VISIONARY / COLLABORATIVE
STEM TEACHER CONFERENCE

‘Cross Pollinating the Curriculum’

Saturday 25 July 2015

Presented by
School of Mathematics & Applied Statistics
School of Education
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Conference Convenors

Dr Caz Sandison
School of Mathematics & Applied Statistics
Faculty of Engineering & Information Sciences

Dr Tricia Forrester
School of Education
Faculty of Social Sciences

Contact Sue Denny for further information. sdenny@uow.edu.au

This conference is supported through the Inspiring Mathematics and Science in Teacher Education (IMSITE) Grant.
http://www.imsite.edu.au

Project initiatives information:
Collaborative project to improve mathematics and science in teacher education:

Work Like a Mathematician Days:

Learning in the CLOWD room to improve mathematics teaching in schools:

Conference webpage
Please check back at the conference webpage for updates to this program.

Registrations
Please register using the link at the bottom of the conference webpage. All meals, drinks and resources are included in the $80 registration fee.

Location
This conference will be held in the McKinnon Building (Building 67) on the University of Wollongong campus (http://www.uow.edu.au/about/campusmap/index.html). There is a lift and ramps for wheelchair or easy access to all venues.


Getting here
If you require directions to get to the university please consult: http://www.uow.edu.au/transport/index.html. The university is a short walk from the North Wollongong train station. Trains run regularly on a Saturday from Sydney (http://www.uow.edu.au/transport/train/index.html), however please check closer to the time in for any rail works on the line.
There is a free Wollongong city shuttle bus that stops at the university on a Saturday (http://www.uow.edu.au/transport/shuttles/index.html).

**Parking**

There is free parking available in most parking areas on the day of the conference. Please ensure that you do **not** park in restricted parking areas or disabled car spaces unless you have the authority to do so. The campus parking is monitored and fines may be issued with penalty notices that are processed by the State Debt Recovery Office, Office of State Revenue, NSW Government. Further information: http://www.uow.edu.au/parking/restricted/index.html.

**Speed Share Opportunity**

A time has been allocated in the afternoon for a Speed Share session whereby a presenter is allocated 3 minutes to share 1 practical idea that other participants can take away and implement in their own classrooms.

If you are interested in participating in this speed share opportunity, please forward a brief outline (including syllabus areas that are covered) and any contact details to Sue (sdenny@uow.edu.au) so that you can be allocated a suitable audience. Any resources that you wish to be distributed to the participants should be sent prior to the conference for copying or uploading to the USB, or bring some copies with you on the day. Please note: there will be no access to photocopiers on the day.

**Resources from the day**

A USB containing resources from the speakers will be issued to each participant of the conference.

**Participant contact list**

A list of participants and their contact details will be issued. Please advise Sue if you **do not** wish your name to appear on the list.

**Professional Development**

This conference has been endorsed by BOSTES as professional development for registered participants. Attendance at this conference will contribute to 6 hours towards Proficient Teacher accreditation.
## Program

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Morning Session

Professor Ian Chubb AC MSc DPhil (Oxford) FTSE, FACE, FRSN
Chief Scientist, Australian Government

Biography

Professor Ian Chubb commenced in the role of Chief Scientist for Australia in 2011.

Prior to that, Professor Chubb was Vice-Chancellor of the Australian National University from January 2001 to March 2011; Vice-Chancellor of Flinders University of South Australia for six years and the Senior Deputy Vice-Chancellor of Monash University for two years.

He was Chair of the Higher Education Council (the Commonwealth Government’s peak advisory body on higher education) from September 1990 to December 1994 and was, until mid-1994, Deputy Chair of the National Board of Employment, Education and Training (the Commonwealth’s peak advisory body on all matters related to the Employment, Education and Training portfolio).

