramatically challenge the conventional nature of engineering practice where future engineers have been expected to be equipped with additional skills in compliment to the mastery of scientific and technological disciplines and one of the skills being highlighted is entrepreneurial skills. The need for engineers to acquire entrepreneurial skills in order to meet the economic and workforce needs have been well recognized and it has been reported that demand for graduates who exhibit entrepreneurial behavior and attitude has increased, where the value of graduates depends very much in the ability of managing and applying knowledge in action within entrepreneurial context. Nevertheless, despite the fact that the importance of acquiring entrepreneurial skills for future engineers has been widely discussed, yet the characteristics or the prominent skills in the entrepreneurial skills set with respect to a specific context of interest were often left undefined. Therefore, a preliminary study has been conducted to explore the prominent skills in the entrepreneurial skillset, in the context of civil engineering practice as the American Society of Civil Engineers (ASCE) has highlighted the necessity of exhibiting entrepreneurial attitude that are conducive for professional practice which may imply the necessity to exhibit entrepreneurial skills as well. The findings of this preliminary study have showed that most of the prominent skills in the entrepreneurial skill set are highly required in the managerial tracks in the civil engineering practice.

Keywords: Civil Engineering Practice, Entrepreneurial Skill Set, Prominent Skill

Measuring Critical Thinking in Online Discussion: Analysis Model

Nurul Nadwa Zulkifli, Noor Dayana Abd Halim and Noraffandy Yahaya

Abstract: The ability to foster critical thinking among students has long been a priority among educators whether it takes place in a classroom or online. The advancement of technology nowadays is the reason why educators use online learning as a means to foster students' critical thinking using the written method. From literature studies, it can be seen that students' critical thinking can be fostered using text-based discussion (often called asynchronous online discussion). One of the methods utilized to analyse students' critical thinking in online discussion is that of content analysis. Several researchers have developed models and tools to facilitate the analysis data representing students' critical thinking. In this study, the researchers specifically gather several models in order to analyse students' critical thinking within online learning. In relation to further studies, the researchers proposed the use one of the models to analyse online discussion transcript.

Keywords: Analysis Model, Content Analysis, Critical Thinking, Online Discussion

Abstract

Scholarly Research in Engineering Education

Application of Mathematical Competencies among Engineering Students through Service Learning Program

Abdul Halim Abdullah, Aznah Nor Anuar, Mahani Mokhtar, Johari Surif, Nor Hasniza Ibrahim and Noor Dayana Abd Halim

Abstract: In recent years there has been an increase in the number of enrolment at tertiary level for engineering programs. This trend will contribute towards the development of professional human capital especially in the field of engineering. However, there is empirical evidence that the number of unemployment graduates in Malaysia increases every year from the year 1996 to 2013. Results from several studies have shown that there is a mismatch of employment requirement between industries with knowledge and skills possessed by university graduates. Therefore, engineering degree holders have difficulties in securing jobs as they cannot meet the expectations from the industries. In addition, engineering students face difficulties in mastering mathematics as a subject due to the lack of mathematical competencies among them. Therefore, students nowadays need to implement the ability to apply what they have learned even from the process of learning. There are various ways to promote the application of mathematical knowledge among engineering students and one of them is through their involvement in solving community problems, or widely known as service learning. Thus, the purpose of this research was to investigate the types of mathematical competencies emphasized by engineering students while they engaged in solving real problems during a service learning program. This study also investigated whether there were differences between mathematics competence of students in terms of gender and countries. The conceptual framework for this study is adapted from the Danish KOM Project which is carried out by Denmark Ministry of Education in the year 2000 in order to see what can be improved in the teaching and learning of mathematics. The name of the project is KOM project which stands for "Competencies and the Learning of Mathematics". Students who joined the program were required to design products which could overcome the problems faced by the community. The program was conducted for nine days at Kampung Punggai, Desaru, Malaysia. By using quantitative method, 55 students from the program were asked to respond to a given questionnaire. The findings revealed that all four mathematical competencies namely thinking mathematically, reasoning mathematically, posing and solving mathematical problems and modelling mathematically, were often used in the process of designing the products which were needed to solve the issues in the community. For thinking mathematically competency, the ability to make prediction for results and relationship (conjecturing) have the highest percentage of usage. This means that the students felt that mathematics is a subject which made sense to them by making conjectures and linking the conjectures with their prior knowledge. In terms of reasoning mathematically, students often used critical thinking skills during service learning program. This was due to the fact that, within the nine days of service learning program, students needed to discuss in groups, solve and make decision in many aspects such as measurement or size of the products. At the same time, they were also needed to think critically. For posing and solving mathematical problems competency, the ability to manage the overall problem solving process was the mathematical skill which received the highest number of responses. This is because the students needed to serve real people with authentic needs. Based on the listed problems faced by the local community, they were able to find solutions by applying engineering or mathematical knowledge which they have acquired in the practical and real-world environments. In addition, the data also revealed that female students and Indonesian students were more dominant in mathematical competencies as compared to the male ones and students from Malaysia and Korea. In conclusion, experiential learning such as involvement of students in service learning program not only contribute towards overcoming problems faced by the community but also provide opportunities for students to apply their knowledge and skills in mathematics. Therefore, the results suggest that mathematics curriculum in engineering programs in Malaysia need to be enriched with practical elements such as service learning in order to enhance the students' competencies in mathematics.

Keywords: Mathematical Competencies, Service Learning Program, Engineering Students

The Use of Augmented Reality Learning Environment to Enhance Students' Mental Cutting Skills and 3-Dimensional Development Skills

Marlissa Omar, Dayana Farzeeha Ali and Mahani Mokhtar

Abstract: Engineering drawing is offered in almost all engineering program with a purpose to give basic training towards the students' graphical reading and drawing. It is also because according to several studies, engineering drawing skills are proved to be one of the factors that help improve students' visualization skills where students who usually have problems in learning engineering drawing are those who lack in visualization skills. Visualization skills is the ability to mentally produce or generate images and it is divided into few abilities including mental rotation skills and 3 dimensional development skills. However, visualization skills is an ability that can be improve by implementing spatial training. Suitable teaching approach are needed in order for students to be able to understand the highly spatial content in engineering drawing subject and also as a part of spatial training. The emerging of new technologies in this era had provide various ways for educators to make teaching and

learning process more effective and interactive as well as easy to understand. Among all the technologies, augmented reality is one of the technology that have the ability to address the subjects involving spatial content due to its affordances in promoting learning through richly spatial contexts and allow the users to have control towards the interactive learning environment. This technology allows users to interact with the real world without being immersed only in virtual world and enable the educators to captured students attention and focus. Hence, this study will examined the effects of augmented reality learning environment in enhancing students' mental rotation skills and 3 dimensional development skills. This is a quantitative study which used quasi- experimental research design towards a population of first year engineering students that took the fundamental of engineering subject. It involves two group of samples which consists of experimental group exposed with the augmented reality learning environment and control group with the conventional method. Both group are given pre- test and post- test of two instrument which is Purdue Spatial Visualization Skills for Rotation test and Purdue Spatial Visualization Test of Development (PSVT:D) developed by Guay back in 1977. The data collected in this study will be analyse using Statistical Packages for Social Sciences (SPSS) where inferential statistics which is paired sample t-test is used to find out the significance difference between the mean score of pre- test and post- test from both experimental and control group. This study found that there are significance difference between the scores obtained by students in experimental and control group which proves that the use of augmented reality learning environment can indeed enhance students' visualization skills and act as spatial training approaches as well as teaching approaches. Thus, engineering drawing educators or other educators teaching subjects that contain spatial contexts are encouraged to implement this learning environment in order to increase students' understanding towards the subjects as well as enhance students' visualization skills.

Keywords: Augmented Reality, Visualization Skills, Engineering Drawing, Mental Rotation Skills, 3-Dimensional Development Skills

Engineering Student Motivation and Learning in Indonesia

Lisa Benson and Cheryl Allendoerfer

Abstract: Motivation has been linked to many aspects of students' academic performance and is a major factor in students' progress in building critical thinking and problem-solving skills. Engineering educators should understand factors that contribute to student motivation to adequately prepare our students to be practicing engineers, to increase interest in engineering, and to create a more diverse engineering workforce. Prior research on achievement motivation has shown that there are important connections between students' perceptions about their future goals and their perceptions of present tasks (i.e. their school-related work). These results suggest that focusing on the time-scale aspect of engineering students' goals and attitudes is important in providing evidence and guidance for developing relevant learning experiences that help students make connections between their current coursework and what they are likely to do in the future as practicing engineers. This study seeks to expand an existing project being conducted with engineering students in the U.S. to a population of students whose perceptions of the future are different from those of U.S. students. Indonesian engineering students were selected as the comparison group for this project expansion because of the predominance of the concept of time as being cyclical, compared to the predominant view in the West and in industrialized nations of time as being linear. This presents a unique opportunity for conducting research related to student motivation from a time-based perspective. The study of outcomes in terms of student motivation in a culture whose conception of time is different from that in Western cultures will be beneficial in expanding our understanding of how students' perceptions of their futures as engineers contributes to their development of important problem-solving skills. The goal of the study is to examine student motivation with respect to the future and how they describe their approaches to solving engineering problems. This analysis draws on interview data collected from two populations of engineering students at two universities in Indonesia. Interviews were coded and analyzed using emergent coding techniques, starting with themes identified within Future Time Perspective (FTP) theory and goal orientation theory. Our preliminary analysis has identified factors contributing to Indonesian engineering student motivation that are different from those of U.S. students that were revealed when students were asked to describe a successful career in the future, to define failure in the present how they respond to it, and to identify aspects of their present work that they perceive to be relevant to their future careers. Indonesian students described success in the future as making their families happy; they described failure as a stepping stone to success and often necessary for their learning; and that learning about interpersonal and professional skills will be the most important aspect of their present work for their future careers.

Keywords: Achievement motivation; failure; Indonesia; engineering students.

Readiness of Civil Engineering Faculty Members in Implementing MOOC

Shahrin Mohammad, Yeong Huei Lee, Cher Siang Tan, Chang Sa'ar Chai, Mahmood Md. Tahir, Mohd Hanim Osman, Sariffuddin Saad, Yusof Ahmad, Baderul Hisham Ahmad, Mohd Yunus Ishak, Hidayah Abd Hassan, Che Ros Ismail and Mohd Nur Asmawisham Alel

Abstract: There is growing worldwide interest in the use of online learning in higher education, notably the massive open online course (MOOC). Malaysia aspires to provide greater access to higher education and MOOC proves to be a very important

enabler and alternative providing opportunities for a greater number of students and also provides life-long learners to continuously learn and re-learn. However, little study has been carried out on the use and effectiveness of the MOOCs ecosystem in Malaysia, such as the readiness of a community in implementing MOOC. Hence, this study addresses the readiness of faculty members in implementing MOOC for civil engineering subjects. Questionnaire surveys have been conducted according to four measurements, namely, attitudes, knowledge, efforts and activities, and resources, of the community readiness model (CRM) to assess the readiness of the faculty member in the MOOC implementation. From the results, it showed that faculty members of civil engineering in Universiti Teknologi Malaysia (UTM) scored "preparation" level for the readiness of the community. Future plans and actions should be designed according to the obtained readiness level.

