

2012 Annual Conference of the Australasian Association for Engineering Education (AAEE)

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Program Handbook

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23rd Annual Conference of the Australasian Association for Engineering Education

*The Profession of Engineering Education:
Advancing Teaching, Research and Careers*

Program Handbook

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Editors

Llewellyn Mann & Scott Daniel

3 – 5 December 2012

Swinburne University of Technology
Melbourne, Australia

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Welcome to Delegates



On behalf of the Organising Committee, I would like to welcome you to the 23rd Annual Conference of the Australasian Association for Engineering Education.

This year's theme, The Profession of Engineering Education: Advancing Teaching, Research and Careers, will explore opportunities for improving teaching and scholarship, rigorous research in engineering education, and career advancement as an engineering educator. Engineering education is in a dynamic period of change, with growth in the adoption of a range of teaching methods and technologies, evolving institutional directives on research and research funding, and the increasing understanding in the Australasian community that engineering education is becoming both an academic discipline and a career path unto itself.

The 2012 AAEE Conference is embracing this changing environment through a strong engagement with three essential components: our relationships to teaching, engineering education research, and professional pathways. Creating an atmosphere of collaboration and innovation, the conference will offer innovative, dialogue-focused paper sessions, a variety of workshops, and Master Classes run by recognised experts – all with the focus of building participants' knowledge and skills in their chosen profession.

I hope you enjoy the next three days and make the most out of every opportunity to share, learn and network with other delegates.



Dr Llewellyn Mann

AAEE 2012 General Chair

2012 Organising Committee

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Keynote Speakers



Ruth A. Streveler is an Associate Professor in the School of Engineering Education at Purdue University. To date, Dr. Streveler has been the Principal Investigator (PI) or co-Principal Investigator (co-PI) of ten grants funded by the US National Science Foundation (NSF). She has published articles in the Journal of Engineering Education and the International Journal of Engineering Education and has contributed chapters to the Cambridge Handbook of Engineering Education Research.

She has presented workshops to over 500 engineering faculty on three continents. Dr. Streveler's primary research interests are investigating students' understanding of difficult concepts in engineering science and helping engineering faculty conduct rigorous research in engineering education.

Ruth Streveler came to Purdue University's School of Engineering Education from the Colorado School of Mines, where she was the founding Director of the Center for Engineering Education. She is PI or co-PI on several NSF-funded projects. She served as the Acting Director for the NSF-funded Center for the Advancement of Engineering Education, a multi-campus project investigating the educational experience of engineering students from August to December of 2006.

Dr. Streveler received her B.A. in Biology from Indiana University-Bloomington, M.S. in Zoology from the Ohio State University, and Ph.D. in Educational Psychology from the University of Hawaii at Manoa.

High Quality Engineering Education Research: Key Elements and Persistent Misconceptions

There's been a lot of talk in recent years about conducting high quality engineering education research. But what does "high quality engineering education research" really mean?

Keynote speaker Ruth Streveler has been helping engineering faculty understand how to conduct engineering education research since 2004 and has presented workshops to over 500 engineering faculty since then.

In this interactive session, she will propose criteria that are essential to creating 'high quality' research and debunk some widespread myths.



Mary Besterfield-Sacre is an Associate Professor and the Fulton C. Noss Faculty Fellow in the Department of Industrial Engineering, Swanson School of Engineering, University in Pittsburgh. In addition, Dr. Sacre is the Director of the Swanson School's Engineering Education Research Center (EERC) and a Center Associate of the University's Learning Research and Development Center.

Her principal research interests are in engineering education assessment and evaluation methods, two areas where she has published widely including a series of eleven articles in the *Journal of Engineering Education* and over 30 presentations at the annual American Society for Engineering Education (ASEE) National Meetings over the past 18 years.

Her current research focuses on three distinct but highly correlated areas – innovative product design, entrepreneurship, and models and modeling in the engineering classroom. From this body of work, she has supported and mentored over 30 graduate students and 50 undergraduate students and has graduated seven Ph.D. students.

In her fifteen-year academic career, Dr. Sacre is the recipient of teaching and engineering education excellence awards including the Carnegie Science Center's Award for Excellence, Innovation in Post-Secondary Education and the Swanson School of Engineering's Outstanding Instructor Award.

Dr. Sacre continues to be a prominent player in elevating the prominence of engineering education on the national level while serving as a model for students at the University of Pittsburgh. She is an ASEE Fellow, and currently serves as an Associate Editor for *Advances in Engineering Education*, having previously been an Associate Editor of the *Journal of Engineering*. In addition, she serves on the Academy of Engineering Management and Systems Engineering at the Missouri University of Science and Technology; and is currently on the advisory board for the National Academy of Engineering's Frontiers of Engineering Education (FOEE).

Dr. Sacre has worked as an industrial engineer with ALCOA and with the U.S. Army Human Engineering Laboratory. She received her B.S. in Engineering Management from the University of Missouri - Rolla, her M.S. in Industrial Engineering from Purdue University, and a Ph.D. in Industrial Engineering at the University of Pittsburgh. Before joining the faculty of the University of Pittsburgh she was an Assistant Professor at the University of Texas – El Paso.

Stretching Our Comfort Zone in the Scholarship of Teaching

In a recent paper by Froyd, Wankat and Smith (2012)¹, five major shifts in engineering education were identified and explained. These shifts include:

1. A shift from hands-on and practical emphasis to engineering science and analytical emphasis;
2. A shift to outcomes-based education and accreditation;
3. A shift to emphasizing engineering design;
4. A shift to applying education, learning and social-behavioral sciences research; and
5. A shift to integrating information, computational, and communications technology in education.

These shifts were explained in the context of the past, but they continue to morph today having potentially significant and progressive impact for the future. As scholars of engineering education it is critical that we understand these shifts with the lens of our changing world and students. This talk will capitalize on what we currently know and provide extensions for the future.

¹ Froyd, J. E., Wankat, P. C. & Smith, K. A. (2012) *Five Major Shifts in 100 Years of Engineering Education*. *Proceedings of the IEEE* Vol. 100 (May).

AAEE 2102 Paper Reviewers

The 2012 organising committee would like to thank the following people who have made a significant contribution to the conference by reviewing papers.

Amir Abdekhodae	Steven Goh	Clive Maynard
Karen Adams	Thomas Goldfinch	Nicoleta Maynard
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Achela Fernando	David Lowe	Giles Thomas
Timothy Ferris	Sally Male	James Trevelyan
John Fielke	Llew Mann	Angela Walker
Anne Gardner	Fae Martin	Keith Willey
Peter Gibbings	Andrew Maxwell	

Monday 3rd December

09.00 - 10.00	Welcome	ATC101
10.00 - 10.30	AAEE Future Directions: Introduction	ATC101
10.30 - 11.00	Morning Tea	ATC Foyer
11.00 - 12.30	Keynote 1: Ruth Streveler, Purdue University	ATC101
12.30 - 02.00	Lunch	ATC Foyer
01.00 - 01.45	Educational Research Methods (ERM) Futures Discussion	ATC Foyer
02.00 - 03.30	Multiple Stream Session 1	Various

Session 1A: Assessment I

Facilitator: Sally Male

EN101

Assessing Student Attitudes Using a Computer-Aided Approach
Desmond Adair, Martin Jaeger and Jaan Hui Pu

Assessment Methodology to Incorporate Internal and External Constituents into Engineering Curricula
Samer Ezeldin

Students acknowledge that deep assessment types improve engineering graduate attributes: Shallow learning still prevails
Rodney Stewart, Angela Walker and Kriengsak Panuwatwanich

Developing assessment tasks to improve the performance of engineering students
Ivan Gratchev and Arumugam Balasubramaniam

Threshold exams to promote learning and assurance of learning
Keith Willey and Anne Gardner

Student participation in and perceptions of regular formative assessment activities
Anne Gardner and Keith Willey

Session 1B: Curriculum Design I

Facilitator: Tim Aubrey

EN102

Flipped Learning in a Civil Engineering management course
Hugh Wilson

Introduction of a Design-Build-Fly into Aerospace Systems Engineering Course
Kevin Massey

Mathematical integration throughout the BE: lecturer expectations versus student knowledge
Michael Jennings, Lydia Kavanagh, Liza O'Moore and Siti Haji Lakim

The Challenges of Running Specialised Taught Courses: The Geothermal Postgraduate Course, University of Auckland
Sadiq Zarrouk