From January 1986 to September 1990, Professor Chubb was the Deputy Vice-Chancellor of the University of Wollongong and Honorary Professor of Biology. During the period 1978-1985 he was an academic in the School of Medicine of Flinders University. Before that he was at Oxford University where, during the period 1971-1977, he was a Wellcome Foundation Scholar, a Junior Research Fellow of St John’s College, and a Royal Society Research Fellow. He spent 1969-1971 as a JF & C Heymans Research Fellow at the University of Ghent, Belgium.

Professor Chubb’s research focused on the neurosciences and was supported by the National Health and Medical Research Council, the Australian Research Grants Scheme and by various Foundations.

Professor Chubb was President of the Australian Vice-Chancellors’ Committee (AVCC) for 2000 and 2001, Vice-President for 1998 and 1999 and an elected member, or member, of the Board of the AVCC between 1996 and 2006. From January 2000 to December 2001 Professor Chubb was a member of the Prime Minister’s Science, Engineering and Innovation Council (PMSEIC). He serves, or has served, on numerous other Boards and Committees related to his university or Commonwealth responsibilities – in universities and in the public and private sectors.

In 1999 Professor Chubb was made an Officer of the Order of Australia (AO) for “service to the development of higher education policy and its implementation at state, national and international levels, as an administrator in the tertiary education sector, and to research particularly in the field of neuroscience”. In 2006 he was made a Companion (AC) in the order for “service to higher education, including research and development policy in the pursuit of advancing the national interest socially, economically, culturally and environmentally, and to the facilitation of a knowledge-based global economy”.

Professor Chubb was the ACT’s Australian of the Year in 2011. He has been awarded five honorary doctorates: a DSc by Flinders University in 2000; a D.Litt by Charles Darwin University and a D.Univ by the Australian National University, both in 2011; an LLD by Monash University in 2012 and a D.Univ by the University of the Sunshine Coast in 2014.
He was elected a Fellow of the Australian College of Education in 2008 and a Fellow of the Academy of Technological Sciences and Engineering and Fellow of the Royal Society of New South Wales in 2014.

Caz Sandison

IMSITE Project leader, School of Mathematics & Applied Statistics, Faculty of Engineering and Information Sciences, University of Wollongong

Biography

Carolyn (Caz) Sandison is a Senior Lecturer in mathematics and the Head of Students in engineering at the University of Wollongong. An award winning lecturer, she has a keen interest in mathematics education, spending lots of time with students and working out more effective ways of teaching and assessing-while thinking about Topological Groups in her spare time. Caz is presently leading a project at UOW looking at how to better recruit, train and retain maths and science teachers through collaboration between discipline experts (mathematicians and scientists) and educationalist experts.

Tricia Forrester

IMSITE Project leader, School of Education, Faculty of Social Sciences, University of Wollongong

Biography

Dr Tricia Forrester is the Head of Students at the School of Education, University of Wollongong. She lectures in Secondary, Primary and Early Childhood mathematics education, having completed her B.Ed. (Hons 1) and PhD in mathematics education. Her mathematics education research interests are currently focused on improving the mathematics content knowledge and pedagogical content knowledge of pre-service primary school teachers, and the utilisation of whiteboard rooms to improve the engagement and learning outcomes of students in mathematics classrooms in a range of educational settings.
**Ian Sheppard**

Wesley College, Perth, Western Australia

**Title:** Big ideas and challenging problems, facilitating integration and differentiation.

**Abstract**

For many teachers there is a pressured feeling to “get through the course”. That is, a feeling of obligation to teach students the skills required to pass the next test or the high stakes assessment. Since these assessments are often skill and memory focused, teachers may then teach to the test. However, a broader perspective suggests there are alternatives. For example, in STEM or in a particular STEM discipline, we might ask what is it that is central to what we want our students to come away with? In my school we contend that experiencing mathematics as a worthwhile engaging problem solving activity is indeed the desired outcome. Adopting this perspective has resulted in less pressure on teachers to get through the curriculum, enabled greater integration of content and lead to enhanced opportunities for challenging problems from which the content is uncovered.