Keywords: Civil engineering, community readiness model, faculty member, MOOC, readiness

Contextual Knowledge Elements Utilization in 3D CAD Model Visualization from Practicing Engineers Perspective

Mohd Fahmi Adnan, Mohd Fadzil Daud and Muhammad Sukri Saud

Abstract: Today's industries demand engineering graduates that are prepared with a good knowledge and skills in using modern CAD modeling tools. However, the current practices have shown that there is a lack of contextual knowledge among Mechanical Engineering Undergraduates and fresh graduate engineers in utilizing 3D CAD modeling software to develop a good product design. Hence, a study addresses the issue has been conducted by focusing on the representation of contextual knowledge in 3D CAD modeling. It is based on a concern that contextual knowledge is applicable to help engineers to contextualize their 3D model in product development process. This article focuses on a part of the study by presenting the essential elements of contextual knowledge in Model Visualization that have been utilized among practicing engineers in their daily design works. The study was conducted using a phenomenological design using a transcendental phenomenology approach. Practicing engineers from one shipbuilding company in Peninsular Malaysia were purposefully selected to be studied. Four series of phenomenological interviews with each participant have been conducted to collect the practicing engineers' experiences. Besides, data from participant observations and documents analysis methods were collected to enrich the final data for this study. From the analysis, there are three most frequent emerging themes in the application of contextual knowledge in visualizing and presenting model using 3D CAD modeling: Realization, Design Intention and Normalization. These three elements play an important role in helping the engineers to contextualize their design work during the stage of visualizing and presenting created model for new product development process. Engineers are expected to develop a creative and innovative product design by utilizing these three elements. In addition, it can support the engineers' interaction and may lead to better use of 3D CAD software in the model visualization process.

Keywords: Contextual Knowledge, Computer Aided Design, Engineering Education

What are Complex Engineering Problems in the Eyes of Engineering Lecturers?

Fatin Aliah Phang, Syed Ahmad Helmi Syed Hassan, Khairiyah Mohd Yusof, Aznah Nor Anuar, Azmahani Abdul Aziz, Yusof Ahmad, Noorzana Khamis, Mohd Fadzil Daud and Yudariah Mohammad Yusof

Abstract: Complex engineering problems are mentioned in almost all the graduate attributes in the Washington Accord for an engineering graduate. This shows the importance of teaching and assessing problem solving skills in complex engineering problems for engineering programs. However, it is not known to what extent engineering lecturers understand and perceive complex engineering problems and how they assess their students on this skill. Therefore, this research was carried out to study the complex engineering problems designed by engineering lecturers in order to find out how they view complex engineering problems. The research was carried out using document analysis and expert review. A total of 65 course files of an engineering program were examined where 41 assessment tasks which were labelled as "complex problem" by the lecturers were collected to be analyzed using descriptive analysis. The result shows that 41.5% of the assessment tasks were not considered to be complex engineering problems by the expert reviewers. This indicates that engineering lecturers may not fully understand complex engineering problems, thus fail to teach and assess this important skill among the engineering students. Hence, the engineering lecturers should be educated on the characteristics and attributes of complex engineering problems before they design their assessment tasks.

Keywords: Complex engineering problems; graduate attributes; problem solving skills.

Engineering Students' Pattern of Metacognition during Complex Problem Solving at Digital Signal Processing Laboratory

Narina A. Samah, Hadijah Jaffri, Ahmad Zuri Sha'ameri, Usman Ullah Sheikh, Naziha Ahmad Azli and Lokman Tahir

Abstract: Complex problem solving is one of the elements of higher order thinking skills heavily emphasized by engineering curriculum across the world. In accommodating the perpetual demands made by both local and international stakeholders,

curriculum developers and program owners of engineering programmes in Malaysia are now venturing into inquiry-based learning (IBL) approaches. Among the various types of IBL, problem-based learning (PBL) approach is considered to be an innovative pedagogical approach in engineering education (EE). Despite extensive studies on the applicability and effectiveness of problem based learning in enhancing engineering undergraduates' learning skills and soft skills, less work has been done to explore the Malaysian electrical engineering undergraduates' higher order cognition while undergoing problem-based laboratory. Hence this paper presents an in-depth qualitative study that examined undergraduate students' patterns of metacognition during the four-week sessions of Problem-based Laboratory (PBLab) at Digital Signal Processing Laboratory (DSP Lab), Faculty of Electrical Engineering, Universiti Teknologi Malaysia (UTM). Qualitative data sets were generated from group interviews conducted on six groups that involved 16 final year students who had undergone the process PBLab at DSP Lab. Drawing on Flavell et al.'s (2002) framework for components of metacognition, theoretical thematic analysis was conducted on the data. The development of the main and constituent themes that describe the students' pattern of metacognition while attempting to solve open-ended microelectronics problems were anchored on the two basic components of metacognition. In specific, the undergraduate students' metacognitive knowledge, as well as their metacognitive monitoring and self-regulations were examined throughout the two main phases of PBLab, which consisted of Phase 1: The identification of problem; and Phase 2: The development of strategies in solving the given problem, as well as the implementation of strategies during the actual problem solving process. This study provides the insights into the understanding of higher order cognitions among undergraduate students who are novice in solving complex engineering problems.

Keywords: Complex problem solving, electrical engineering undergraduates, metacognition, problem-based laboratory, qualitative research in engineering education

Assessing Students' Practical Intelligence in Hands-on Electrical Laboratory via Psychomotor Domain by Using Engineers Automated Testing Kit

Mohd Hisam Daud, Zol Bahri Hj. Razali and Maizam Alias

Abstract: These instructions give you guidelines for preparing papers for RCEE & RHED. Experience in an engineering laboratory is important for engineering students and likely to enhance understanding of engineering concepts for which they have learned the theory. Although the aim of the laboratory is an opportunity to learn and gain experience, the authors do not know much about what actually happens in a typical laboratory class. The development of experience either intentionally or unintentionally, will happen when the students are performing tasks in the laboratory. Hands-on laboratory classes have always been valued for the practical experience gained by engineering students and likely related to psychomotor domain. An effective way to measure tasks in psychomotor domain might provide a useful way to compare the learning utility of hands-on laboratory classes. In this research, the authors proposed of using Engineers Automated Testing Kit in testing practical experience (psychomotor domain) after performing laboratory classes. The practical exercise with the Testing Kit has demonstrated that first year electrical engineering student's (experiment group) gained significant practical experience from laboratory class and able to score significantly compared to the control group. This technique may provide a way to measure that elusive component of engineering laboratory experiences referred to by most people as "hands-on practical experience". Methodologies and detail results for this research are described in this paper.

Keywords: Practical intelligence; Engineering technology; psychomotor domain model; Laboratory classes; Practical skills

Impact of an Introduction to Engineering Course on First year students' view on engineering

Nur Fazirah Jumari, Khairiyah Mohd-Yusof and Fatin Phang

Abstract: Motivating students to learn engineering is important in improving students' success and retention. Among the motivation factors in learning is career expectation. Career expectation can be defined as one knows what he/she will do such as responsibility, satisfaction and usually listed as part of a job description. On the other hand, the lack of understanding material compounded with the difficulty in engineering content makes the students feel lost and demotivated. Therefore, Introduction to Engineering course is designed to introduce the field of engineering and prepare the students in learning engineering. One of the objectives of this course is the students are expected to be able to define engineering and the roles and responsibilities of an engineer in various aspects. The purpose of this study is to explore students' understanding of engineering before and after they undergo the Introduction to Engineering course. In this exploratory study, six students from the first year Chemical Engineering program that undergo Introduction to Engineering course were chosen as respondents based on their answer to the statement "I want to be an engineer when I graduate from university" for the interview. Thematic analysis technique was used as a method of analysis to identify the students' view on engineering. Before entering this course, students define engineering as the application of mathematics and science, develop new technology, improving human life, providing the society with a better life, inventing some products, important to the nation, and give a contribution to society by reducing the pollution. After completing this course, the students create a new understanding that engineering consist of the task that requires problem solving skills to improve the lifestyle of the society, and engineering is a field of creative innovations. The

students are also aware that they should develop the required soft skills in university as preparation to become an excellent engineer.

Key words: introduction to engineering, what is engineering

Development of Problem-solving Process Rubrics (PPR) in Assessing Problem Solving Skills

Nur Ayuni Shamsul Bahri, Naziha Ahmad Azli and Narina A. Samah

Abstract: Rubrics are scoring tools that are normally used with performance assessments. They include three important parts such as criteria, descriptors and levels of students' performances. Nowadays, many rubrics have been designed and they can easily be found on the internet. But, from 1,000,000 to 13,000,000 rubrics uploaded on the internet, how to determine the best rubrics which are suitable for engineering education courses? It is difficult to answer this question because several rubrics have been designed for different contexts and they cannot be generalized to other contexts. Due to the foregoing reason, this study has been done in order to design a Problem Solving Process Rubric (PPR) that focuses on assessing problem-solving skills, especially for the Project-based Laboratory (PB Lab) course. This paper reports the step-by-step process on how the PPR has been developed and hopefully, this processes guide the lecturers to construct a rubric systematically by determining the relevant rubric's criteria, descriptors and levels of performances, so that it can assess the required outcomes effectively.

Keywords: Rubrics, problem-solving skills, assessment

Perception of Lecturers on Problem Based Learning in Civil and Environmental Engineering Courses

Nor Amani Filzah Mohd Kamil, Berhannudin Mohd Salleh and Sabariah Musa

Abstract: Problem Based Learning (PBL) is a requirement in learning and teaching in engineering course. However, the perception of the academic staffs in engineering course to implement the PBL is still unknown. In addition, knowledge and awareness of PBL among the academic staffs is never measured. Thus, this study was conducted to assess the awareness and perception of academic staffs on implementation of PBL in engineering course. This study was conducted in Faculty of Civil and Environmental Engineering, UTHM, at the end of 2015. Academic staffs from different discipline in civil engineering were requested to participate in this study as respondents. Data about staff sociodemographic characteristics, PBL awareness and perception were collected via a pre-designed structured questionnaire. All respondents are aware on PBL and 91% of respondents had implement PBL in engineering course. Almost 70% of respondents choose 'Project' to implement PBL and 68.2% of respondents select 'Course provided by faculty' for distribution of PBL information. Respondent shows agree 36.4% that PBL make learning more interesting and learning outcome can be achieved. Evaluation of student's performance by PBL implementation easier compared to conventional course which 45.5% of respondents agree. Respondents also agree 38.1% and 36.4% respectively that PBL taken more time and required more material compared to conventional course. But, 36.4% of respondents strongly disagree that implementation of PBL can reduce the lecturer burden. In open ended question, mostly respondents shows the positive respond which provide early exposure to real engineering problem, make learning faster, increase lecturer's soft skill, student appreciate in completing their project and fulfill the current needed. However, some respondents think that PBL only suitable to implement for theoretical course and a few respondents less agree on PBL implementation due to massive guidance and required extra time. Thus, it is suggested that faculty provide detail planning and earn time and material to assist the lecturer in PBL implementation.

Keywords: academic staff, civil engineering course, opinion, PBL

Promoting Ethical Skills in First Year Engineering Students through Socially Relevant Experiments

Yogesh Velankar, Gopalkrishna Joshi and Preethi Baligar

Abstract: The next generation of graduates should possess several technical and professional skills in order to adapt to the rapidly changing nature of business and technology. Graduates from engineering education programs are expected to perform their professional roles demonstrating technical competence while adhering to the highest ethical standards and practices. However, the teaching of professional and ethical responsibility is often neglected as part of the engineering education program curriculum. In this dynamically changing nature of business, technology and education, it is imperative for ethics discourse to take centre stage rather than being on the sidelines. Neglecting ethics education can have severe consequences. Society as a whole suffers from the actions and decisions taken by ethically challenged practitioners. Engineering education stakeholders need to take proactive action to tackle this situation upfront. Education leaders, administrators, engineering educators and all other related stakeholders may face several challenges incorporating ethics education into engineering education curriculum. To address these challenges, the authors have incorporated ethics education right from the first year of

the engineering curriculum. In this paper, we present a case study of promoting ethical skills in first year engineering students through socially relevant experiments.