Curriculum Development and Educational Research: the barriers to good practice and what to do about them

Lesley Jolly, Lyn Brodie, Juliana Kaya Prpic, Caroline Crosthwaite, Lydia Kavanagh and Laurie Buys

I can see what you are doing: Using collaboration software to increase student engagement during computer-screen-based tutorials
George Banky

Session 1C: Professional Practice Learning**Facilitator: James Trevelyan EN103**

Site walks as a learning practice for professional engineers

Donna Rooney, Ann Reich, Keith Willey, Anne Gardner and David Boud

Supporting Critical Reflection of Professional Practice Competencies within a Work-Integrated Learning Course

Graham Jenkins

Professional Reflection and Portfolios to Aid Success and Employability

Michael Bramhall, Chris Short and Raju Lad

Implementation of industry sustainability metrics across multiple undergraduate design project

Margaret Jollands, Mark Latham and Raj Parthasarathy

Sustainable Practice: an ontological politics

Jennifer Goricanec

Review of the nexus between Urban and Regional Planning and Engineering Education

Delwar Akbar and Mohammad Rasul

Session 1D: Teaching Tools I**Facilitator: Graham Moore EN313**

From tiers to tables - enhancing student experience through collaborative learning spaces

Gary Rasmussen, Doug Hargreaves, Les Dawes and Jonathan James

The development of creativity in engineering students

Clint Steele and Amir Abdekhodae

Comparison of Technology Enabled Learning Practices (TELP) in Engineering: a Student's Perspective

Matthew Joordens, Jaideep Chandran and Alex Stojcevski

Integrating Real Equipment into Virtual Worlds

Tania Machet and David Lowe

Strategies to Remove Barriers and Increase Motivation to Use the Tablet PC in Formative Assessment

Antony Dekkers, Prue Howard, Nadine Adams and Fae Martin

Session 1E: Project Based Learning I**Facilitator: Jo Devine****EN715**

Seeing the BIG picture: how learning to teach assists final year engineering students develop their problem-solving skill set

Robyne Bowering

A project based learning activity to motivate students towards a higher level of appreciation of materials science in maritime engineering

Denis Lisson and Vikram Garaniya

Research Based Learning: A Coastal Engineering case study

Nick Cartwright

Project Based Learning in Embedded Systems: a Case Study

Brett Wildermoth and David Rowlands

Scenario Based e-Learning to improve Problem Solving Skills

Usman Rashid and Esther Ventura-Medina

Repackaging science, engineering, technical and other applied studies curricula into authentic projects and problems

Adam Hendry and Chloe Viney

Workshop 1**EN303**

Defining Your Discipline to authenticate your Curriculum

Roger Hagraft and David Dowling

Workshop 2**EN304**

Designing evidence-based assessment: Assuring academic standards
Wageeh Boles and Mary Besterfield-Sacre

Master Class 1**ATC422/423**

Engineering Education Research 101: Investigating Teaching and Learning in Engineering
Matt Eliot

03.30 - 04.00

Afternoon Tea

ATC Foyer

04.00 - 05.30

Multiple Stream Session 2

Various

Session 2A: Assessment II**Facilitator: Mark Symes****EN101**

Providing the right feedback to the right students: applying an innovative e-Assessment system in engineering education
Hui Jiao and Natalie Brown

Towards Authentic Assessment - an Evaluation of Assessment in a Postgraduate Engineering Asset Management Course
David Thorpe

A Pilot Study of e-Quiz and e-Review programs in the Online Blended Learning of First-Year Engineering Mechanics
Yu Dong, Anthony Lucey and Garry Leadbeater

Exams in computer programming: what do they examine and how complex are they?
Simon and Judy Sheard

A model for enhancing assessment and teaching practice at the coalface: Insights from a Fellow-In-Residence Engagement program
Wageeh Boles and Hilary Beck

Session 2B: Curriculum Design II**Facilitator: Graham Jenkins****EN102**

A curriculum design, modelling and visualization environment
Ian Cameron and Greg Birkett

Individual structuring of curricula sets
Olga Belyaeva, Valeriy Solomonov and Alla Frolova

How does an academic's concept of curriculum affect how they engage with its design and development?
Lynette Johns-Boast

Engineering science and pure science: do disciplinary differences matter in engineering education?
Renee Smit

Development of Project Management Skills through Collaborative Learning
Mushtak Al-Atabi

Session 2C: Graduate Attributes & Accreditation **Facilitator: Julie Mills** **EN103**

Assessing Higher Education Learning Outcomes in Civil Engineering: the OECD AHELO Feasibility Study
Roger Hadgraft, Jacob Pearce, Daniel Edwards, Hamish Coates and Julian Fraillon

Mapping workshop learning to graduate attributes for Civil Engineering Surveying
A. H. M. Faisal Anwar, J. Awange, B. Arora, H. Nikraz and J. Walker

Stakeholders' perception of competencies of aviation graduates and its implications to curriculum design
Chrystal Zhang, Stephen Fankhauser, David Newman, Paul Bates and Neil Hyland

An Approach for Studying Multiple Learning Outcomes of Undergraduate Engineers
David Knight

Re-engineering an Engineering Education Programme: Example of the University of Botswana
Tunde Oladiran, Giuditta Pezzota, Jacek Uziak and Marian Gizejowski

A Unified Model for Embedding Learning Standards into University Curricula for Effective Accreditation and Quality Assurance
Richard Gluga, Judy Kay, Raymond Lister and Tim Lever

Session 2D: Engineering Education **Facilitator: Les Dawes** **EN313**

Why Do Attempts at Engineering Education Reform Consistently Fall Short?
James Trevelyan

Understanding Best Practice in Engineering Education Using the Concept of Pedagogical Content Knowledge
Hannah Jolly, Lyn Brodie and Warren Midgley

A Contribution to Disambiguation of Interdisciplinary Knowledge
Kazem Abhary, Hanne Kirstine Adriansen, Hung-Yao Hsu, Zlatko Kovacic, Dennis Mulcahy and Sead Spuzic

Quality in Engineering Education Research: arriving at consensus
Lesley Jolly, Keith Willey and Anne Gardner

The relationship of teacher-student interpersonal behaviour and degree specialisation in Engineering Education
Tony Rickards and Jim Greenslade

How can writing develop students deep approaches to learning in the engineering curriculum?
Rosalie Goldsmith, Keith Willey and David Boud

Workshop 3 **EN303**

Qualifying Qualitative Research Quality (The Q³ Project): A conversation for engineering education researchers
Joachim Walther, Nicki Sochacka and Nadia Kellam

Workshop 4 **EN207**

Designing Pedagogically Sound Laboratories
David Lowe, Gnana Bharathy, Ben Stumpers and Steve Murray

Workshop 5 **EN304**

Applying a sustainability framework to engineering design courses
Margaret Jollands and Mark Lathan

Master Class 2 **ATC422/423**

Building a Career in Engineering Education
David Dowling, Lydia Kavanagh and Tom Goldfinch

05.30 - 07.00 Industry Expo ATC Foyer

Session 3D: Student & Staff Engagement**Facilitator: John Findlay****ATC101**

Volunteering in school science lessons: expectations and experiences of university students
Emily Cook, Christopher Fluke, Rosemary Chang and Llewellyn Mann

Prototype of an Intervention Strategy with a focus on mathematics support for first year Civil Engineering students 'at risk'
Birgit Loch and Dominique Elliott

Is lecture attendance just a flip of a coin?
Scott Daniel, Alexander Mazzolini and Mark Schier

Engaging Engineering students with the wider community: the Endeavour program at the University of Melbourne
Robert Schmid, Nicole Meaker and Doreen Thomas

The Teaching and Learning Development Program: An opportunity to excel?
Lydia Kavanagh, Liza O`Moore, Carl Reidsema, Tracey Papinczak and Caroline Crosthwaite

Mad as Hell and Not Taking It Any More?: Job satisfaction amongst engineering educators in Australian universities
Lydia Kavanagh, Liza O`Moore and Lesley Jolly

Workshop 6**EN303**

Developing Teamwork that Works! Embedding intercultural capacities in ICT and engineering using a transdisciplinary approach
Elena Sitnikova, Patricia Kelly and Diana Collett

Workshop 7**EN304**

Get Set for Success: An update on the EngCAT project
Lorelle Burton, David Dowling, Lydia Kavanagh, Liza O`Moore, Tim Aubrey, David Lowe, Janelle Wilkes, Rex Glencross-Grant and William McBride