**Biography**

Ian is currently Head of Mathematics at Wesley College in Perth where he has been since 2008. He is passionate about supporting students to experience mathematics as a meaningful problem-solving activity and employs an inquiry/problem solving approach in his classroom. He has written materials to support the use of CAS technology in the Senior Secondary years, including being the principal author in the ClassPad activities series of books. He has previously worked as a writer with HOTmaths and as a mathematics consultant in New York City, after many years of teaching in South Australia. He has fond memories of his time at the Australian Science and Mathematics School in Adelaide where an inquiry approach was implemented for Years 10 -12 mathematics courses.
Peter Thompson

BOSTES

Title: NSW Syllabus opportunities in STEM, reflections on practice

Abstract

In 2010 an integrated STEM program was taught to year 9 engineering students at a South West Sydney high school. This involved using gaming strategies to develop skills in mathematical analysis to apply scientific principles to solving engineering problems. This unit of work meets requirements of the Board of Studies Teaching and Educational Standards (BOSTES) syllabus in Industrial Technology (Engineering) module on structures. Students learn about insulation, K and R factors, thermodynamics and computational fluid dynamics while learning structural engineering principles. Students learn to apply formulas for the calculation of heat loss. They are then challenged, in groups of 4 to design a structure that will not only survive the wind loading of an Alaskan winter but also provide the thermal properties that will keep 4 bodies alive for 72 hours given the calculated heat loss. This application of project and problem based learning exemplifies an integrated STEM approach where students see the use of knowledge in real world application. The student’s performance in NAPLAN was tracked from year 7 to year 9 and the group of students who participated in this class had the greatest value added of any other individual group at the school. As the BOSTES inspector, an update will be included regarding the impact of Australian Curriculum developments on NSW syllabuses.

Biography

Peter was formally head teacher, Technology at Bossley Park High School, South Western Sydney. He has previously been a Supervisor of HSC Marking for Design and Technology, Automotive Technology and ElectroTechnology. Examination committees in Design and Technology, Industrial Technology and Engineering Studies. Peter has presented at state, national and international conferences regarding Design, Technology and Engineering education in Australia.
Scott Sleap
Center for Geotechnical and Materials Modelling and Australian Research Council, Centre of Excellence for Geotechnical Science and Engineering, The University of Newcastle, Maitland Grossmann High School Cumberland St East Maitland N.S.W

Title: Integrated Science Technology Engineering & Mathematics Curriculum

Abstract
Regional Development Australia (RDA) in the Hunter Region has designed and implemented an innovative school based program to improve career pathways for young people in Science, Technology, Engineering, and Mathematics (STEM). The Hunter “ME Program” is one of three Defence Materiel Organisation (DMO) projects nationally with a total budget of $12,000,000 over five years. The program involved contextualising the NSW Year 9 to 12 curriculum with real world experiences with an emphasis on advanced manufacturing technologies. The program allowed for the development of an embedded cross disciplinary school based curriculum known as iSTEM. Its creation was as a result of collaboration between science, engineering and mathematics teachers, and local manufacturing industries. It integrates the traditionally separated STEM subjects in an environment which utilises higher order problem solving strategies and employs emerging technologies such as robotics and additive manufacturing. Problem based learning strategies and industry collaboration was integral to the success of the School Developed, Board Endorsed Course (SDBEC). Significant increases in student enrolment data for the broader “ME” program and the steady increase in the number of schools adopting the iSTEM curriculum demonstrates its potential to meet the many of the outcomes mentioned in the recent review of STEM by the Chief Scientist, Ian Chubb.