Keywords: Engineering Ethics, First Year Engineering

Evidence-Based Personas of First Year Engineering Students as Potential Pedagogical Tool

Aisha Mahmood, Yudariah Mohammad Yusof and Mohd Fauzi Othman

Abstract: The rate of translating research into practice needs to be accelerated in engineering education. In this study, the evidence-based student personas are developed to be used as potential pedagogical tool for transferring implications of this research to community of practice including engineering and mathematics faculty, junior researchers and postgraduate students. The engineering students' personas while activating the mathematical thinking processes during problem solving activities through blended learning will guide the practitioner how to improve further or influence future teaching and learning experiences.

Keywords: Engineering Student Personas, Engineering Education, Mathematical Thinking, Blended Learning

Skills Development among First Year Engineering Students through "Introduction to Engineering" Course

Nur Shahira Samsuri, Khairiyah Mohd-Yusof and Azmahani Aziz

Abstract: The world is facing new and complex challenges that require collective efforts of professionals. To be successful in today's world, engineers must possess professional skills. Unfortunately, our educational system provides very few opportunities for students to develop professional skills. The institutions must introduced new teaching approaches in order to support the development of learning teams in engineering courses. To overcome this problem, one of the universities in Malaysia has introduced "Introduction to Engineering" course to all first year engineering students in order to develop the desire professional skills. The purpose of this study is to investigate the impact of "Introduction to Engineering" course on student's professional skills development among engineering students in different faculties. An exploratory mixed method research design was employed among first year engineering students at selected faculties in one of the university in Malaysia. The data collection that has been used for qualitative and quantitative study is focus group interviews and survey questionnaire respectively. The qualitative results were analyzed using thematic analysis method. From qualitative results, seven major themes have been sorted out to develop quantitative instrument which is communication, creative thinking, problem solving, leadership, team working, management and critical thinking skills. The themes emerged from the qualitative results were used as guide for a literature survey to develop a questionnaire. Items from existing established questionnaires available in literatures were selected as constructs of the developed questionnaire. A pilot test was conducted before it was administrated to the real respondents. In this study, 120 students were randomly selected from three faculties namely Faculty A, Faculty B and Faculty C. The quantitative data were analyzed using SPSS software. From the results, it shows that the "Introduction to Engineering" course helps the students to enhance several professional skills especially in team working, communication and critical thinking skills that expose them to the nature of engineering tasks and settings and thus prepare them to become future engineers.

Keywords: First year experience, future engineer, professional skills development

Harnessing Mathematical Thinking Powers of Engineering Students' in a Computer Support Learning Environment (CSLE)

Fereshteh Zeynivandnezhad, Zaleha Binti Ismail and Yudariah Mohammad Yusof

Abstract: The current situation in teaching and learning mathematics for engineering undergraduates is very procedural such that students are not actively thinking in mathematical manner. It is believed that mathematical thinking can be improved in a conducive learning environment such as using a computer algebra system. A CAS, namely Maxima was selected to be integrated in a differential equations (DEs) course that focus on making mathematical thinking explicit to create the CSLE. Maxima has the capacity to manipulate mathematical expressions symbolically and graphically with high speed of calculation and visualization. Six engineering students who participated in CSLE solved some DEs problems and later be interviewed. Data were collected qualitatively to elicit mathematical thinking processes from student activities and notes in teaching episodes. Data were analyzed using thematic approach base on Mason's mathematical thinking powers. Findings showed students were aware of their mathematical thinking powers and used them frequently while working in CSLE. The study implies that CSLE can play a role in enhancing mathematical thinking of engineering students by making explicit the thinking processes using prompts and questions.

Keywords: Engineering education; Mathematics education; Teaching experiment; Mathematical thinking powers; Differential equations; Computer Algebra System

Desired Mathematical Competencies in Outcome Based Engineering Curriculum

Soheila Firouzian, Zaleha Binti Ismail, Roselainy Abdul Rahman and Yudariah Mohammad Yusof

Abstract: In the engineering programs, the role of mathematical competencies seems to be crucial due to the importance of mathematics and its application as the fundamental base of engineering courses and engineering work. As a developing country, Malaysia attempts to compete along with other countries in technology and science. Over the years, the number of industries in Malaysia has been rapidly increasing, leading to a high demand for engineers. As a premier university for engineering Universiti Teknologi Malaysia (UTM), train qualified engineers through outcome based engineering education program. This accomplishment should be compatible with the Engineering Accreditation Council of the Board of Engineers (EAC-BEM) standards that inform outcomes of mathematics courses in the planning stage of engineering curriculum. UTM develop the engineering curriculum according to the requirements indicated by the EAC-BEM, as well as the Malaysia Quality Framework introduced by the Ministry of Higher Education in 2004. According to accreditation policy, engineering graduates should have essential skills, attributes, and capabilities reflected in graduate outcomes as specified in the EAC Manual. UTM implements its engineering program in a way to meet the objectives stated in EAC and BEM in order to prepare capable graduates and to enhance capabilities of students in a number of aspects. However, some researchers believe that an accurate review should be done on the specification, objectives, and outcomes of programs as well as other supporting resources provided for the requirements of OBE at UTM. To bridge the gap between the university education and workplace demands for mathematical competence of the engineers, this paper aims to present how required MCs of engineers can be addressed in clear and distinct outcomes of an outcome-based engineering mathematics curriculum. To do so, a list of required MCs of engineers has been provided based on the results of previous works. A questionnaire was designed accordingly as the instrument of this investigation. Thirty mathematics lecturers who had experience teaching engineering students were sampled purposively to respond to the quantitative survey. Based on their responses, a guideline has been proposed to explicitly integrate MCs into the learning outcomes of mathematics courses offered in engineering programs at UTM. The guideline is a schema of the possible outcomes in the form of desired MCs that are effective in nurturing the prospective engineers. It is hoped that this contribution will guide mathematics lecturers to explicitly incorporate MCs in their teaching to meet the demand in the workplace as well as the requirements of engineering courses as expected by engineering lecturers.

Keywords: Mathematical competencies, outcomes, engineering curriculum.

Level of Non-Technical Skills among Electrical Engineers in Malaysia: Perceptions from Fresh Engineers and Senior Engineers

Muhammad Khair Noordin and Mohd Safarin Nordin

Abstract: Non-technical skills are becoming crucial requirements for engineering graduates to be hired by a company or industry. Unfortunately, employers nowadays are giving a number of complaints on the level of non-technical skills among fresh engineers. Engineering graduates are not equipped with sufficient non-technical skills as university has different perception on undergraduates' skills development compared to the industry. Thus, this study was conducted to evaluate the level of non-technical skills, namely communication, problem solving, team working, lifelong learning and ethics among electrical engineers in Malaysia. The research was conducted among electrical engineers at Tenaga Nasional Berhad (TNB) as respondents because TNB is the leading company that has the highest number electrical engineers in Malaysia, which involved fresh engineers and senior engineers. The study was conducted using both qualitative and quantitative methods. Result shows that the fresh engineers claimed that they were unequipped with sufficient non-technical skills after they graduated from university. This was happened because the university was put too much emphasis on technical skills development. Moreover, the senior engineers also perceived that the fresh engineers were lack with non-technical skills as they claimed that non-technical skills are very important for engineers in the industry. Therefore, it is crucial for university and other higher institution to provide engineering graduates with the skills required by industry since they are responsible to prepare the engineering students to work in industry.

Abstract

Scholarly Experience Sharing in Engineering Education

Outreaching and Engaging Students with STEM through AEROFAIR

Zulfaa Mohamed-Kassim and Noorfazreena Kamaruddin

Abstract: One critical issue facing Malaysia's aim to become a developed nation by 2020 is in the possibility of attaining only half of its targeted capacity of workforce in the fields of science, technology, engineering and mathematics (STEM). This national challenge of motivating students towards STEM presents opportunities at many scales and levels, one being the urgent need for tertiary STEM institutions to conduct outreach programs to attract prospective students. This paper presents the development, implementation, and outcomes of AEROFAIR, a long-term outreach project by the School of Aerospace Engineering at the Universiti Sains Malaysia designed to promote STEM to secondary school students through hands-on activities related to aerospace engineering. Discussion on these activities focuses on indoor flight, a new outreach platform introduced in Malaysia through this project. The project has been organized into two consecutive outreach programs, each consisting of a half-day workshop and a half-day competition event participated by more than 240 students and teachers. Surveys were conducted to assess the outcomes of each program. Feedback from participants largely indicated positive impact of the activities in generating interest towards STEM, but recommended a few suggestions to improve the physical and organizational aspects of the programs. Recommendations from AEROFAIR 2014 had been implemented in AEROFAIR 2015, resulted in better students' learning outcomes and in producing longer flight times during the competition. Further improvements will be incorporated in organizing the next AEROFAIR program in 2016, with the main aim of scaling-up the impact of this outreach project.

Keywords: STEM outreach, aerospace engineering education, and indoor flight.

The Impact of Instructional Scaffolding in Social Collaborative Learning Environment on Engineering Students' Knowledge Construction

Tan May Ling and Jamalludin Harun

Abstract: Engineering students show very little gains in high knowledge construction level that allow them to integrate and apply in the real world, practicing notably to develop the competence and expertise in the engineering field [1]. Moreover, industry indicates that engineering students are deficient in skills and show poor quality achievement in academic performance [2]. In order to satisfy the needs of today's engineering students in a digital world environment, social collaborative learning (SCL) environment is vital to inculcate into engineering education. Thus, instructional scaffolding (IS) imperative to embed in SCL environment in order to foster engineering students' knowledge construction to a higher level. The aim of this paper is to evaluate the impact of IS in SCL environment on engineering students' knowledge construction level. Engineering Science course was selected for this study. It is a compulsory course for Marine, Civil, Mechanical and Electrical engineering students in polytechnics Malaysia. In addition, this course lies at the foundation of the engineering field. The method of design comprised of a Quasi-experimental setup that involved the pre and post-test design which was undergoing by 74 participants from one of the Polytechnics in North Malaysia and the samples of this study were used to identify the improvement of knowledge construction level. They were 36 Civil engineering students (experimental class) that completed the learning activities tasks in the social collaborative learning (SCL) environment through Facebook discussions with instructional scaffolding support and 38 Mechanical engineering students (control class) completed the conventional collaborative learning (CL) environment which was conducted in the engineering classroom. The results showed that the engineering students in SCL environment reflect significantly higher score when compared with CL environment. There was a statistically significant improvement in a test from 3.05 scores to 13.98 scores, an improvement of 10.93 scores for the experimental class. On the other hand, control class showed a significant improvement of 8.68 scores in a test from 2.58 scores to 11.26 scores. Simultaneously, compare with the combination of results in the percentage of knowledge construction level, as can be seen that engineering students in the control group and the experimental group have increased for each level of knowledge construction whether in conventional collaborative learning or social collaborative learning environment. In other words, they have improved their scores (marks) in different of percentages such as 86.11 of argumentative knowledge construction and 64.00 of metacognitive knowledge construction for the experimental group. On the other hand, engineering students in the control group have 84.21 percentage of argumentative knowledge construction and 13.16 percentage of metacognitive knowledge construction. The other knowledge construction levels such declarative knowledge and procedural knowledge also showed that the engineering students have improved their performance in the test. The findings of this paper reported that both learning environments would bring about a strong positive impact on engineering students' knowledge construction levels. This can assist instructors or engineering educators to redefine the role during delivery content learning. However, there is a limited study on the implementation of instructional scaffolding in a social collaborative learning environment in order to foster engineering

students' knowledge construction. The use of instructional scaffolding in online SCL environment is the subject of much argument from researchers and deserves further investigation.