Master Class 3**EN307**

Why, When and How to use Qualitative Methods in Engineering Education Research
Arnold Pears

Master Class 4**ATC422/423**

Frontiers of Outcomes-Based Assessment
Brent Jesiek, Roger Hadgraft and Ian Cameron

12.30 - 02.00	Lunch	ATC Foyer
01.00 - 02.00	AAEE AGM	ATC101
02.00 - 03.30	Australian Council of Engineering Deans (ACED) Q&A	ATC101
03.30 - 04.00	Afternoon Tea	ATC Foyer
04.00 - 05.30	Multiple Stream Session 4	Various

Session 4A: Professional Skills**Facilitator: Margaret Jollands EN101**

Developing Critical Thinking Skills and an Understanding of Social Justice in Engineering Education
Julian O`Shea, Caroline Baillie and Rita Armstrong

Measuring Students' Propensity for Lifelong Learning
John Chen, Karen McGaughey and Susan Lord

Embedding professional skills in a second-year chemical engineering unit
Gordon D. Ingram and Chi M. Phan

Language Characteristics of Reflective Writing
Graham Moore and J. Kaya Prpic

Improving engagement and critical judgement skills through peer-assessed reflective journals
Gavin Buskes

Session 4B: Student Feedback & Attrition**Facilitator: Wageeh Boles EN102**

A Comparison of On-line and 'In-class' Student Feedback Surveys: Some Unexpected Results
Alexander Mazzolini, Scott Daniel and Llewellyn Mann

An Investigation into the Contribution of Student Profile, Student-Lecturer Interaction and Student Workload in Teaching Evaluations
Samanthika Liyanapathirana

Screencasts - are they the panacea for dealing with students' diverse mathematical skills?
Janelle Wilkes

The Impact of Curriculum on Engineering Students' Attrition
Homa Edalatifard, Elena Prieto and Kaushik Mahata

Where do engineering students really get their information?: using reference list analysis to improve information literacy programs
Clayton Bolitho and Niall O`Luanaigh

Session 4C: Online Learning II**Facilitator: Euan Lindsay EN103**

Engaging distance students through online tutorials
Jo Devine and Weena Lokuge

Are online learning modules the kiss of life or death for lecture attendance?
Colin Kestell, Craig Willis, Steven Grainger and Dorothy Missingham

Physics Practicals for Distance Education in an Undergraduate Engineering Course
John Long, Warren Stannard, Ken Chenery and Matthew Joordens

Implementing multimedia resources in online learning and its effect on student understanding
Belal Yousif, Marita Basson and Carola Hobohm

Improving student interaction using an e-learning tool for engineering design and construction
Craig Willis and Lindsay Doherty

Session 4D: Teaching Tools II**Facilitator: David Lowe ATC101**

The Effects of Learning Styles and Perceptions on Application of Interactive Learning Guides for Web-based Courses
Janus Liang

Geocentric Contextualized Mobile Learning with the Engineering Pathway Digital Library
Kimiko Ryokai, Alice Agogino and Robert Kowalski

Enhanced Collaboration with Re-usable Learning Objects
Lynette Johns-Boast and Kim Blackmore

Web-based Lecture Technologies and their Effects on Student Performance
Jason But and Rhys Shobbrook

Teaching Tools as Teaching Tools: Contextualised Authentic Learning Examples
Nickolas Falkner and Katrina Falkner

Wednesday 5th December

09.00 - 10.30	AAEE Future Directions: Community Discussion	ATC101
10.30 - 11.00	Morning Tea	ATC Foyer
02.00 - 03.30	Multiple Stream Session 5	Various

Session 5A: Student Learning I

Facilitator: **Caroline Crosthwaite EN101**

Scoping metalearning opportunity in the first three years of engineering

Jan Meyer, David Knight, Tom Baldock, Mehmet Kizil, Liza O`Moore and David Callaghan

Using Neo-Piagetian Theory, Formative In-Class Tests and Think Alouds to Better Understand Student Thinking: A Preliminary Report on Computer Programming

Donna Teague, Malcolm Corney, Colin Fidge, Mike Roggenkamp, Alireza Ahadi and Raymond Lister

Using Hands-on Models to Improve Student Learning Outcomes in Statics

Terry Lucke and Peter Killen

Improving Learning Effectiveness for a Third Year Materials Unit

Chensong Dong and Ian Davies

Peer assisted learning in an online postgraduate course on engineered fibre composites

Allan Manalo and Thiru Aravinthan

The impact on values and learning behaviours of engineering students from an authentic learning environment: Preliminary Analysis and Observations

Steven Goh, Sandra Cochrane and Megan Brodie

Session 5B: Team Assessment

Facilitator: **Lesley Jolly**

EN102

A Review of Mathematical Equations to Assign Individual Marks from a Team Mark

Kali Prasad Nepal

Student Perceptions of Teammates' Performance: Influence of Team Formation Method

Andrew Wandel and Keith Willey

Team Based Learning as a Method for Improvement in Large Engineering Classes

Laurence Pole and Nolan Bear

A framework for Assessing Individuals who Learn in a Team Environment

Prue Howard and Matt Eliot

Adaptive group formation to promote desired behaviours

Amir Mujkanovic, David Lowe and Keith Willey

A case-study on intra-group assessment of inter-disciplinary group work

Palaneeswaran Ekambaram, Florence Yean Yng Ling and Ngoc Tram Nguyen

Session 5C: Innovative Programs

Facilitator: **Tim McCarthy**

EN103

Higher Degree Research at Australian Universities: Responding to Diversity in Engineering and Information Technology

Shamim Samani, James Trevelyan, Karen Woodman, Prasad Yaralagadda, Acram Taji, Pujitha Silva and Ramesh Narayanswamy

Analysis of Competitiveness of Batangas State University College of Engineering Using Porter's Five Competitive Forces Model

Tirso Ronquillo

The PhD thesis by publications in Engineering: insights for supervisors

Jane Moodie and Karen Hapgood

Bridging the Gap for Diploma Students Taking a Degree Unit as Elective in Engineering

Adeline L. Y. Ng and Lisa Yong

Integrating Fundamental Sciences into Engineering Curriculum

Josef Rojter

Session 5D: Engineering Design**Facilitator: Colin Kestell****ATC101**

The effects of background upon engineering design expertise and producing more competent engineering design students (a Sino-occidental comparison)

Clint Steele

Enabled Design: Engaging First Year Engineers in Inclusive Design

Jeremy Smith and Huy Huyen

The Process of Design Based Learning: a Students' Perspective

Matthew Joordens, Alex Stojcevski, Guy Littlefair and Sivachandran Chandrasekaran

CADET - Centre for Advanced Design in Engineering Training

Guy Littlefair and Alex Stojcevski

Pedagogy of Engineering Design and Engineering Graphics

Alireza Asgari and Bernard F Rolfe

Symposium 2**EN304**

The 'Not Invented Here' Syndrome: Breaking the Resources Re-use Barrier

Wageeh Boles, Robin King and Roger Hadgraft

Workshop 10**EN307**

Embedding Intercultural Competency Education in the Curriculum

Thomas Goldfinch, Elysabeth Leigh and Les Dawes

Workshop 11**EN308**

Interdisciplinary teaching and student support

Michael Bramhall and Chris Short

Master Class 6**ATC422/423**

Engaging Large Classes

Carl Reidsema and Lydia Kavanagh

12.30 - 02.00

Lunch

ATC Foyer

02.00 - 03.30

Multiple Stream Session 6

Various

Session 6A: Student Learning II**Facilitator: Lynette Johns-Boast****EN101**

Applying Perry's Theory of Intellectual Development to Facilitate Student Acceptance of Indeterminate Problems

Martin McCarthy

Students' understanding about the brightness of light bulbs connected in DC electric circuits

Suchai Nopparatjamjornras and Thasaneeya Nopparatjamjornras

Improving Engineering Students Skills using a Digital Storage Oscilloscope using Multimedia Resources

Daniel Oswald, Desmond Baccini, Graham Wild and Steven Hinckley

Supporting Local Access to Collections of Distributed Remote Laboratories

Michael Diponio, David Lowe and Michel de La Villefromoy

Barriers to Adopting Remote Access Laboratory Learning Activities

Alexander Kist

A New Implementation of Keller Plan Teaching for an Undergraduate Electronic Engineering Course

Andrew Mackie, Brian Usher and Andrew Martchenko

Session 6B: Assessment & First Year**Facilitator: Julian O'Shea****EN102**

Online assessment using a graphical interface for decision problems
Steven Davis

Students self-assessment of assignments - is it worth it?