Biography
Scott Sleap has been a Head Teacher for over ten years, and is currently in the position of Head Teacher, Teaching and Learning at Maitland Grossmann High School. Scott is nearing completion of his PhD in Engineering at The University of Newcastle after receiving a research scholarship in 2010. He has worked as a casual lecturer in both undergraduate and postgraduate studies at The University of Newcastle, specialising in Engineering, Technology and Applied Studies. Scott has been a consultant for the highly successful advanced manufacturing school pathways program known as “The ME Program”. He has helped produced a large array of STEM based curriculum material, including the innovative iSTEM program. Scott has been an educational consultant for Video Education Australia helping produce many engineering and design based educational videos. As a Higher School Certificate marker in Engineering Studies, he has experience at many levels of marking operations. He is a dedicated Technology Educator who has a passion for STEM and promoting public education.
Steve Delaney
Warrawong High School

Title: Engaging low SES Community students in iSTEM

Abstract

In this talk, I will present ideas on practical maths activities in Technology, Design and Engineering based subjects targeted at engaging low SES students. I will focus on ideas that ensure all students are provided early experiences with a range of technology and engineering opportunities that form the foundations for a fun and exciting potential future involved in STEM learning experiences. I will demonstrate some of the engaging STEM curriculum activities we engage our Stage 3 & 4 (Years 5-8) students in including; ‘Blow Me Up’, ‘An Engineers Career’ & our F1 in Schools & Aeronautical Velocity Challenge initiatives.

During the presentation we will explore some hands on simulated engaging lessons including the design, construction (and potential destruction) of timber towers, design, evaluation and mathematical application engineering bottle rockets, and participate in a brief collaborative computer aided design session.

Biography

Steve is a head teacher at Warrawong High School and has been involved in teaching STEM for many years. He is the F1 in Schools Illawarra Hub Coordinating Teacher. Steve is particularly passionate about transition programs and Stage 4 Technology (Mandatory) to provide early opportunities of Engineering for these students.
Matt Scott
Canobolas Rural Technology High School

Title: STEM at Conobolas Rural Technology High School

Abstract
Currently CRTHS is developing 10 week STEM units of work, featuring Science, Mathematics and Design and Technology for Stage 5 (NSW Year 9&10 students). This unit of work is to be trialed across Term 1 and 2 and then implemented across CRTHS as a STEM unit.

This unit centres on a mousetrap powered dragster. Euan Lindsay (Foundation Professor, CSU Engineering School, Bathurst) is acting as the client. His fictional racing team gives away these dragsters as a promotional item and would like them redesigned to be smaller and either faster, have greater endurance or be more predictable (ability to stop where predicted). Students, in groups of three, build a control dragster, test and record results for performance. Students will conduct experiments and research in order to improve their dragster’s speed, endurance or predictability. This will culminate in a race day where teams will present and demonstrate their modified or redesigned dragsters to the client. This unit has been developed by a team of teachers representing each of the STEM areas and will be delivered within Science and Mathematics lessons within the existing timetable structure. CRTHS has also developed a Technology (Mandatory) unit for the iiate Aeronautical Velocity Challenge, which suggests outcomes for learning from the Mathematics and Science syllabus as a STEM activity.

Biography
Matt Scott is Head Teacher Technology and a leader of the STEM team at the Canobolas Rural Technology High School in Orange NSW. CRTHS includes a large number of low socio-economic and 20% Indigenous students. He is a HSC marker for Design and Technology. Matt’s interests include integrating educational technologies like 3D printing, Laser cutting, coding and micro development computers like Raspberry Pi into class programs to enhance student engagement and to promote the STEM message. Currently Matt is developing a whole school STEM strategy for implementation at CRTHS in 2016.
Cassandra Portelli

Hunter School of the Performing Arts

Title: Framing the Truth: STEM Research for Students

Abstract

The Hunter School of the Performing Arts participated in the inaugural National Secondary Schools Poster Competition in 2014. This competition was organised by the Statistical Society of Australia, and delivered locally by Dr Peter Howley from the University of Newcastle. It involved students from Years 7-12 in research to produce an informative poster.

Students were provided with a list of possible research questions from across many fields of study. They were allocated a mentor from the University of Newcastle who discussed what made a good research question and helped to refine their data collection methodology. They were also allocated class time to pursue their research and present their findings. The posters were judged on clarity of message, data collection, analysis and conclusions, graphs and tables, presentation and creativity/importance.