Keywords: Engineering students, instructional scaffolding, knowledge construction, social collaborative learning.

Adopting and Implementing Active Learning and Cooperative Learning Approaches in Lecture Based Engineering Class

Dereje Engida Woldemichael and Azman Zainuddin

Abstract: In line with the global trend shifting from teacher-centered to student-centered education and to produce graduates with 21st century skills, this paper presents the result of scholarship of teaching and learning in a typical lecture based engineering class. In order to address the challenges faced by the lecturer and students in today's environment, instructional methods namely active learning and cooperative learning that allows the students to be active and engaged in the learning process has been adopted and implemented in Dynamics course for second year Mechanical Engineering students at Universiti Teknologi PETRONAS. In lecture class we use a number of active learning approaches namely: think-pair-share, concept questions, two minute paper and closure review. In tutorial classes we used formal cooperative learning approach. The learning outcomes, the learning activities and assessments for the course were revised based on constructive alignment approach. Furthermore, the learning environment is designed considering the four pillars of how people learn namely: assessment, knowledge, learner, and community-centered. The effect using active learning and cooperative learning on learning and student perception in comparison with traditional lecture based approach were studied using quantitative survey from students and indirect feedbacks in teaching evaluation. The survey data were collected using Google form. Two separate surveys were conducted for different batches (May semester and September semester 2015) with 35 and 47 respondents respectively. The responses were recorded and coded in statistical package for social sciences (SPSS) software and analyzed. The result from both surveys describes, that most of the respondents do consider the effectiveness of active learning and cooperative learning approaches implemented. The results from the survey was in line with previous results reported in literature for both active learning and cooperative learning approaches.

Keywords: Active learning, closure review, concept questions, formal cooperative learning, think-pair-share.

Towards Integrating GIS to the University's Educational Programme

Stephanie Mae Salcedo and Rejen L Albores

Abstract: This Last 2013, the GIS Resource Center in MSU-IIT was established through Climate Change Commission's Project Climate Twin Phoenix. It was through this project that a set of personnel (regular and contractual) from the Mindanao State University-Iligan Institute of Technology (MSU-IIT) were capacitated on geomatics technology such as the use of the Global Positioning System (GPS) and Geographic Information System (GIS). Furthermore, in 2014, the MSU-IIT was involved into two national mapping programs. One program deals with flood hazard mapping and the other on resource mapping. Almost all of the personnel that were involved in the Twin Phoenix Project were absorbed in the mapping programs plus a substantial number of people were employed with participation of faculty members, OJTs and thesis students. It is in this mapping program that capability for geomatics technology has been reinforced, enhanced and made accessible to many parties. And because of it, awareness of the technology has become widespread such that faculty members have been clamouring mapping program personnel to teach their students on geomatics technology. As a result, mapping workshops using ArcGIS and GPS were undertaken for Engineering and Biology undergraduate and graduate students. Even Local Government Units (LGUs) such as the City Environment Management Office (CEMO) were trained and waiting to be trained. During the course of these trainings, a structured mapping workshop for undergraduate, graduate, post graduate students and even professionals have been developed. Specifically GIS mapping workshop were divided into 4 courses: Basic, Intermediate, Advance GIS and Field Activity. Advance GIS lessons vary depending on the audience background. Civil Engineering students for instance were given watershed delineation activity in connection with their Water Resources Engineering course.

Keywords: Education, GIS, Mapping

Activity Theory: Inculcating Fundamental Engineering skills and Attributes through Mini-Project Laboratory Activity

Md. Shahar Aftanasar, Norizah Mohamad and Ahmad Nazri Ali

Abstract: Early introduction to essential and fundamental components in engineering skills and desired attributes are imperative in assuring continuous development for competent and proficient future global engineering graduates. This paper explores the use of activity theory as a framework in designing mini-project activity program for 1st year basic laboratory course. The framework implements engineering design stages as a tool for developing themed-prototype. This study analyses reflection essay from 1st year EE 2014 and 2015 intake, with a combined total of 254 students. Scoring rubric was used to

assess qualitatively random transcriptions in week 14 after final assessment of the prototype. Findings have indicated six essential themes that emerged from the analysis: collaboration; workable knowledge; engineering design; communication; attitude and mentorship. These have positively confirmed that expected engineering skills and attributes that is coherent with the school's intended outcome, have been internalized and comprehended by most 1st year students.

Keywords: Activity Theory; Engineering Design Process; Project-Based Learning

Impact of Faculty Satisfaction and Student Feedback on Students' Performance- A Case Study of FAST-National University

Farrukh Idrees, Waseem Ikram and Azhar Rauf

Abstract: This research intends to explore the impact of faculty satisfaction and student feedback on students' performance in higher education. The unit of analysis of the study encompasses one campus of FAST National University. The paper provides insight for future evaluation of higher education learning environments by linking faculty satisfaction, and student feedback on student's performance in technical and non-technical courses. Faculty satisfaction is measured through a structured survey questionnaire, designed by Higher Education Commission of Pakistan. Validity and reliability of the questionnaire is calculated through CFA and Cronbach alpha values. Students' performance is gauged by calculating average score of a class size of approx. 40 students who are being taught on average 6 subjects. Average score of about 600 students of all badges in Islamabad are included. This paper takes a statistical approach by applying descriptive statistics, correlation, regression, ANOVA to assess the impact of faculty satisfaction of 80 faculty members covering both adjunct and regular faculty, and student feedback on students' performance. In addition, moderating role of gender, status and seniority level of faculty on students' performance have also been tested. Further research may be done to explore the impact of other factors impacting learning behavior of students. In addition, more rigorous quantitative and qualitative techniques e.g. factor analysis, design of experiments, focus groups etc. may be used to triangulate the findings. Further, sample size may be enhanced by including other engineering universities to generalize the findings of the study.

Keywords: Student Feedback, Student Performance, Faculty Satisfaction Survey, Quality Measures, Higher Education, Critical Factors, Engineering School, CFA

Abstract

Scholarly Research in Higher Education

Emotional Intelligence of Engineering Undergraduate in a Service Learning Programme

Mohamad Norhakim Sahroni, Sharifah Kamilah Syed Yusof, Zaleha Binti Ismail and Yudariah Mohammad Yusof

Abstract: Current research on the importance and relevance of the relationship between emotional intelligence and work outcomes has continuously gained momentum since the publication of Daniel Goleman's best seller Emotional Intelligence: Why It Can Matter More Than IQ (Goleman, 1995). Professional expertise is no longer the only standard by which to evaluate graduates. "Soft skills", like emotional intelligence are viewed as effective ways to distinguish potential high-performance workers and those who will be "no more than" a worker. This paper attempts to associate emotional intelligence while carrying out engineering tasks in SL by engineering students. In enriching the data for this study, researchers involve qualitative observation during the process of data collection. In the study, EI is used in all stages of problem solving. But its use varies according to the level of the work phase itself and abilities of students. Most of the students have a low self-awareness of social awareness.

Keywords: Emotional Intelligence

Evaluation of Laboratory Facilities for Engineering Technology Programs in Malaysian Technical Universities

Kamilah Radin Salim, Kamsiah Mohd Ismail, Habibah Norehan Haron, Rozita Juliana Abd Rahman, Rosmah Ali, Noor Hamizah Hussain, Morina Abdullah, Norhayati Mohamed Nor, Normah Mulop and Zainai Mohamed

Abstract: Malaysia has put emphasis on Engineering Technology programs in its effort to be a developed country by 2020. This demand for Engineering Technology programs to be implemented is to increase the number of technical graduates for the industry needs. The Malaysian Technical University (MTUN) institutions and UniKL are among the higher education institutions in Malaysia that offer Engineering Technology programs at the undergraduate level. These institutions main agenda is to produce skilled work-ready graduates. Being in its infancy, MTUN has yet to produce their first batch of Engineering Technology graduates. This article reports the evaluation of the facilities at MTUN, as part of a bigger research scope. The data collection method in this study is mainly qualitative, which comprise of interviews, observations and document analysis. The interview protocol and observation checklist were developed and validated by experts and found reliable after running a set of pilot interview and observation. Interviews were carried out on the lecturers, whereas observations were made in the classroom, laboratories and a teaching factory. Document analysis that was carried out was on the Code of Practice for Program Accreditation (COPPA) document. This study also adopted the quantitative method using survey questions on students' satisfaction of the facilities related to the application-based practice oriented at the institutions. From the laboratories observations, interviews with the lecturers, analysis of COPPA document and survey questionnaires answered by students, it can be concluded that the laboratory facilities provided by the three MTUN are adequate for the current number of students.

Keywords: Engineering technology, hands-on skill, laboratory, practice-oriented

Engineering Undergraduates' Motivation in Learning Computer Programming

Nor Azlinda Azmi, Khairiyah Mohd-Yusof, Fatin Phang, Saharudin Haron, Nor Alafiza Yunus, Zarina Abdul Muis and Syed Ahmad Helmi Syed Hassan

Abstract: Motivation to learn is central to the development of effective learning. As the needs to embed computer programming in engineering education is a priority, motivating the students to learn programming is important for engineering academics. Meanwhile, planning an effective learning environment to increase students' learning motivation for difficult subjects, such as computer programming is also an initiative towards academic improvement in engineering programmes. This paper discusses analysis of interviews conducted with ten engineering undergraduates to explore their motivation towards learning computer programming. It is based on a naturalistic inquiry study which allows an in-depth interpretation of the students' experience sharing. The findings are discussed in the perspectives of Bransford's How People Learn (HPL) framework principles which are learner, knowledge, assessment, and community centred. HPL framework is useful as a guide for instructors to design and plan effective learning environments. The findings and discussion presented in this paper are useful for computer programming instructors in engineering faculties to create an effective learning environment in order to develop or improve students' motivation to learn.

Keywords: Motivation, computer programming, How People Learn framework, engineering undergraduates.

Evaluating Knowledge Transfer Success in Personal Learning Environments in Higher Learning Institution

Nur Syafiqah M. Sani, Noreen Izza Arshad and A. Izudin Zainal Abidin

Abstract: Knowledge transfer has been the common practice that happens daily through individuals' learning process. However, the success of this knowledge transfer process is rarely being evaluate due to the fact that there are lack of standardized guidelines or frameworks to conduct the evaluation. Therefore, the main objective of this study is to propose an evaluation framework in order to evaluate the success of knowledge transfer that happens in Personal Learning Environments (PLEs). Significantly, this study will look into the success of knowledge transfer that happens in informal learning through PLEs among students in Higher Learning Institution. In Higher Learning Institution, the process of transferring knowledge were seen as the commonly happening practice, as it is where the learning processes take place. In the process of coming out with the proposed evaluation framework, a deep literature studies into previous works has been conducted. The proposed evaluation framework is developed based on the combination of few previous model/ frameworks from the literature studies and then were brought into the knowledge management perspective especially knowledge transfer. It includes a chain of fit relationships between human, organization and technology factors. The proposed evaluation framework will then be assessed by conducting a qualitative action research experiments in a chosen higher learning institution that conduct knowledge transfer process through PLEs. The experiments were conducted in a few cycle and took place in a well technology- equipped lectures and tutorial room and participants were provided with sufficient materials regarding to the topic syllabus in the course. The findings of this research will be categorized into two significant aspects which are the performance on objective score and performance on the subjective view. Various patterns were observed on how the participants' performance were affected by the PLEs. Based on these performance scores and views, the success of knowledge transfer will be able to be evaluated. The research findings can contribute to practitioners, specifically academicians, in providing guidance to essentially evaluate knowledge transfer for their students and organizations. Next, the practitioners could also use the evaluation framework in evaluating issues and reasons why their knowledge transfer process fails. This study also providing a new perspective on PLEs where it promotes the learners to organize and take control of their own learning process and therefore reflects on their ability to capture knowledge by learning on their own.