Badri Basnet, Marita Basson, Carola Hobohm and Sandra Cochrane

Peer Learning and Performance: Results from a First Year PASS Implementation
Brice Shen and Gavin Buskes

Examining First Year Students' Preparedness for Studying Engineering

Lorelle Burton, David Dowling, Lydia Kavanagh, Liza O'Moore and Janelle Wilkes

Thai first-year engineering student ideas about magnetic forces
Kreetha Kaewkhong

Effectiveness of an evidence-based predictive model for motivating success in freshmen engineering students

Achela Fernando and Peter Mellalieu

Session 6C: Engineering at High School & Podcasts**Facilitator: Hannah Jolly****EN103**

Improving Engineering Awareness of Secondary School Students
Dragi Klimovski, Antonio Cricenti and Peter O'Donoghue

Engineering Education in the Middle School: Exploring Foundational Structures
Lyn English, Peter Hudson and Les Dawes

Power of Engineering: Changing the perceptions of year 9 and 10 female school students towards an engineering career

Felicity Briody, Steven Goh and Les Dawes

Using Podcasts to demonstrate the use of graphical/numerical techniques in Chemical Engineering
Esther Ventura-Medina

Teaching threshold concepts in engineering mathematics using MathsCasts
Birgit Loch and Catherine McLoughlin

Session 6D: Class Delivery**Facilitator: Lyn Brodie****ATC101**

Refined `Chalk-and-Talk` of Lecture Content: Teaching Signals and Systems at the Griffith School of Engineering
Stephen So

Intensive Teaching Modes: Benefits, Drawbacks and Directions Forward
Matthew Welsh

Facilitator - more than a trivial merging of a facilitator and a tutor
Sally Male and Andrew Guzzomi

Student Perceptions of a Day-Long Mathematical Modelling Group Project
Peter Bier

Uncanned learning through an Industry based final year project - Food for thought
Karen Hogan

Managing information for capstone engineering projects
Madeleine Bruwer, Aaron Blicblau and Kourosh Dini

Workshop 12**ATC425/426**

War stories: Engaging students during computer-screen-based tutorials
George Banky and Wayne Rowlands

Advancing Engineering Education as a Career

MC7: Evaluating your Teaching for Promotion

Dr Lesley Jolly

Wednesday 5th @ 2pm

At many universities, academics are being asked to supplement routine student evaluations with extra evidence of the worth of their teaching. This Master Class will focus on how you can gather that evidence, without doing a full-blown research project. You will begin with a consideration of how your teaching is supposed to work, which will help you identify appropriate performance indicators. You will then consider a range of types of evidence to demonstrate performance. By the end of the workshop you will have acquired one or two tools for planning and carrying out evaluation that are not expensive in time or resources and a list of references for where to go for more ideas.

MC5: Publishing in Engineering Education: An Editors Viewpoint

A/Prof Les Dawes¹, Dr Prue Howard¹ and A/Prof Mary Besterfield-Sacre²

Tuesday 4th @ 4pm

This session will present a professional development opportunity to gain a better understanding of the journal review process and successful publishing in Engineering Education. The presenters, all current Engineering Education Journal Editors will demystify the editorial process used to help authors meet professional publishing standards. The session will be interactive and presents a means of exchanging current thinking and provides helpful hints in developing quality Conference papers into published journal papers.

Learning outcomes include:

- strategies authors can use in planning and writing their papers,
- understanding criteria related to the scholarly content and contributions of a manuscript and the quality of the composition and presentation,
- what editors look for in a good paper and how best to respond to reviewers comments.

¹ Editors of Australasian Journal of Engineering Education

² Currently an Associate Editor for Advances in Engineering Education having previously been an Associate Editor of the Journal of Engineering.

MC2: Building a Career in Engineering Education

Prof David Dowling, A/Prof Lydia Kavanagh and Mr Tom Goldfinch

Monday 3rd @ 4pm

The Master Class is designed to help you prepare a strategic plan for building a career in engineering education. The session will be built around a number of aspects fundamental to a successful career:

1. Engaging with opportunities – funding, recognition, promotion etc.
2. Stepping out of the sandpit: establishing collaborations across disciplinary, institutional, and national boundaries
3. Surrounding yourself with the right people – researchers, mentors, gurus etc.
4. Modelling best practice teaching: walk the talk
5. Recognising your reality: the path ahead can be challenging

The session will be run in three parts:

1. Who are we, and what do we know about a building a career in engineering education? (Short presentations by the presenters)
2. What are the possibilities for your career and what do you need to be doing to capitalise on these? (Participant reflection)
3. How can we help you? (Facilitated discussion and Q/A session)

This master class is for you if:

- you are thinking that you'd like to do more in engineering education;
- you are finding it difficult to get funding and/ or recognition for the work that you're doing in engineering education; and/or
- you want to see if engineering education might be a career direction for you.

You will leave with ideas about where to go next with your career, and an annotated hand-out based on the 5 fundamental aspects outlined above. Hopefully you will also leave with some new contacts and a broader view of the opportunities open to you.

Curriculum Development and Educational Research: the barriers to good practice and what to do about them

Lesley Jolly^a, Lyn Brodie^b, Juliana Kaya Prpic^c, Caroline Crosthwaite^a, Lydia Kavanagh^a and Laurie Buys^d

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BACKGROUND

Curriculum change is acknowledged to be a difficult process to initiate and maintain (Graham 2012). Over the last two years we conducted an ALTC-funded evaluation of the use of the Engineers Without Borders (EWB) Challenge projects in first-year engineering. We asked the question "what works for whom under what circumstances" in recognition of the complexity of curriculum development, and given that different aspects of the process play out differently in different settings. Phase 2 of the project involved three University participants' trialling implementation recommendations resulting from the earlier stage of the evaluation. Results indicate that knowledge of best practice methods does not always directly relate to successful implementation. Thus, consideration needs to be given regarding how knowledge is translated into practice.

PURPOSE

This paper examines the barriers and aids to successful curriculum change and recommends strategies academic staff can use to embed best practice and the results of educational research in their curricula.

DESIGN/METHOD

Phase 1 of our study used a multi-method approach, incorporating survey, in-depth interviews, observation and focus group strategies with 13 participating Australian Universities. Phase 2 used observation, staff diaries and collaborative critical reflection within an ethnographic framework with a subset of three participant universities. Analysis involved a discursive critical collaboration between participants, as well as thematic analysis.

RESULTS

Three significant issues emerge relating to curriculum development including: a) aligning assessment criteria and project goals, b) consistency in course delivery, and c) collaboration. These themes will be explored particularly relating to impacts for implementing course curriculum changes and our roles as course designers, colleagues and role models for our students.

CONCLUSIONS

Our discussion is situated in the context of recent research on curriculum change. For instance, researchers have found that change "has to be radical and widespread in order to stick" (Graham 2012). We use our data to explore what counts as radical and how to attain a wide spread.

KEYWORDS

Curriculum change, evaluation, embedding best practice

Defining Your Discipline to authenticate your curriculum

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OVERVIEW OF THE WORKSHOP

The Defining Your Discipline (DYD) Stakeholder Consultation Process was designed to be used by education institutions and/or industry organisations to connect educators with practitioners and other stakeholders to develop a set of practitioner authenticated Graduate Capabilities for a program in their discipline. The DYD Process ensures that the input from each stakeholder is equally valued so that the opinions or biases of individuals or groups do not impact on the final outcome. The Process is an efficient, effective, flexible and inclusive consultation process that has been trialled in four disciplines and at three qualification levels. The resulting Graduate Capabilities can be used to guide the development of curriculum for a program, to inform a review of existing curriculum, or to guide reviews by external accrediting organisations.

In this action learning workshop, the participants will be provided with an overview of the ten steps in the DYD Stakeholder Consultation Process, and experience in three key steps: gathering; clustering and synthesising the information from discipline stakeholder groups.

ACTIVITIES

The planned activities for a 90 minute Workshop are outlined in the following table. The timelines are indicative.