In addition to providing an authentic venue for most relevant outcomes from the Statistics and Probability strand of the Mathematics Curriculum, the project saw students accessing and contributing information relevant to Science, Engineering and the Humanities, and using technology to record observations and present their poster.

This presentation will discuss how the competition was structured and presented to students, the types of tasks they chose to undertake, how they went about pursuing their research, and take a look at the products they created.

Biography

Cassandra Portelli (B Ec, Dip Ed, M Ed) is Head Teacher of Mathematics at Hunter School of the Performing Arts. She is passionate about Mathematics Teacher Education and is guest lecturing this year at the University of Newcastle. She is also keen on financial literacy (leading her to participate as a trial school in the National MoneySmart Program), and collaborative classrooms (she is currently co-teacher of a class of eighty Year 7 students, using choice matrices to encourage engagement in Mathematics). Last year she was involved with the inaugural National Secondary Schools Poster Competition, part of the International Statistical Literacy Project. Come find out what the competition is about, and how to get your students involved in 2015!
Bob Wheway

University of Wollongong

Title: Promoting STEM Education in NSW and ACT High Schools through 5 initiatives including a suite of competitions and a travelling STEM Roadshow

Abstract

This presentation will include the motivation for, the history of and the ongoing outstanding results of the following 5 initiatives:

1. Thirteen (13) High School STEM Competitions including three (3) Maths via Digital Media Competitions.
2. Three (3) Annual Engineering Studies Days.
3. The Travelling Rural/Indigenous STEM Roadshow.
4. The introduction of the Board of Studies endorsed iSTEM courses into Illawarra/South East Region High Schools.
5. The Aeronautical Velocity Challenge (AVC), a statewide NSW Competition organised jointly with the Institute of Industrial Arts Technology Education (iiate).

Biography

Bob Wheway has a BE (UNSW) with First Class Honours & the University Medal and a PhD (UNSW). He is a Fellow of UoW, an Honorary Principal Fellow in the Faculty of Engineering and Information Sciences at UoW and an Adjunct Associate Professor in the School of Engineering & Logistics at Charles Darwin University, Darwin. After an academic career at UoW commencing in 1968 and finishing in 1998, Bob, in 2000, started the first of the 5 STEM initiatives to be outlined in his presentation. From this very humble beginning in 2000 with a pilot Year 11 Engineering Studies Competition for High Schools between Bulli and Kiama, the current STEM initiatives at UoW are now viewed by many as state of the art - perhaps more precisely state of STEM.
Megan Vazey

Association of Independent Schools, New South Wales

Title: STEM Roadmap K-12

Abstract

In 2014 AISNSW embarked on an innovative Partnership in Education project to lift uptake, engagement and achievement in STEM. 25 AISNSW member schools were selected to participate in a range of projects from K-12 to invigorate teaching practice in the STEM disciplines, and to develop a set of shared project artefacts.

This talk will highlight some of the key themes in STEM in 2015, and provide a roadmap for successful STEM education from K-12, looking towards the future of Australian students as innovators, entrepreneurs, inventors, engineers, scientists and developers; while considering global, sustainable, and ethical futures.

We will examine knowledge as a neural network, tacit vs explicit knowledge, and various old STEM habits that seem to die hard. As well, we'll look through a historical lens, and think about lessons offered to students and educators in a range of engineering successes and failures.

To wrap up this session, participants will share in hands-on unplugged computational thinking exercises, and get some pointers for furthering their own personal education, research and development in STEM.

Biography

Dr Megan is currently the STEM (Science, Technology, Engineering and Maths) consultant at AISNSW. Over the past two decades Megan has worked as an R&D Computer Engineer with Zomojo, Alcatel, Canon (CISRA) and EMC. With a PhD in Computing (artificial intelligence and expert systems), first class honours in Electrical Engineering, and an Executive MBA, Megan has been a Senior Design Engineer, Project Manager, Software Consultant, and a Computational Analyst in High Frequency Trading. Megan has drafted several patents and is published in a number of conferences, journals and books. Most recently she was CEO of Techonauts Pty Ltd.