Keywords: knowledge transfer, personal learning environments (PLEs), evaluation of knowledge transfer success, evaluation framework, higher learning institutions.

UTM Sustainable Living Laboratory Campus; Are the Implementations Effective?

Rozana Zakaria, Gamal Alqaifi, Abdul Rahim Abdul Hamid, Shaiful Amri Mansur, Aziruddin Resang, Irina Safitri Zen, Masalah Bandi, Mohamad Sukeri Khalid

Abstract: A sustainable campus acting as a premier hub for sustainability in operations, research, education and engagement between university, public and industry. The purpose of sustainable campus is to achieve sustainability's goals to promote society into having a sustainable lifestyle in a local or a universal scale. An effective living in sustainable campus requires precise planning and execution, whereby universities represent the leading keys in achieving environmental, social and economic measures through sustainable practices in sustainable campuses. This paper presents the achievement of UTM sustainable campus as a living laboratory from the final year student point of view. A matrix questionnaire was developed and distributed to final year students. A descriptive analysis, correlation analysis and factor analysis were employed to determine the level of effectiveness of UTM sustainable living laboratory campus with the degree of association between the Economic, Environmental, Social and Institution benefits. It has been found that sustainable living laboratory campus elements rate 6.86 to 7 out of 10 to the corresponding benefits while the association between those benefits have been proven to be significantly related. The factor analysis was used to extract the components to represent the elements that best describe the benefits of sustainable living laboratory campus. In conclusion an association of potential benefits from sustainable campuses can be achieved by sustainable implementations of education, research, operations. Thus sustainable campus initiatives promote synergies to the sustainability way of human life.

Keywords: Economic, Environmental, Institutional, Social, Sustainable Campus

Authentic Learning Environment for the Implementation of Data Structure Subject through MOOC: A pilot study

Nor Bahiah Ahmad, Dayang Norhayati Abang Jawawi, Najwa Azmi and Nadirah Mohamad

Abstract: Massive Open Online Course (MOOC) is a new phenomenon that rapidly emerged in the educational world. Despite of being known and increase in demand in today's world, MOOC have several issues which include high attrition rate and

student's authentication which lack of research discussed on it. Therefore, this is an initial study that discussed on implementation of Data Structure course in an authentic learning environment based on authentic learning features. The study found that low progress in students' learning which has possibility trigger high attrition issue. Further study is needed to set measurement for encountering the issue.

Keywords: Attrition, authentic learning environment, authentic learning features, MOOC

Cognitive Conflict Strategies in Video-Based Learning Enhance Students' Conceptual Change

Radhiah Ab Rahim, Norah Md Noor and Norasykin Zaid

Abstract: Education Development Plan 2013-2020 stated that learning in Malaysia should have embarked on ICT in education. Due to that point, video is relevant to the 21st century learning. Previous studied found that video give advantages in students' attention, motivation and performance. Thus, this paper studied the effectiveness of the video based learning embedded within Cognitive Conflict Strategies (CCS) to enhance students' conceptual change. There are three videos developed by using ADDIE Instructional Design Model and each video is embedded with different CCS elements. The five elements of Cognitive Conflict Strategies are (1) Meaningful information, (2) Challenges student's existing concept, (3) Able to gain attention, (4) Motivation, and (5) Comfortable while using the video. The flipped classroom approach is used where the student watch these videos before come to the class. Data was collected by using a set of question as pre-test and post-test from 18 part time students taking Information Technology Applications & Communications subject whose were chosen using purposive sampling. The findings reported that, the video embedded with all five CCS elements get highest score in Wilcoxon signed-ranks test compared to the other two video with the lesser number of CCS elements that implement in the videos. This study shows that Cognitive Conflict Strategies were able to increase the students' level of conceptual change. Therefore, it is believed that students need up-to-date learning and teaching styles that can nurture them towards creativity and innovation in line with the modernization era. Thus, video based learning environments can help to stimulate students to explore deeper on what they have learned in a more interesting approach.

Keywords: video-based learning, cognitive conflict strategies, conceptual change

Awareness and Procedural Knowledge as Predictors of Students' Intention to Use BookMyne: An Exploratory Study

Babakura Mamman, Zaleha Ismail, Mohd Nihra Haruzuan Mohamad Said, and Rosemaliza Moh'd Kamalludeen

Abstract: This study explored the levels of awareness and procedural knowledge of undergraduate students in IIUM, Gombak and examined the levels of students' intention to use BookMyne as a library search tool that can allow users to access the library catalogue on the go. The study employed Rogers' (2003) conception of knowledge and Davis' (1989) technology acceptance model (TAM) as its theoretical background. A total of 415 students (228 females and 187 males) from 8 kulliyahs in the IIUM Gombak campus participated in the survey. A self-developed questionnaire with 20 items measured three major constructs of interest, i.e. awareness knowledge, procedural knowledge and intention to use, on a 5-point Likert scale. The items were first content validated by experts and pilot tested before being administered to the respondents. The data were analyzed quantitatively using descriptive statistics, Pearson's product moment correlation and multiple regression analysis. The results showed that IIUM students have low levels of awareness and procedural knowledge of BookMyne, but despite having low knowledge of the system, they demonstrated a high level of intention to use the system. Knowledge and Intention to use was found to be significantly correlated with awareness and procedural knowledge with strong positive associations. In addition, the results of the MRA revealed that procedural knowledge positively predicted student intention to use BookMyne. The findings have important implications on how the IIUM library management and instructional technologists could devise a systematic strategy to improve students' knowledge of BookMyne in order to increase their use of the library catalogue.

Keywords: Awareness Knowledge, Procedural, TAM Model, BookMyne, Digital Resources.

Meta-analysis on Interaction in Online Learning

Masarrah Abdul Mutalib, Noor Dayana Abd Halim and Noraffandy Yahaya

Abstract: Interaction in education is defined as direct effect that influence students, instructors and contents in promoting students' achievement in learning. The interaction is not only applied directly face-to-face that is normally occur between teacher and students in classroom; rather the interaction appear between a teacher and students is mediated through technology in the online setting. Previous research has identified that there is still lack of empirical research that how one should arrange online interactions content to improve meaningful learning during online interaction. Therefore, the purpose of this meta-analysis is to investigate the types of interactions that occur in online learning together with its importance in an

online setting. As the conclusion, results from the previous research show that, interaction plays an important role by engaging students actively in online learning.

Keywords: Interaction, learning environments, online learning

Mathematical Competencies among Postgraduate Students

Nur Athirah Aziz, Yudariah Mohammad Yusof and Zaleha Binti Ismail

Abstract: In university, students are provided with knowledge and the university is also alert of students with higher intelligence quotient that will enable them to succeed. However, the students still do not reach competence in what has been taught. Everyone or every student can have skills in mathematics but it is rare to meet those who are highly competent in mathematics. Thus, this study was conducted to identify the MC among postgraduate students in faculty of education. By using qualitative method, a total of 12 postgraduates' students were chosen as respondents for this study. This research was done using set questions of mathematical competency (MC) which they need to solve the questions in a group. Analysis data was made based on written solution and observation during the discussion. Based on the findings revealed that, most of the respondents apply competency in their written solution is using aids and tools with formulating situations mathematically (UATF). It is also the highest frequency of MC which is 15. In a conclusion, respondents did not use fully of MC in their solution.

Keywords: Mathematical competencies

Predicting Students' Performance Based on Instructors' Pattern of Metacognitive Scaffolding

Nurul Farhana Jumaat and Zaidatun Tasir

Abstract: Metacognitive scaffolding is a strategy provided by an online instructor to assist students to develop their own understanding and improve their achievements in learning. To date, studies have focused on the effect of metacognitive scaffolding on students' performance. However, researches that focus on the understanding of the pattern of metacognitive scaffolding and its effect on students' learning success are still lacking. The purpose of this study is to predict students' performance based on the instructors' pattern of metacognitive scaffolding through data mining: a decision tree analysis. This study used a pre-experimental, post-test only research design. One online instructor and 37 postgraduate's students from the Educational Technology program participated in the study. The data were mined based on the frequency of metacognitive scaffolding posted by the instructor in Facebook group discussion and also students' scores in the performance test. The decision tree analysis predicts that students who achieved grade A in their study were prone to receive a combination of guidance that focused on the process of learning (MS4), the assistance from the instructor presenting the rationale for tasks and activities (MS1), the guidance from the instructor who encourage the relationship among participants (MS5) and supervised text comprehension (MS7) by the instructor such as giving response and feedbacks towards students' comments. Thus, the results serve as a guideline for online instructors to prompt these dominant mechanisms of metacognitive scaffolding in order to increase students' performance in learning.

Keywords: educational data mining, decision tree analysis, metacognitive scaffolding, pattern discovery

Impact of Affirmative Action in Engineering Education: Case Study of an Affiliated Private Engineering College in India

Suhasini Desai

Abstract: This paper reports findings of a research on actual impact of Affirmative Action in Engineering Education with specific reference to a private engineering college affiliated to a university in state of Maharashtra, India. Data on one batch admitted in 2011 and graduated in 2015 is considered. Method of stratified sampling is devised. Research questions are framed so as to quantitatively explore any correlation between gender, location, caste status, academic performance and recruitment status after graduation of the students in the population under study. Findings are revelatory from AA policy point of view and in some places counterintuitive as well. Results are discussed with reference to social dynamics in India. Directions for future research in this crucial area are provided.

Keywords: Affirmative Action (AA), Engineering Education (EE), India, Reservation Policy

Decision Support System for Awarding Shcolarship Using SAW and TOPSIS

Ni Gusti Ayu Putu Harry Saptarini and Putu Indah Ciptayani

Abstract: Scholarship is a program to assist students in continuing their education. This study presented a decision support system (DSS) to recommend scholarship recipient using SAW and TOPSIS method. The data used in this study was taken from Bali State Polytechnic (BSP). Scholarship recipient selection is a multi criteria decision making that can be complex and need much time. The aimed of this study is to compare the SAW and TOPSIS method for scholarship recipient selection based on execution time and the score resulted for each applicant. This study used fuzzy criteria for TOPSIS. The time execution for SAW is about 1.71 ms and 6.75 ms for TOPSIS method. The time difference of both method was not too high. The final score resulted by both method was different. There were five differences over ten sample data. The final score resulted by TOPSIS was same for some applicants, but for SAW, the score was different for each applicant. Based on decision maker opinion, they preferred use SAW method instead of TOPSIS.