Activity	Explanation	Time
1	Introduction to the Workshop	5 min
2	Brief overview of the DYD Stakeholder Consultation Process	10 min
3	Divergent Phase: In this <i>individual</i> activity, the participants will list the <i>communication</i> tasks that a graduate of their program would be expected to undertake (where necessary under supervision) in their first three years of work. The <i>communication</i> field will be used for the task definition activity as it is common to all disciplines.	20 min
4	Convergent Phase: In this <i>group</i> activity, the participants will cluster the tasks developed by the members of their group, negotiate names for the clusters, identify additional tasks and order the tasks in each cluster.	15 min
5	Synthesis Phase: Each group will report on the clusters and tasks they identified. Strategies for synthesising the tasks/ clusters from the groups will be discussed and trialled	15 min
6	Overview of the User's Guide for the DYD Stakeholder Consultation Process. Each participant will receive a copy of the draft Guide (may be posted after the conference).	15 min
7	Discussion and evaluation	10 min

The resources required for the workshop include: whiteboard and pens, butcher's paper, computer with projection facilities, and a table for each group (5-7 participants) to use for the clustering phase.

TARGET AUDIENCE

Engineering educators, particularly those involved in curriculum design and accreditation. No prior knowledge is required.

OUTCOMES

At the conclusion of the workshop the participants will leave with the knowledge, skills and experience to be able to use to the DYD Process to define a set of Graduate Capabilities for a program in their discipline.

REFERENCES

Dowling, D., & Hadgraft, R. (2011). *The development of a systematic consultation process to define graduate outcomes for engineering disciplines*. Paper presented at the REES 2011 Conference, Research in Engineering Education Network. Madrid, Spain.

Dowling, D., Hadgraft, R., & Lamborn, J. (2011). *Developing an inclusive stakeholder consultation process: A case study*. Paper presented at the AAEE Conference, Perth, Australia.

KEYWORDS

Graduate outcomes; Stakeholder consultation; Engaging practitioners.

PRESENTERS' BACKGROUNDS

David Dowling and Roger Hadgraft are the leaders of ALTC funded '*Defining Your Discipline To Facilitate Curriculum Renewal in Undergraduate Programs*' project. The project, which commenced in 2010, will be completed in November 2012. The deliverables from this important and successful project will include:

- Graduate Capabilities for Environmental Engineering Degree Programs: A Guide for Australian Universities
- The DYD Stakeholder Consultation Process: A Users Guide

Towards Authentic Assessment – an Evaluation of Assessment in a Postgraduate Engineering Asset Management Course

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BACKGROUND

An evaluation of assessment of the University of Southern Queensland postgraduate engineering management course ENG8104 *Asset Management in an Engineering Environment*, which is taught in a number of Faculty of Engineering and Surveying programs, is discussed. This evaluation considers the way in which participants in this course are assessed in relation to the authentic assessment of the sustainable life cycle management of engineering assets. Current assessment is by a mid-semester assignment and an end of semester examination, each worth 50 per cent of marks in the course. The question is raised whether this assessment is an authentic approach to evaluating whether learners both understand the course material and can apply it in a way that meets current and emerging professional engineering requirements.

PURPOSE

The following research question is addressed:

To what extent does the assessment of this course meet the requirements of professional engineers in undertaking sustainable life cycle management of engineering assets, including contemporary and emerging professional issues?

DESIGN/METHOD

The research method adopted for this study used the following steps to meet the research objectives:

- Review sustainable life cycle management of engineering assets.
- Review course assessment methodologies, including authentic assessment.
- Apply program evaluation principles to assess issues and develop options.
- Evaluate how assessment for the course compares with advantages claimed for good assessment practice.
- Develop conclusions with respect to course assessment

Research is primarily based on evaluation of course assessment from the point of view of the author as an observer participant examiner. Other research inputs include review of professional practice requirements, analysis of past assessment results, and anecdotal information.

RESULTS

The study has shown that the assignment in this course partially authentically assesses the requirements of professional engineers undertaking sustainable life cycle asset management. It has also shown that the examination is not a good instrument for authentic assessment of these requirements.

CONCLUSIONS

While current assessment for this course tests learner knowledge and is aligned with course objectives, it is considered that it may not provide the best approach for assessing professional engineering practice in sustainable life cycle asset management. This paper addresses the assessment process in this course from this point of view.

KEYWORDS

Asset, management, authentic; assessment, evaluation.

Understanding Best Practice in Engineering Education Using the Concept of Pedagogical Content Knowledge

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BACKGROUND

The concept of Pedagogical Content Knowledge (PCK) is used in educational research to explore the complexities of effective teaching practice. PCK is the 'knowledge-in-action' and 'knowledge-of-action' (Park & Oliver, 2008) which allows teachers to make decisions about what to do in order to teach well. It is a type of expertise that is specific to the discipline in which it is applied, but is distinct from either disciplinary content knowledge, or general knowledge of pedagogy. The nature of PCK is yet to be researched specifically for the engineering discipline. To date, in the disciplines for which PCK constructs have been defined (for example, in History, Science or Literature), there is a close similarity between how the discipline is studied and how it is practiced. In engineering, the study of the discipline and the practice of it are very different, raising questions about how the make-up of engineering PCK accounts for the nature of the discipline, and how it reflects the nature of best practice in engineering teaching.

PURPOSE

This paper asks how PCK may be defined for engineering education research purposes, and what the implications of this are for existing work in the discipline. This involves elucidating the interrelated variables which determine how teachers undertake engineering teaching. It suggests that some modification to accepted PCK constructs is necessary in order for PCK to capture the practice-based orientation of the engineering discipline.

DESIGN/METHOD

The paper draws on research findings from the higher education research field generally, and engineering education research specifically, to illustrate how the PCK construct can be applied to the engineering discipline. It uses the PCK model of Park and Oliver (2008), itself a synthesis of PCK research, to explore the complexities of teaching practice in engineering education. Data from an ALTC project ("Curriculum Renewal in Engineering Through Theory Driven Evaluation" PP10-1647) are used to further illustrate the argument, and Pierre Bourdieu's "Field and Habitus" (1990) is proposed as an appropriate theoretical framework for undertaking further exploratory research.

RESULTS

An appropriately modified PCK construct promises to be a useful means for understanding the variables affecting teaching practice in engineering. Its particular strength lies in the fact that, when studied with an appropriate methodology, it has the capacity to capture the culturally and contextually contingent nature of teaching practice, as well as the many other interrelated factors which determine *how* engineering teachers undertake practice. For example, although all of the courses examined in the ALTC study were first year project-based courses with similar objectives, different teachers had different conceptions of the knowledge, skills and ways of working required of students, and therefore undertook their teaching in different ways. This difference can be understood in terms of the variation in how each teacher's PCK is formulated, including their prior experience and beliefs, and the institutional context in which they were operating.

CONCLUSIONS

By looking at how PCK can explain teaching practices in engineering education, and by examining how the many variables comprising PCK interact for teaching engineering, we can begin to develop a clearer picture of how best-practice (as informed by the plethora of wider research in engineering education) may be achieved, and the realistic pathways towards this ultimate goal.

KEYWORDS

Pedagogical Content Knowledge (PCK), Bourdieu, Field and Habitus, Engineering knowledge

Digging deeper using 'habitus' – a fresh approach to understanding student behaviour

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BACKGROUND

Government policies in Australia aim to increase participation in higher education (Australian Government, 2008), so it is becoming more important to understand the factors affecting the progression and retention of an increasingly diverse student cohort. A great deal of work has already been done in the area of progression and retention in Australia and internationally, much of this has been based around identifying factors that indicate a student's probability of success. These factors include demographic, psychosocial and academic indicators.

French sociologist Pierre Bourdieu developed his theory of habitus in the late 20th century as a means of exploring the role of social class on individual aspirations and behaviour. Bourdieu's concept of habitus and its relationship to his concepts of Field, cultural Capital and Dispositions form a theoretical framework and the basis of a methodology which enable the rigorous investigation of human actions and interactions (Reay, 2004). As yet, Bourdieu's concepts have not been widely used as a framework within engineering education research; his theories are complex, fluid and relatively inaccessible to the novice sociologist (DiMaggio, 1979).

PURPOSE

This discussion paper explores the potential for the work and theories of Pierre Bourdieu to provide an alternative approach to engineering education research on student diversity issues, including progression, retention and student success. Student actions, attitudes and beliefs that are known to contribute to success can be traced back to a student's habitus, a concept developed by Bourdieu.