Megan is passionate about the STEM disciplines and is currently working in NSW schools to enhance uptake, engagement and achievement in these subjects. Her many interests include Computer Engineering, Software Development, Embedded C++, Python, Web development, Mindstorms, Raspberry Pi, Arduinos, Scratch, Minecraft and Robotics.
David Jacques
Corrimal High School

Title: Digging your way into Minecraft

Abstract

When Markus Persson released the alpha version of Minecraft in May 2009 he had no idea what was about to be unleashed. The simplistic game with terrible graphics has become revolutionary. Its ‘sandbox’ design has kept kids entertained for countless hours all around the world. A school in Sweden has made Minecraft a compulsory unit in Year 7. Why would they do this? What benefits are they finding from using this software? In this discussion I will be giving you a small taste into the world that is Minecraft and showing you some of the endless possibilities for education. My focus will be for a Mathematics class setting, but you will quickly discover this amazing game has applications across many KLA’s.

Biography

I am currently a Mathematics teacher at Corrimal High School and have almost reached my 10 years of teaching milestone. I hold a Bachelor of Mathematics and a Diploma in Education (Mathematics) from the University of Wollongong and am currently completing my Masters in Educational Leadership. For the past two years I have worked at the University of Wollongong as a tutor for a 3rd year Maths Education subject. I have also presented at the Universities Learning Labs program for gifted primary school students for the last two years and at a Summer session conference on Teaching Students with Difficulties in Mathematics - 'Learning Difficulties in Mathematics - Nature or Nurture?' - Jan 18th 2013. I have presented at two MANSW conferences: Speed share: Making Maths engaging - 2012 and Riding the way of change: Exploring the NSW Syllabus for the Australian Curriculum - 'Developing fluency in mathematics' - May 18th 2013.
Bernardo León de la Barra
School of Engineering and ICT, University of Tasmania


Abstract
Bernardo will describe some of the challenges and opportunities in the integration of STEM Curricula. He will also outline how to develop 21st century learners through integrated STEM curricular experiences. His talk will also provide some guidelines on how to attract students to non-traditional fields and occupations through integrated STEM Curricula. Finally, he will illustrate how to identify real-world contexts for the effective classroom integration of STEM content. Some of these discussions will be framed in a wheelchair sports context.

Biography
Dr Bernardo A. León de la Barra has been one of the main driving forces behind the integrated STEM education movement in Tasmania. His integrated STEM education work (http://www.utas.edu.au/stem) has been funded locally, nationally, and internationally, and seeks to highlight and promote the importance of integrated STEM education for Tasmania and Australia’s future. Bernardo has made major contributions to curriculum resources in two national projects: “Development of mathematics pathways for VET students to articulate to related higher education courses” (http://www.utas.edu.au/mathematics-pathways, funded by the OLT); and “STEMCrAfT (STEM Critical Appraisal for Teachers) Building capacity for rural and regional STEM teachers using a peer support model” (http://stemcraft.weebly.com), funded by the Australian Maths and Science Partnership Program (AMSPP). He is also a project team member in the 2015-2017 AMSPP project titled “Towards Educating Mathematics Professionals Encompassing Science and Technology (TEMPEST)” and in the 2015 OLT Seed Project “Reskilling the manufacturing workforce and developing capabilities for the future”.

Bernardo’s research interests include K-12 integrated STEM education and its role in attracting more girls and students from low SES, regional and rural communities to the STEM fields. He is also interested in exploring how a collective impact framework could be used to improve engagement, retention, completion and educational attainment in Tasmanian communities, with a particular focus on changing attitudes and raising educational and vocational aspirations through cradle-to-career integrated STEM education.