Keywords: decision support system, DSS, SAW, scholarship, TOPSIS

Effectiveness of Using BizApss in Enhancing Students' Achievement with Different Learning Styles

Noor Dayana Abd Halim, Amir Jusoh, Mahani Mokhtar and Abdul Halim Abdullah

Abstract: Effective teaching and learning environment can be created if teachers are able to identify students' learning styles since learning styles can differ from one student to another. Learners are supposed to have an authority to control their own learning, therefore it is important to ensure that they engage and be responsible for their learning. In order to ensure that students are fully engaged in their own learning, the differences between each learner must be taken into consideration in designing each teaching and learning session. For this purpose, the aim of this study was to design and develop a learning software named as BizApss which integrated VAK (visual, auditory, kinesthetic) 1989 learning styles model. In addition the study also investigated the effects of BizApss towards students' achievement. This software was developed according to the step by step process in ISD model by Hannafin and Peck (1988). Besides, BizApss was developed based on an entrepreneurship subject and the software covers three subtopics which are target market, market shared and marketing strategy. The development of one subtopic was based on one learning style either visual, auditory or kinesthetic. The samples of this study were 30 students who enrolled in the entrepreneurship subject from MARA Professional College and they were selected randomly. During the learning process, students with different learning styles used the same software. After learning each subtopic using the software, students were given a set of test in order to investigate the effectiveness of BizApss towards the students' achievement. The results were analyzed using Kruskal Wallis test after the normality test was run. The findings indicated that students' achievement improved after using BizApss. Furthermore, a comparison between the students' achievement and their learning styles was also being analyzed. The result showed that there were differences in the mean rank for the BizApps developed between the three types of students. In conclusion, the students were dominant towards the design which matched their learning styles either visual, auditory or kinesthetic. For visual learners, the result revealed that students can understand easily when they saw pictures and explanations at the same time. This finding is aligned with the study conducted by [1] which found that the use of images and visual teaching aid helps students stored the knowledge in long term memory. [2] also noted that delivery of knowledge using pictures and diagrams gives a lot of advantages to students. Similarly, auditory students are dominant towards the BizApss which was developed based on their learning style. [3] stated that auditory learners will focus and listen to teachers explanation at first and then will conduct activities based on their understanding. In addition the result on kinesthetic learners revealed that students were interested with the designed of BizApss since they enjoyed the interaction provided in the software. It is because, the interaction in BizApps provided the opportunity for them to be involved actively when they learned using the software. This statement was supported by [4], since they highlighted that students with kinesthetic learning styles were inclined towards participating actively in the teaching and learning processes. As conclusion, this study has implications on developers of multimedia courseware, particularly instructional designers. [5] emphasized the importance of designing learning materials with different perspectives to match various learners' characteristics and preferences. Therefore, instructional designers must take the findings of this research into consideration when designing, developing and delivering multimedia in order to enrich students' achievement and motivation towards the subject matter through individualized instruction.

Keywords: Learning style; Visual; Auditory; Kinesthetic

Video Learning Practices Enhancing Students Critical Thinking Skills

Nurul 'Izzati Hamizan, Norasykin Zaid and Norah Md Noor

Abstract: The Pre-Post-test for quasi-experimental research has conducted on effectiveness of the learning video in influencing students' achievement level, critical thinking level, and the suggestions learning practices of learning video for undergraduate students. In this research, 47 undergraduate students were selected using purposive sampling and distributed into two groups which are control group (24 students) and treatment group (23 students). The research instruments such as pre test, post test, questionnaire and interview were used for data collection. Data have analyzed by paired-samples t-test using ANOVA on the achievement of the students after given the treatment. In addition, the researcher used qualitative quantitative analysis and content analysis method to triangulate the results from the experiment, in order to obtain the elements of critical thinking used

in assessment answer sheet. The findings shown there was increasing of the achievement's level for both control and treatment group. With compared to control group, the treatment group has slightly increase in mean difference of pre-post test (6.72 point) and displayed the highest maximum marks (91 marks). Thus, educators can embed the critical thinking's elements in class activities which required undergraduate students to actively participate in the class.

Keywords: A maximum of five keywords in alphabetical order and separated by commas

A Design Framework of Teachers' Professional Development in Indonesia

Anton Subarno, Mei-Ying Chien and Wen-Fu Pan

Abstract: The role of teachers in the 21st century is changing dramatically. Today, there are so many sources for doing self-learning, such as the information browsed from YouTube, Wikipedia, Blogs, social networking websites etcetera. Teachers should be capable of handling all the different resources for helping students to learn. Teachers' professional development is a sustainable program to update knowledge, skills, and other capabilities to improve teachers' performance. A practical solution to update the teachers' capability is the professional development in electronic learning (e-learning). This paper is aimed to explore the benefit of e-learning to support teachers' teaching, and further to analyse a framework for teachers' professional development in e-learning. The literature review will be used to explore the definition of e-learning and in-service teacher training in New Zealand and China. The review of teachers' professional development in New Zealand suggests four items; namely, categories, elements, principles, and stages. The practice of teachers' training in China provides how the professional development program can be organized. It is found that a framework of teachers' professional development in e-learning shall focus on five aspects, including: stages, levels, categories, principles, and time-scheduling. "Stages" refer to the identification of teachers' problems or needs; teachers will engage in the training activities if they find them useful. "Levels" refer to the professional development identified and applied in different unit levels, including individual, department, and organization. "Categorization" refers to the appropriate training program, such as the category of tool use is helpful for teachers to update the skills of operating new tools for teaching. "Principles" refer to the guidance given to the training process, such as being learner-centered, good-practicing, collaborative, innovative, affordable and sustainable. "Time-scheduling" refers to the conception, application, and evaluation sessions; each session should have enough time to learn the materials and practice the theory as well as evaluate the implementation. The above framework is given mainly based on the review of in-service teacher training in New Zealand and China. New Zealand has joined the massive open online course (MOOC) consortia of Australia and the United Kingdom, and China has presented a good quality of distance education programs in Asia. Based on the literature review and analysis, it can be summarized that e-learning is a learning process by using digital devices to achieve the learning objectives or improve the organization's performance. E-learning can be defined as a tool and a process for learning. E-learning "as a tool" means electronically mediated asynchronous and synchronous communication for the purpose of construction and confirming knowledge that emphasizes as media of communication between teachers and students. E-learning "as a process for learning" means an opportunity for individuals or organizations to use applications, programs, objects, website, etcetera in the learning process. This paper suggests that a design framework of teacher's professional development can follow the five aspects, including stages, levels, categories, principles, and time-scheduling. The five aspects should be done in chronological order. Teachers' professional development in e-learning can be started based on the result of an analysis of their needs in teaching; teachers in Indonesia are encouraged to participate in a community of teachers' professional development, such as teachers' working groups, subject-matter teachers' forum, and training and workshop for special purposes.

Keywords: e-learning; teachers' professional development; in-service program

Developing Critical Thinking Skill through the Use of Collaborative Asynchronous Online Discussion Based on Spod Model

Mohd Fadzli Ali, Nurul Nadwa Zulkifli, Lokman Mohd Tahir and Mohd Nihra Haruzuan Mohd Said

Abstract: Lack of critical thinking skills can be identified by the graduate's inability to perform tasks, especially those of problem solving. One significant report was a nationwide study by Radin Umar (2009) from the Higher Education Department, who used the Malaysia soft skills scale (My3S) to gauge the employability skills proficiency among graduates. Unfortunately, the findings revealed that the students were generally weak in critical thinking. Consequently, graduates who lacked this skill were unemployed (Fairuzza, et. al., 2011 & Nik Hairi, et al., 2012). However, instead of blaming unemployed graduates, the learning institutions with e-learning technology were urged to play a significant role. Based on the Socratic Productive Online Discussion (SPOD) model, this study encouraged the use of Socratic questions to encourage critical thinking when students look deeper into the assumptions, viewpoints, perspectives and evidence in analysing the assumptions (Walker, 2005). This study adopts a mixed-method case study approach. The quantitative data from Watkins and Corry's (2005) questionnaires measures the students' e-learning readiness and their usage of online forum discussions. The qualitative data derived from the transcripts of the students' online discussions were analysed in two stages using (1), the Socratic Question Prompts and (2), a content analysis approach of the Interaction Analysis Model by Gunawardena et. al. (1997). The findings showed that students' critical thinking skills can be built from collaborative learning through online forums. The outcome could be used to propose the best practice

for lecturers at higher learning institutions to promote students to think critically through collaborative asynchronous online discussion.

Keywords: critical thinking; online discussions; Socratic question prompts; employability

Reinforcing Teacher's Role in Retaining Students' Interests Discussing Online in their Learning Process at Malaysian Tertiary Institution

Mohd Fadzli Ali, Noorshazeriza Hishamuddin, Lokman Mohd Tahir and Mohd Nihra Haruzuan Mohd Said

Abstract: In 2006, the Ministry has published an official report on the recommendations concerning the development and direction of higher education in Malaysia (Ministry of Higher Education, 2006). The report became part of the Malaysia national education policy. The Ministry has directed all tertiary institutions including public and private universities to integrate the use of online learning with classroom learning, emphasise the role of the teacher as facilitator, and promote learning as an on-going process throughout life. The e-learning policy became ambitious in 2010 when the government's higher educational development programme called the Economic Transformation Plan (ETP) extended the use of elearning to distance education. In 2011, the Ministry launched the Malaysia Education Online (MEdO), an online learning platform delivering education programmes from Malaysian universities, colleges, polytechnics and training institutes. Many studies from the literature related to asynchronous online discussions among tertiary students provide various advantages such as allowing students' flexibility to provide feedback (Wonziak and Silveira, 2004), enabling knowledge construction (Noroozi, et. al., 2013), encouraging critical thinking (Meyer, 2003), and interacting with the lecturers regardless of time and space (Ally, 2004). Likewise in the Malaysian context, research related to online discussions has demonstrated increased confidence in students' learning. Although the findings showed positive responses, there are studies (Yusniza et al., 2011; Alias, 2012; Noriah et al., 2012; Maslawati & Shahizan, 2014) saying otherwise due to teachers' weaknesses in keeping students' interests and motivation in regards to online discussions in their learning process. Based on Ames' (1992) teaching strategies and Keller's (1987) ARCS model, a systematic guide was developed for teachers to properly help students use online discussions when completing their assignments. With reference to this systematic guidance, a qualitative case study on how to retain the students' motivation to use online discussions was conducted. The respondents were final year students working in small groups. Each respondent was made compulsory to answer a checklist based on the items from Khan (2008) that was used to gauge their background skills in using online forum. The research instruments used were online discussions and interviews. The transcripts from the online discussions were analysed using a coding scheme developed from the systematic guide (developed from Ames' (1992) teaching strategies and Keller's (1987) ARCS model) while the data from the interviews with the group leaders was used to support the findings derived from the transcript analysis. The findings revealed that the teaching strategies used in this study were able to retain the students' interest and motivation to continue using online discussions to complete their assignments.

Keywords: asynchronous online discussions, ARCS model, students' motivation

Implementation of Group endeavours in Service Learning among Teachers in Singapore

Fatimah Zahra Abdul Mutalib, Mahani Mokhtar, Noor Dayana Abd Halim, Dayana Farzeeha Ali and Abdul Rahim Hamdan

Abstract: The current unstable social, political and economic climate of the world brings a wave of issues that can have adverse impacts on Singapore's national development. Since the society is implicated in these issues, their voice must be taken into account when generating solutions. They are the ones who face the reality at the grassroots level and so, they are in a much better position to provide ideas for the solutions. This is the 'whole-society' approach in tackling societal issues. The main ingredient for this approach is strong community engagement as it enables the society to generate bottom-up solutions for the resolving of complex challenges. However, the recent National Youth Council's Survey 2014 revealed that the youths in Singapore are lacking in community engagement. Hence, education institutions should play a more active role in instilling the significance of community engagement among the youths. Interested education practitioners in Singapore can indeed look upon the vast research of service-learning done in other countries and institutions to elicit the benefits and best practices for the implementation of service-learning in Singapore. However, the contexts of these countries and institutions are different: what works for them may not work for the service-learning in the Singapore context. This research was thus conducted to provide a more contextualised understanding of service-learning carried out in Singapore. This research was a case study of how Group Endeavours in Service-Learning (GESL) project was implemented as part of the Postgraduate Diploma in Education (PGDE) program at the National Institute of Education (NIE). This research was guided by Kolb's experiential learning theory which explains theoretically the process of how experiences can be transformed into knowledge for future action. This research explored the experiences and challenges faced by teachers when conducting GESL and developed a profile of the implementation of GESL. Data collection was conducted using semi-structured interviews conducted with six teachers, and documents related to GESL. Thematic analysis was used to analyse the data. The findings of this research revealed the major procedures of the GESL implementation were as such: group formation, mass lecture briefings, weekly GESL meetings, reflection, sharing on Service-Learning Day as well as assessment. In terms of experiences, the teachers felt ambivalent towards the overall GESL experience but they agreed that GESL pushed them out of their comfort zone and facilitated the transfer of

learning to their daily duties as teachers. A number of challenges were also highlighted: supervisor's frequent absence, the intensity of the PGDE program and ensuring continuity of the GESL project. This research concluded that while the teachers reaped many benefits of active engagement with the community, their experiences were also affected by the way GESL is implemented and the challenges that arose throughout the whole GESL program. This case study research provides stakeholders in the higher education sector an overall understanding of how service-learning brings the youth closer to the community. This understanding is hoped to facilitate advocacy for more service-learning programs to be conducted on a wider scale to give more youths the opportunities to be active members of the society.