DESIGN/METHOD

Issues of academic performance, retention and progression in an engineering program can be better understood against the background of individual student choice and behaviour. Bourdieu's theory of habitus presents a lens through which to view the motivations behind individual student decisions to study engineering. This paper will discuss his theories and argue that his work can be directly applied to investigations into student choices (of engineering as a career, institution of study, and mode of study); academic performance; retention and progression. An example of a possible study will be outlined to demonstrate the possible applications.

RESULTS

Bourdieu's theories are shown to have direct application to the investigating the underlying sociological reasons for student performance in engineering. Their application can lead to a deeper understanding of why factors that have already been identified as significant to student success are less often found in students from 'non-traditional' backgrounds.

CONCLUSIONS

Bourdieu's work presents an opportunity for engineering education researchers to further understand why demographic, psychosocial and academic factors, which are known to play a role in the success or otherwise of students are exhibited in particular educational settings. Furthermore, it provides a fresh theoretical framework for investigations in to engineering education phenomena.

KEYWORDS

Diversity; progression; retention; student success; Bourdieu

Get Set for Success: An update on the EngCAT project

Lorelle J. Burton^a, David G. Dowling^a, Lydia Kavanagh^b, Liza O’Moore^c, Tim Aubrey^d, David Lowe^e, Janelle Wilkes^f, Rex Glencross-Grant^f and William McBride^g.

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OVERVIEW OF THE WORKSHOP

In 2011, the Office for Learning and Teaching (OLT) funded a national project entitled “Get set for success: Using online self-assessments to motivate first year engineering students to engage in and manage their learning”. This research project aims to identify factors that lead to success in first year engineering studies. The project will deliver a prototype model of the Engineering Career Appraisal Tool (EngCAT), an online educational resource that enables individuals to self-assess their cognitive (e.g., spatial, mathematical, and technical skills) and non-cognitive (e.g., personality traits, career interests and approaches to learning) abilities.

Initial data have been collected and some initial results are available for the EngCAT project. Commencing engineering students across five Australian universities completed cognitive and non-cognitive tests to help them self-assess their readiness for the programs and to empower them with self-awareness and learning skills.

The tests included:

- Get Set for Success Phase 1: a 52 item multiple choice online quiz that assesses students’ maths, physics, chemistry, and spatial abilities.
- Get Set for Success Phase 2: an online set of questionnaires consisting of:
 - International Personality Item Pool (IPIP) – 50 items measuring five factors of personality;
 - Approaches to Study Skills Inventory for Students (ASSIST) – 52 items measuring three approaches to learning; and
 - Interest and Motivation for Studying Engineering – 31 items.

Students received personalised feedback on their test performance.

This workshop will provide participants with an opportunity to learn about these tests, the advantages and disadvantages of the tests, and to work in small groups to discuss the best ways that these tests can be incorporated into first year curricula to provide commencing students with a positive start, and ultimately a successful outcome, to their studies.

ACTIVITIES

The activities which will take place in the workshop are outlined below.

Activity	Explanation	Time
1	Introduction to the Workshop	5 minutes
2	Brief description of the project and progress to date	10 minutes
3	Researchers from each of the 5 participating universities to discuss successes and challenges in the 2012 testing phase.	20 minutes
4	Opportunity for participants to examine the tests used and to discuss key factors that should be included in a national test; participants can draw up some posters in small groups	20 minutes
5	Tables report back on outcomes	15 minutes
6	Discussion and summary of recommendations	15 minutes
7	Workshop close	5 minutes
Total		90 minutes

TARGET AUDIENCE

This workshop will be of particular interest to anyone involved in Engineering Education.

OUTCOMES

The workshop will enable the participants to:

- learn about the set of tests developed for use in this project;
- share experiences about the successes and challenges of the methods used to deploy the tests, particularly relating to student engagement with the tests; and
- explore key lessons learned from 2012 testing that can be used to improve outcomes in 2013 and beyond.

KEYWORDS

First year engineering students, academic success, cognitive abilities, non-cognitive abilities.

PRESENTERS' BACKGROUNDS

Prof Lorelle Burton, Associate Dean, Learning and Teaching, and Professor of Psychology, Faculty of Sciences, USQ

Prof David Dowling, Professor in Engineering Education, Faculty of Engineering and Surveying, USQ

A/Prof Lydia Kavanagh, Director of 1st Year Engineering, Faculty of Engineering, Architecture & IT, UQ

Dr Liza O'Moore, School of Civil Engineering, UQ.

A/Prof Tim Aubrey, Associate Dean, Faculty of Engineering and Information Technology, UTS

Prof David Lowe, Associate Dean, Faculty of Engineering and Information Technology, Sydney University.

Dr Janelle Wilkes, School of Environmental and Rural Sciences, UNE

Mr Rex Glencross-Grant, School of Environmental and Rural Sciences, UNE

A/Prof Bill McBride, Assistant Dean Teaching and Learning, School of Engineering, UoN

All presenters have a particular interest in Engineering Education, with a focus on transition into university studies.

Engaging distance students through online tutorials

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BACKGROUND

This paper explores the use of an online tutorial system by distance students in a large first year engineering statics course. Student feedback suggests that this course is often perceived as a hurdle course for students, so the course team is constantly searching for new ways to support distance students and enhance their course experience. Most distance students have time constraints and multiple commitments other than their study, they do not have the face to face interaction with course staff that on-campus students do. Consequently they have fewer opportunities to access content specific assistance as they work through course materials and to receive immediate feedback on their own performance.

In 2011 we implemented an assessable online tutorial system, known as Mastering Engineering®, as a platform for providing targeted, ongoing tutorial assistance and timely feedback to distance students. This form of learning assessment was implemented for the entire cohort but the needs of the 60% who were studying by distance was the primary motivation.

PURPOSE

This study investigates the way that the system was used by the students to identify whether differentiated usage patterns could be discerned for students at differing levels of achievement in the course. It explores the hypothesis that high achieving students would use the assessable online tutorials as an aid to their study and so would access and complete the tutorials regularly throughout the semester, while poorly performing students would tend to only access them towards the end of semester (as the exam period neared).

DESIGN/METHOD

A stratified sampling of students from different grade bands was taken and their interaction with the system was investigated through the collection of data pertaining to their access patterns and time on task throughout the semester. This data will be analysed for statistical correlations between tutorial usage patterns and course achievement.

RESULTS

It was found that regular and consistent engagement with the system was practiced by students achieving high course marks while, conversely, students with lower course outcomes exhibited inconsistent and bundled usage patterns. There is also a strong statistical association between the marks achieved for the tutorial series and final course results.

CONCLUSIONS

Clear differentiation between usage patterns of high and low achieving students, coupled with correlation between tutorial results and exam results, suggests that the online tutorial usage patterns of high achieving students are more effective in terms of overall course achievement. In 2012 an increased frequency of assessment will be implemented to test whether a more consistent engagement with the system can be encouraged in low performing students.

KEYWORDS

Assessment, distance students, online

Implementing multimedia resources in online learning and its effect on student understanding

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BACKGROUND

The Engineering Materials course is one of the common subjects for first year engineering students and provided the ideal opportunity for this study due to the large class size and the presence of certain traditionally complex concepts. Based on the data collected by four international universities, most engineering students face problems in understanding complex topics in the Engineering Materials course, for example, atomic bonds, the binary phase diagram, and the microstructure of materials. It is argued here that introducing multimedia resources and visualization tools such as animations, videos, photos, inking and sketching in teaching could enhance students' understanding of both threshold concepts and complex knowledge.

PURPOSE

The aim of this research was to determine whether students reported an enhanced understanding of concepts identified as complex by previous research, when these concepts were presented in a technologically and visually enriched format.

DESIGN/METHOD

Threshold concepts as well as complex knowledge that require higher order thinking were identified using a subset of data from **data** of the course **collected** in previous semesters. For each concept, a suitable multimedia resource was developed, for example videos and animations. These were then enhanced further by the addition of inking during Camtasia Relay recordings of lectures. The students were subsequently surveyed electronically to determine if there was an increase in their perceived level of understanding.

RESULTS

From the results it was clear that students reported an increase in their perceived levels of comprehension. The implementation of the improved techniques impacted on the final results of the students' grades, with a significant difference between the traditional technique and the new one, i.e. the new technique significantly improved the students' results. An unexpected phenomenon observed was an increase in the level of engagement in electronic forums. It appears that the newly applied technique encourages student discussions via online forums, which in turn enhanced their level of engagement.