Keywords: Service-learning, community engagement, youths, teacher education, Singapore

Abstract

Innovative Practice Sharing in Engineering Education

Outcomes Assessment and Analysis using iOBE

Zulfaa Mohamed-Kassim and Noorfazreena Kamaruddin

Abstract: One challenging aspect of the outcome-based accreditation process for engineering programs in Malaysia is in its demand for detailed program assessment to measure the attainments of students' learning outcomes from multiple perspectives. The main issues are: integrating assessment data across multiple levels and communicating outcomes data effectively. This contribution presents iOBE, a software-based solution to address this need. The package consists of two software modules: iOBE Calculator and iOBE Aggregator, for use at the course and program level, respectively. It is designed for robustness in its computational framework, flexibility in managing data, and simplicity at the users' end. A case study of actual courses offered at the authors' institution were done to illustrate the use of the software to assess multiple courses. Two matrices were defined for each course to map how assessment components in the courses addressed the course-level and program-level learning outcomes. Key outputs of the software are: emphases and attainments of outcomes for selected groups of students, populations of students attaining specific outcomes levels, and gaps in students' performance. The software offers a number of advantages. First, its multi-parameter results offer analysis from various perspectives to assess performance at multiple levels. Second, aggregated data on the attainment of outcomes can assist course instructors and program administrators in recommending directions for improvements. In the case study, the disparity found in the results for a similar cohort of students highlights the need to review the teaching, learning, and assessment practices among these courses. Third, the ease and flexibility in operating the software improves the efficiency of assessing outcomes at the course and program levels, thus reducing unnecessary loads for engineering educators in implementing OBE.

Keywords: Outcome-based education, assessment of program outcomes, and integrated assessment system.

Open-Ended Malik & Naveed Interventions (OMNI) Techniques for Engineering Freshmen

Qaiser Malik and Naveed Zafar

Abstract: The present technology infested environment has made the knowledge access an exceedingly simple affair. The emerging scenario encourages students to make sense of this open knowledge through self-learning. The issue becomes more challenging for developing countries where English is not the mother tongue yet it is used as the educational language. In this context a need was felt to develop ready-to-use self-intervention techniques to facilitate active learning and to overcome the language barriers. These techniques guide learners' thinking in a multiple structured manner making use of different perspectives e.g., linguistics, visual clues, anchoring, grafting, interfacing, integrating, formatting. The idea is for the student to be able to understand things and shed away the old habit of rote learning. In essence OMNI techniques are a set of tools for: 1) developing scientific and inquisitive mindset; 2) developing culturally relevant mind-operating-system; 3) restoring self-image, self-confidence, and self-esteem of the learner who has been through the primary/secondary education system infested with innumerable setbacks; 4) making use of the vast bank of prior tacit knowledge acquired through social interaction; and, 5) seamlessly integrating student's IQ with EQ. It is believed that a one-time thorough session of OMNI techniques shall enable the student to transform into active learner forever. These mutually exclusive techniques were primarily designed for engineering freshmen yet are considered equally applicable to any domain. OMNI techniques complement each other when applied in unison. The techniques have been found to be impacting the learners in a Major Engineering University (MEU) in Pakistan. The OMNI techniques were piloted in fall 2013 in a newly designed Engineering Foundation Course and are now being implemented successfully in the UG curriculum for freshmen for the last two years.

Keywords: Academic interventions, active learning, prior knowledge, structured thinking, rote learning

MOOCs in Engineering Education - a literature review

Azhar Rauf, Mohd Fadzil Daud and Mohd Nihra Haruzuan Bin Mohamad Said

Abstract: MOOCs are the love 'em/hate 'em turbulence of higher education. This recent and disruptive innovation, an evolutionary cousin of distance learning and open educational resources, promises to stir up some dust and ruffle some feathers in the arena of higher education, engineering education in particular. The evolution of MOOCs continues with its transition from cMOOCs to xMOOCs, sMOOCs, mMOOCs and even SPOCs. The intent of this literature survey is to snapshot the state of the knowledge, the global trends and opinions of the stakeholders in MOOCs vis-à-vis engineering education. This survey covers multiple facets starting from how the future of engineering education and ABET outcomes can benefit from the

new fad with MOOCs as well as some of the educational theories behind this innovation. It scans the challenges in producing and converting engineering courses (especially upper level engineering courses) to MOOCs. Various proposed models for incorporating MOOCs in engineering higher engineering institutions worldwide are discussed. Finally, the reported student satisfaction with MOOCs shows the efficacy of this innovation.

Keywords: Engineering Education, Literature Review, Massive Open Online Course, MOOC

An Innovative Approach to Develop Global Engineers by Supporting the Students via Diversity in Engineering Education

Rutika Ghariya, Kalp Bhatt, Tosha Shukla and Juned Shaikh

Abstract: The paper depicts about the student support activities which aims to nurture engineering education and entrepreneurial culture among the students at Gujarat Technological University. This paper also presents the pedagogical inputs and interventions, which have created the right environment for student support activities at University. These activities fill a gap between quality of the teaching process and the learning outcomes and are implemented as a part of student support system. The Student Support Program is unique in terms of its aim, structure and modes of function. The university community is supposed to welcome every new idea and rigorously evaluate its truth by using all the available tools.

Keywords: Community Innovation & Co-Creation Centre (CiC3), Flash Venture, GTU Innovation Council, Open School of Design, Student Start up Support System.

Importance of Oral Communication Strategies to Engineering Students

Hairuzila Idrus

Abstract: The professional skills area most widely discussed in research and the engineering profession is the need for improved communicative competence in engineering graduates. Graduate engineers are expected to possess adequate engineering knowledge and technical expertise. In addition, they are also expected to be able to articulate well through oral presentation. Oral presentation skills is an asset for engineers. An engineer with good oral presentation skills has a better chance in career advancement and promotion rather than one who does not. Thus, it is vital for engineering students to have exposure to oral communication strategies for them to become good presenters. The purpose of this study is to identify the communication strategies used by engineering students while delivering oral presentations in an oral communication skills course. Presenting to an audience may generate anxiety and concern that the presentation might not be delivered effectively. Good presenters have found ways to overcome or cope with this concern. Thus, the Oral Communication Strategies Inventory (OCSI) was used to access strategies that the students used for coping while delivering their oral presentations. The OCS inventory included eight categories of strategies for coping while speaking and seven categories of strategies for coping while listening. However, for the purpose of this paper, only speaking strategies was analyzed. The respondents were 100 engineering students enrolled in a Communication Skills course. Results of the data analysis revealed that the good presenters employed more Oral Communication Strategies than the average presenters. The better students had more frequently used social-affective, fluency-oriented, and non-verbal strategies for coping with speaking problems. The average students, on the other hand, do utilize the social affective and non-verbal strategies but on a much lesser degree. Regression analysis was used to explain the relationship between communication strategies used by the students and the grades they obtained. The strategies used were mapped against the grades they obtained for the course to gauge the strategies used by students who scored A (good presenters) versus those who scored B (average presenters). The findings suggest that average presenters should be made aware of the mentioned skills and be accustomed to them in order to enhance their oral presentation skills. As such, introducing oral communication strategies to engineering students could help them improve their oral presentation delivery, especially the ones employed by good presenters.

Keywords: Oral Communication Strategies, Engineering students, Oral Communication Skills

A Response to the Twenty-First Century Challenges to Philippine Engineering Education: Innovative and Revitalized Graduate Programs Engineering Education

Manuel Belino

Abstract: Higher education institutions in the Philippines face several challenges in preparing the engineering education for competition in the global arena. These challenges include a shift from input-based to outcomes-based system of education, impact of the implementation of K to 12 basic education on engineering programs and institutions, membership in international alliances for accreditation and global practice of engineering like the Washington Accord, internationalization of education, and compliance with the Philippine Quality Framework. Although these challenges are overwhelming to our institutions and to us, engineering educators, a focus on our successes and achievements while confronting them is uplifting. In partnership with the

Philippine Association of Engineering Schools (PAES), the Technical Panel for Engineering and Technology (TPET) of the Commission on Higher Education (CHED) is taking the lead in outcomes-based education. As early as the current school year, TPET is assessing the impact of the implementation of the K to 12 basic education to engineering programs and the various technical committees are reviewing and revising their respective curriculum. Definitely, the grant of provisional signatory status to the Philippines by the Washington Accord is a boost to engineering education. By designing a master's and doctoral program in engineering education, CHED is attuned with the recent developments in engineering education in the international scene such as: the granting of academic degrees from bachelor's to doctoral level in engineering education; the publication of engineering education journals in specific fields of engineering; and, the resurgence of interest and efforts to make engineering education a scholarly field of research.

Keywords: Outcomes-based education, engineering education, program outcomes, competency standards

Using an Analytic Hierarchy Process to Develop Innovation DNA for Industry-Oriented Applications in Mechanical Design of Vocational College Students

Dyi-Cheng Chen and Ci-Syong You

Abstract: While Industry-oriented applications have been extensively investigated, the mechanical design innovation for vocational college students is unexplored. First, this study collects the status of mechanical design in various countries, the scope of technical knowledge of mechanical design and the relevant literature on Innovation DNA performance. Innovation DNA has used in the generation of novel ideas for new ventures. The four behaviors were questioning, observing, experimenting, and idea networking. The two cognitive patterns were associational thinking (or pattern recognition) and a desire to change the status quo. In addition, this study involves a quantitative and qualitative content analysis of relevant documents, textbooks and educational objectives of mechanical design performance innovation, which includes questioning, observing, experimenting and idea networking, industry-oriented applications in four hierarchies and 20 indexes. Second, this study assesses these criteria by employing the analytic hierarchy process (AHP) technique to solicit opinions from 11 experts by using questionnaires. Results show that questioning, observing and experimenting, idea networking have weights of 25.1%, 21%, 26%, 27.9%, respectively.

Keywords: Industry-oriented applications, Innovation DNA, Analytic hierarchy process (AHP)

Civil Engineering Exit Test

Yusof Ahmad, Shahrin Mohammad, Mohd Nur Asmawisham Alel, Azman Kassim, Mohd Hanim Osman, Yeong Huei Lee, Sariffuddin Saad, Baderul Hisham Ahmad, Che Ros Ismail, Mohd Yunus Ishak, Norhidayah Abdul Hassan, Cher Siang Tan

Abstract: Fundamental knowledges are very important to all engineers. It should be at their fingertips because they need to solve a lot of problems daily at site. Sometimes the solution is needed in a very short period and thus urgent decision from engineer should be made. However, feedback from industry claims that the students are weak in fundamental knowledge. Civil Engineering Exit Test (CEET) is an innovative assessment method to evaluate the students' attainment of cognitive domain in fundamental of core courses to all final year students at undergraduate level. CEET is a form of summative measurement of students' attainment of learning outcomes. CEET can be used to standardize and upgrading the level of basic engineering knowledge of all new engineers. There are 19 courses covered in CEET; mostly they are very general and some with little calculations. All questions were prepared and checked by competent academic staff to ensure its quality. The relevancy of the questions was vetted by stakeholders represented by practicing professional engineers from industries. All students should pass all the POs addressed in this test. The test results revealed that all students in each session has passed in which more than 75% of students graduating in the first round and the rest passed after the second or third round. The achievement of each PO measured results demonstrate very good performance index which is positioned as good or excellent. This also reflects the effectiveness of the syllabus and curriculum of the Civil Engineering Program. Thus, CEET can be used as a tool for assessing the basic knowledge in civil engineering. The test can be suggested to Institute of Engineers Malaysia (IEM) to become preliminary assessment before the candidates sit the examination for Professional Engineer (P.Eng). In future, this test will be conducted using online system.

Keyword: Exit Test, Program Outcomes, Fundamentals of Engineering

Engineering Education at Kanazawa Institute of Technology: To Foster Engineers Who can Make Ethically and Professionally Appropriate Decisions

Fumihiko Tochinai and Hidekazu Kanemitsu

Abstract: The authors have been in charge of engineering ethics education at Kanazawa Institute of Technology, one of the largest technical private universities in Japan, whose practices have received high reputations. Rooted in one of its Founding Principles, the Institute has put emphasis on engineering ethics education. 'Ethics across the curriculum' is introduced its "Design Project" education with the aid of an E-learning system "Agora." The authors have conducted researches on important values in engineering from the point of view of globalization. Their educational and research practices in engineering ethics education will be discussed in this paper.

Keywords: Kanazawa Institute of Technology, Ethics across the Curriculum, Engineering Ethics Education, E-Learning

Lessons in the Implementation of Continuous Quality Improvement in the Civil Engineering Program of De La Salle University

Mario De Leon, Lessandro Estelito Garciano and Andres Winston Oreta

Abstract: This paper describes the process and lessons learned in the implementation of the OBQA model adopted by the Gokongwei College of Engineering, De La Salle University (GCOE DLSU) designed for program level assessment. The structure of OBQA in DLSU adheres to CHED Memorandum Order (CMO), No. 46, series 2012, on the Policy-Standard to Enhance Quality Assurance (QA) in Philippine Higher Education through an Outcomes-Based and Typology Based QA. Specifically at DLSU GCOE Civil Engineering department, the pilot academic year for OBQA process started in 2nd term 2014-2015 and ended in 1st term 2015-2016. This period constitutes one cycle of the civil engineering program assessment that evaluated a total of 68 courses (21 courses during the 1st term, 22 in the 2nd term and 25 in the 3rd term). The OBQA process followed and observed various steps, to wit; (1) formulation of program educational objectives, (2) definition of student outcomes and performance indicators, (3) curriculum mapping, (4) syllabus design, (5) outcomes-based assessment and (6) continuous improvement of the courses. In order to facilitate data gathering required for further analysis, an OBQA monitoring instrument was adopted to provide an inventory and listing of student outcomes and performance indicators, assessed courses, faculty, OBQA syllabus, assessment level, tasks, target, performance and evidences which are structured in three phases, namely; Phase 1 (Course delivery), Phase 2 (Assessment) and Phase 3 (Improvement). Data and evidences obtained from various courses and specific assessment methods used are qualitatively and quantitatively described and analyzed. Appropriate actions and recommendations were then identified to realize the continuous quality improvement (CQI) of the civil engineering program. These recommendations are designed to be implemented in the next cycle (2016-2017) of the OBQA process geared towards upholding the delivery of quality education in the university.

Keywords: outcomes-based quality assurance, continuous improvement, student outcomes

Enhancing the Employability of Engineering Graduates by Developing and Empowering the Faculties

Prafulla Hatte and Yogesh Bhalerao

Abstract: Engineering education is becoming more dynamic, global and the paradigm is shifting from teaching to learning. Industry is demanding employability skills, values and soft skills from the graduates, whereas degree programs are addressing learning outcomes and contextual knowledge. Indian economy largely depends on growth of quality education in engineering. With the present industrial scenario, the exponential advancement in technology, knowledge, automation, computational capabilities and communication options, the industry is facing a very tough competition. The graduate engineering attributes like motivation, leadership, communications skills, deep learning, and team work can be enhanced for each successive batch by empowering and developing faculty teams. It is many times very challenging to develop all the skills of the engineering graduates during or after academic program, so as to develop them as employable engineers. But it is possible to adopt the approach of faculty development and empowerment, so that the required skillsets can be transferred to the students by these empowered faculties during the regular academics. With the continual growth in the curriculum contents and the least possible separate time available for skill development, it becomes essential to imbibe the skills indirectly during the regular course delivery in learning sessions. A study is done for finding the major challenges in teaching learning, students' learning styles, type of learners and the need of training to be provided to faculties. A batch of faculties was trained for various skills like enhanced teaching learning skills, active learning, cooperative learning, Problem Based Learning (PBL), presentation skills, planning the sessions and assessment tools. The outcome of the use of enhanced pedagogical techniques and skill based learning environment was observed over a period of two years. Results show considerable rise in various skills of the students like better attention, enhanced results, confidence building. This has ultimately resulted in rise in placement of the students.

Keywords: Active Learning, Employability of Engineering Graduates, Empowering the Faculties, Innovations in Teaching-Learning

Enhancing High Order Thinking Skills (HOTS) and Improving Teamwork Skills among Chemical Engineering Students through the Development of Board Game Activity via Cooperative Learning

Mohammad Tazli Azizan, Hairuzila Idrus, Nurhayati Mellon, Suzana Yusup, Raihan Mahirah Ramli, Haslinda Zabiri and Dzulkarnain Zaini

Abstract: In order to produce a holistic and balanced well-rounded student, one of the teaching strategies that can be adopted for the engineering students is cooperative learning. This study aims to enhance high order thinking skills (HOTS) and improve teamwork skills among the third year chemical engineering students using cooperative learning strategy. Complex instruction method is adopted by instructing the students to develop a board game and embed technical based questions, which are related to kinetic and reactor design subject (KRD) and other two courses, as part of the integrated project. The reflections from the students suggested that though they enjoyed the activity, it was a challenging and complex task, which in turn provoked their thoughts and also made them acquired teamwork skills.

Keywords: Cooperative Learning, Board Game, High Order Thinking Skills, Teamwork Skills

Laboratory Practices for Formative Assessment in Undergraduate Microwave Engineering Education

Kok Yeow You

Abstract: Microwave Engineering (ME) is a technology-based course. Students can easily score high assessments in this course, because more of the engineering students are interested in this kind of application-oriented course. Normally, the achievement of students in this course is evaluated based on their summative assessment. Hence, the score of evaluation which obtained by the students in this course oftentimes does not match with the actual quality of the students, especially regarding their practical skill. In this paper, several simple practical assignments were proposed for undergraduate students to complete their assessment in ME course.

Keywords: Microwave engineering, practice works, formative assessment

The Impact of Feedback Phase to the Development of ICT Product: Case Study Software Project Course

Harry B. Santoso, Fauzan H. Sudaryanto and Wade Goodridge

Abstract: Software Project (in Indonesian: "Proyek Perangkat Lunak") is the title of a course at the Faculty of Computer Science Universitas Indonesia focused on teaching students to make an information and communication (ICT) product in a team. In order to complete the course, the participants are required to engage in a complete software development cycle. The course also incorporates a feedback mechanism for real customers that set the requirements needed for further development. According to the literature, feedback provided by targeted users has influenced many industrial products and developers can use such feedback to create products based on the users' actual need. This study investigates the effectiveness of this feedback process as a mechanism to determine its continued application in the project through future terms. The study focuses on an analysis of methods used by class' participants to gather the feedback as well as determining any factors impacting the feedback process. The research team followed five steps to conduct the study. Findings presented include discussions on the feedback mechanism; the influences of feedback request; and the main difficulties experienced by the participants. One hundred and fifty-six students participated in the study. The students were grouped into 31 teams. Quantitative and qualitative data was gathered from four different sources: (1) syllabus; (2) team questionnaire; (3) individual questionnaire; and (4) feedback forms. Within a single semester, the students were asked to develop a product by following the phases designed by a team of lecturers.

Keywords: Feedback, innovation, software development project, product

Multimedia Instruction Applications for Engineering Education

Ataollah Zarei, Khairiyah Mohd-Yusof and Mohd Fadzil bin Daud

Abstract: Effective use of educational technology depends on knowledge of why and how to utilize technology to solve teaching and learning problems. The present study conducts a systematic literature review of the limited studies undertaken on multimedia instruction applications for engineering education to critique the current status of knowledge in this area. The conventional qualitative content analysis method was employed for data analysis. The results highlighted multimedia instruction enhances engineering students' understanding of engineering concepts, procedures, problems and solutions through direct visualization. Furthermore, it can indirectly assist students in achieving higher order learning levels and skills through enhancing or supporting educational resources and increasing students' motivation. Mobile multimedia instruction and a student-generated multimedia learning approach to improve engineering education are suggested for future research.

Keywords: Educational technology; Engineering education; Multimedia instruction; Teaching and learning problems; Systematic literature review

Enhancing Sustainability Knowledge using Problem among Engineering Students

Azmahani Aziz, Khairiyah Mohd-Yusof and Amirmudin Udin

Abstract: Sustainability issue is a concept that is not new but not easy and complex to define. Therefore, quality teaching is the most effective lever to transform education and delivered important outcomes for students. This paper seeks to investigate the design of sustainability problems used on student's knowledge among first year engineering students at a public university in Malaysia. A qualitative study was employed in order to answer the research objective. The problem is set in a real world setting to integrate the three pillars of sustainable development. It consists of three stages with gradually increase in difficulty. The four domains of knowledge (declarative, procedural, effectiveness and social) that could influence ecological behavior were used to analyze the problem. Cooperative Problem-Based Learning (CPBL) was implemented as the student-centered learning environment. The result shows that the convergence of the four domains of knowledge in the problem and supports with CPBL learning environment have changed students' perception associated with sustainability on knowledge. It has proven that effective use of problem related to sustainability issues in CPBL learning environment could enhance cognitive and affective domains of sustainability outcomes.

Keywords: Sustainability Knowledge, Student-centered learning, Problem-Based Learning

From Classroom to Commercialisation of Interactive Pressure Vessel Design, iPVD

Nur Syafiqah Kamarudin

Abstract: Pressure vessel is the most crucial part in the plant, use to hold up the fluids at a pressure different from the ambient pressure which is 15 psi. Student of chemical engineering program study the designing of the pressure vessel safely by referring to the American Society of Mechanical Engineers Code, ASME code. Three part of the pressure vessel is contains the top head, bottom head and vessel shell in various type of shapes. From the theoretical learning program in the class this service of design pressure vessel can be commercialize to the market by introduce the interactive and simplified tool of effective pressure vessel, iPVD. This interactive short cut method based on ASME code have the effective and accurate result in designing pressure vessel in short time compare to the manual calculation. The result has been validated by the Asturi Metal Sdn Bhd pressure vessel engineers support this interactive make this software strongly functioning. Students of Department Chemical Engineering and Process, UKM satisfied the interactive pressure vessel by surf the url during testing period is <http://www.ipvd.my/ukm> and prefer to choose use this approach in learning and teaching process.

Keywords: Interactive pressure vessel, classroom, commercialization, mechanical design

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