CONCLUSIONS

The majority of the students preferred the delivery of lectures enriched with multimedia resources and an added layer of inking in the recordings. The survey conducted showed that 73 per cent of the students reported an enhanced understanding of both threshold knowledge as well as complex knowledge in the Engineering Materials course.

KEYWORDS

Multimedia resources, online engineering education, students' understanding, threshold knowledge, complex knowledge

Peer assisted learning in an online postgraduate course on engineered fibre composites

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BACKGROUND

While the attractiveness of courses delivered via distance learning increases to the working and remote students because of the flexibility they provide, it is more difficult for an examiner to keep these students engage in active learning than those in a classroom. Discussion forums were identified as one way of replicating the energy of face-to-face engagement in an online environment (Meyer, 2003). In the same way, peer assisted learning encourages active learning where students can explore answers through discussion (Cheng and Walters, 2009). Recently, the Australia's first online course on engineered fibre composites has focused on using both the online technical discussions and peer assisted learning as a tool to exchange knowledge and experience among practicing engineers and senior undergraduate engineering students to enhance their knowledge on fibre composite materials. This online discussion is introduced and included in the assessment criteria.

PURPOSE

How technical discussions facilitated students' learning and engagement in an online postgraduate course on engineered fibre composites?

DESIGN/METHOD

Discussion topics are designed and posted in the online forum such that it provide opportunities and a platform where students discuss and exchange ideas on technical issues in the context of their own experiences combined with their critical thinking on the different study modules of the course. The teaching team then facilitated the discussion to ensure a more active engagement amongst students and to keep the discussion focussed. The overall performance of the students are then analysed with respect to the quality of participation, questions and comments on the online discussion forum. The views and learning experiences of the students are also sought to determine the effectiveness of this learning and teaching method.

RESULTS

Results showed that the online discussions resulted in students to have a collective knowledge on different technical aspects of the course through the combine sharing of limited experience and knowledge by each student. There is also a good evidence of exchange of ideas among students rather than a flow of information from the teaching team. Moreover, the online technical discussion forums keep the high level of interest on the different study modules and active participation of students to learning. Most of the students indicated that the online technical discussions have been a very useful way to gain extra knowledge from other students. It was observed that the level of engagement among students and the exchange of ideas are highest on the discussion topic where the teaching team participated most. The results also showed that the students who are more active in the discussion forum achieved a better grade than those students who rarely participated in the forum.

CONCLUSIONS

Based on the results, peer assisted learning in online technical discussions is an effective tool to enhance a more effective student's learning and engagement. This provided an avenue to students to have a broader knowledge on engineered fibre composites through the combination of the shared experience and knowledge by each student. Moreover, it encouraged active learning where students can explore answers through discussion. The results showed that the students who actively engaged in the discussion forum achieved better grades.

KEYWORDS

Peer assisted learning, online technical discussion, fibre composites.

The impact on values and learning behaviours of engineering students from an authentic learning environment: Preliminary Analysis and Observations

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BACKGROUND

Cochrane & Goh (2008) explore a librarian's and course examiner's reflections on an information literacy experiment in a third year Materials Engineering course. Following this experiment, the course was restructured using authentic project-based learning and information literacy strategies. Authentic learning environments open up opportunities to help students learn about the value of research skills and the importance of professional sources. The research is framed around relational and constructivist pedagogy in that if students are immersed in a rich and authentic professional environment with real-time input from industry practitioners, they are more engaged with the learning experience as designed. This paper proposes that authentic learning environments designed around scaffolded learning opportunities have the ability to change the values and behaviours of engineering students. This paper provides additional research data that was not previously presented at the preliminary stage of the investigation. The observations and analysis presented are of a preliminary nature, hence, the suggested findings are provided with limitations on its reliability and validity.

PURPOSE

Literature points to the ability of changing values and learning behaviours of students via successful engagement. Two complementary engagement methods used are authentic case studies and/or problem-based learning approaches. This research aims to examine this assertion and proposes that even though certain learning behaviours are changeable via intervention; the underlying values may be too entrenched to be changed in one course, and will require systematic intervention across a program of courses. The initial behavioural change in itself will ultimately become another entrenched behaviour as dictated by the value system that confines it. This case study provides insights and generalisation to highlight this proposition. Further data and analysis is required to validate the proposition.

DESIGN/METHOD

The methodology used in this research is based on description case study approach, and the preliminary data collected from survey instrument is presented. Here, the descriptions of the impact on values and behaviours at one engineering course are based on observation and surveys applied to the participants. Other relevant data were collected but are not presented in this paper.

RESULTS

Data has been collected from 2009, 2010, 2011, and 2012. The findings suggest that even though the intervention is effective in changing certain behaviours, and definitely provide renewed engagement with the learning opportunities presented, the underlying values and other entrenched behaviours appear to be difficult to change over one semester.

CONCLUSIONS

Authentic learning environments supported by project-based learning and information literacy strategies does open up opportunities to help students learn about the value of research skills and the importance of professional sources.

KEYWORDS

Authentic learning; Problem-based learning; information literacy; student engagement.

Student Perceptions of Teammates' Performance: Influence of Team Formation Method

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BACKGROUND

This study investigates the group dynamics within the third problem-solving course in a series of four studied by on-campus and distance-education students. The cohorts were organised into teams of on-campus and distance-education students. The distance-education students were further organised into teams comprised of members from the same city or region (where possible). The motivation for this practice was to provide the opportunity for some social interaction for students who otherwise can feel isolated. Research has indicated that colocated teams tend to behave in a more socially-oriented fashion, while distributed teams tend to behave in a more task-oriented fashion. This paper is interested in how the team formations affect peer assessments to obtain individual marks.

PURPOSE

The hypothesis is that distance-education students placed in colocated teams will tend to behave more like the on-campus students when completing and reviewing their peer assessments.

DESIGN/METHOD

Where possible, distance-education students were grouped together in the same city or otherwise in the same region; the remaining students were randomly allocated to teams. A survey was conducted at the end of semester to ascertain their experiences of the peer assessment; trends from the survey are compared across two years to provide evidence to support the hypothesis.

RESULTS

We found that to some extent the social aspects of being in a colocated team resulted in these distance-education students to treat the peer assessment in a similar manner to the on-campus students, that is they had a heightened level of interest in the outcomes and how that impacted their team. A major contributor to the colocated distance-education students' behaviour change was the introduction in the latest offering of an initial practice (formative) peer assessment that encouraged them to critically assess at an early stage whether their team was working effectively. A low response rate for the on-campus students to this formative peer assessment delayed this influence, evident once they had completed the first summative peer assessment (after the first assignment), but it was not observed at all in the distributed distance-education students.

CONCLUSIONS

The results suggest that collocating teams improves social-orientation and collaboration by facilitating the opportunity for students to meet face-to-face. This is in contrast to random allocation of these teams that other investigations suggested were prone to be more task-oriented. This orientation directly affects how the students undertake the peer assessment task: while all students see it as an opportunity to allocate marks fairly, the colocated teams were more likely to use the review of the results as an opportunity to change their behaviour.

KEYWORDS

Group work; Peer assessment; Collocated teams.

Barriers to Adopting Remote Access Laboratory Learning Activities

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BACKGROUND

Laboratories form an important part of engineering education and program accreditation. Delivering practical learning activities for distance students is difficult. There have been many initiatives in this space from small scale experiments to large scale national and international projects, such as Labshare (Lowe et al., 2009) and iLab (Harward et al., 2008). Current literature suggests that a lot of attention has been paid to implementation details of individual experiments and systems. However, the impact of learning activities has received little attention. Anecdotal evidence also suggests that these technologies are not widely used as learning and teaching tools. By investigating a number of Remote Access Laboratory (RAL) activities that are hosted in a common environment (Kist & Gibbings, 2010), this study investigates barriers that inhibit the wide application of this technology.

PURPOSE

What are the barriers for inception and implementation of learning activities that employ RAL technology?

DESIGN/METHOD

Five learning activities have been evaluated that make use of RAL technology. The activities are at various stages in the implementation cycle and include learning activities in three different disciplines. A mixed methods approach has been used that included interviews with staff, observations and focus groups with students. A program logic approach (Taylor-Powell, Jones, & Henert, 2003) has been used to map inputs activities, outputs and outcomes of the RAL implementation. Barriers in the conception and realisation process have been identified.

RESULTS

A number of barriers exist that inhibit the wide and rapid deployment of RAL activities. This paper focuses on conceptual and pedagogical issues. Key barriers include: limited understanding of what RAL is and what RAL can do; learning tasks have to be newly defined; and, specific learning activities have to be designed and learning materials have to be developed.

CONCLUSIONS

The paper concludes that from an educational perspective, RAL activities should not be treated differently from any other learning activity and attention should be paid to the principle of constructive alignment. Design and implementation of RAL learning activities is not simply a case of rewriting material for face-to-face delivery, generally, it requires a careful scaffolding of the learning activity.

KEYWORDS

Remote Access Laboratories, practical learning activities, implementation barriers.

Students' self-assessment of assignments - is it worth it?

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BACKGROUND

Self-assessment refers to the involvement of learners in making judgements about their own learning, particularly about their achievements and the outcomes of their learning (Boud & Falchikov, 1989). Enhanced learning and professional development are the desirable end effect of self-assessment. However, questions are often raised about the reliability (i.e. accuracy and consistency) of students' self-assessment. Recent studies have revealed substantial discrepancies in students' self-assessment performance in terms of accuracy and consistency, potentially leading to the rejection of self-assessment. Hence, understanding the scope and limitations of students' self-assessment is critical.

PURPOSE

This study was intended to examine the reliability and importance of self-assessment, and uncover other significant learning and professional development benefits of students' self-assessment.

DESIGN/METHOD

Over the last three years, a longitudinal study of self-assessment of an assignment was conducted of successive first year university student cohorts, comprising of more than 75 per cent distance students. Students were asked to self-assess their assignments with the help of self-assessment guidelines and model answers. On the self-assessment feedback rubric provided, they allocated marks and provided justification for the marks for each assignment answer. Feedback from students' self-assessment was analysed quantitatively to examine the accuracy and consistency of self-assessment with respect to tutor's assessment, and qualitatively to understand the impact of self-assessment in their learning and professional development.

RESULTS

A comparison of students' self-assessment marks with the tutor's assessment marks showed that the majority of the students (~ 47%) overestimated their performance, while a significant proportion (~39%) remained within ± 10 per cent of the tutor's assessment marks, and the remaining (~14%) undervalued their work. Correlations between students' self-assessment and tutor assessment marks ranged between -0.14 to 0.8 for various on campus and distance student cohorts. The accuracy of students' self-assessment was less than promising when considering tutor's marks as the benchmark (or expert judgement). These results are consistent with the findings of many other researchers including Boud & Falchikov (1989) and Lew et al. (2010). A wide range of correlations between various student cohorts also showed the lack of assessment consistencies. Therefore, students' self-assessment may not be a reliable (i.e. accurate and consistent) assessment technique even though some researchers have reported improved reliability under specific circumstances (e.g. Ross, 2006; Ward et al., 2002; and Rolheiser & Ross, 2006). The study has revealed that the major contributor to learning during students' self-assessment is not the accuracy or consistency of students' self-assessment. Instead it is the change in students' psychological perspectives when they go through the process of self-assessment. In this study metacognition, constructivist learning, and self-efficacy have been identified as triggers to students' learning and professional development during self-assessment.

CONCLUSIONS

The study has demonstrated that students vary considerably in assessing their own work. Hence, the learning gained during students' self-assessment may not come from the accuracy and consistency of self-assessment. Instead, it is triggered by the change in students' psychological perspectives resulting in metacognitive knowledge, learning constructivism and development of self-efficacy.

KEYWORDS

Students' self-assessment; accuracy; consistency; metacognition; constructivist learning; self-efficacy.

Examining First Year Students' Preparedness for Studying Engineering

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BACKGROUND

This national project builds on recent studies that have aimed to develop strategies to enhance enrolment, progression, and graduation rates in engineering programs. Implementing these strategies will help to address the critical skills shortages in the engineering profession in Australia. To ensure the outcomes have wide applicability, the project team has deliberately drawn students from five universities that cover the spectrum of Australian universities and engineering programs: the University of Southern Queensland, the University of Queensland, the University of Technology, Sydney, the University of Newcastle, and the University of New England.

PURPOSE

The purpose of this paper is to report on initial descriptive data of this longitudinal project which will examine the knowledge, motivation, personality, and learning approaches of first year engineering students and how well they each predict subsequent retention and academic performance. These outcomes are yet to be achieved and are beyond the scope of this paper.

DESIGN/METHOD

An online battery of self-assessment tests was developed for this project based on diagnostic pre-testing used by a number of the participating universities, and other standard measures. The battery measures cognitive abilities (e.g., spatial, maths, physics, and chemistry) and non-cognitive abilities and traits (e.g., personality traits, career interests, and approaches to learning) of first year engineering students. Retention and academic results at the end of first year will be used as outcome variables, and regression analyses will be used to ascertain which of these variables are reliable predictors of academic success. Focus group data will enable some qualitative amplification of these results.

RESULTS

Outcome variables for the project will not be available until the end of 2012, however, this paper reports on preliminary descriptive and cognitive data from 505 first-year students commencing engineering studies at the five partner universities in Semester 1, 2012. Overall, students reported that they found the self-assessments and personalised feedback helpful in preparing them for their studies. Half of those who completed the cognitive skills quiz scored better than 70% across the range of questions. Results in physics, chemistry and spatial abilities were consistent across programs and study modes. However, students in two-year and three-year programs did not perform as well in maths as those in four-year degree (or equivalent) programs, and external students did not score as well in maths as did students enrolled on-campus. The implications of these findings are discussed.

CONCLUSIONS

First-year engineering students indicated that they enjoyed the opportunity to self-assess their readiness and to be linked with early support where needed. Data from the battery will inform the development of the Engineering Career Appraisal Tool (EngCAT), an online educational resource that will enable school students and mature-age people who might be considering engineering as a career option to self-assess their cognitive and non-cognitive capabilities and skills.

KEYWORDS

First year engineering students, academic success, cognitive abilities, non-cognitive abilities.

Power of Engineering: Changing the perceptions of year 9 and 10 female school students towards an engineering career

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BACKGROUND

The engineering profession in Australia has failed to attract young women for the last decade or so despite all the effort that have gone into promoting engineering as a preferred career choice for girls. It is a missed opportunity for the profession to flourish as a heterogeneous team. Many traditional initiatives and programs have failed to make much impact or at best incremental improvement into attracting and retaining more women in the profession. The reasons why girls and young women in most parts of the world show little interest in engineering haven't changed, despite all the efforts to address them, the issue proposed here in this paper is with the perceptions of engineering in the community and the confidence to pursue it. This gender imbalance is detrimental for the engineering profession, and hence an action-based intervention strategy was devised by the Women in Engineering Qld Chapter of Engineers Australia in 2012 to change the perceptions of school girls by redesigning the engagement strategy and key messages. As a result, the "Power of Engineering Inc" (PoE) was established as a not-for-profit organisation, and is a collaborative effort between government, schools, universities, and industry. This paper examines a case study in changing the perceptions of year 9 and 10 school girls towards an engineering career.

PURPOSE

To evaluate and determine the effectiveness of an intervention in changing the perceptions of year 9 and 10 school girls about engineering career options, but specifically, "What were their perceptions of engineering before today and have those perceptions changed?"

DESIGN/METHOD

The inaugural Power of Engineering (PoE) event was held on International Women's Day, Thursday 8 March 2012 and was attended by 131 high school female students (year 9 and 10) and their teachers. The key message of the day was "engineering gives you the power to change the world". A questionnaire was conducted with the participating high school female students, collecting both quantitative and qualitative data. The survey instrument has not been validated.

RESULTS

The key to the success of the event was as a result of collaboration between all participants involved and the connection created between government, schools, universities and industry. Of the returned surveys (109 of 131), 91% of girls would now consider a career in engineering and 57% who had not considered engineering before the day would now consider a career in engineering. Data collected found significant numbers of negative and varying perceptions about engineering careers prior to the intervention.

CONCLUSIONS

The evidence in this research suggests that the intervention assisted in changing the perceptions of year 9 and 10 female school students towards engineering as a career option. Whether this intervention translates into actual career selection and study enrolment is to be determined. In saying this, the evidence suggests that there is a critical and urgent need for earlier interventions prior to students selecting their subjects for year 11 and 12. This intervention could also play its part in increasing the overall pool of students engaged in STEM education.

KEYWORDS

Women in Engineering; Girls in Engineering; Perceptions of Engineering; Engineering Careers.

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