



FACULTY OF ENGINEERING

AUGUST 2007

International Recognition of Faculty's Excellence

The Faculty of Engineering recently won a World Bank contract in international competition with other European and Australian Universities to assist a University in Chile in the development of its engineering curriculum. The Chilean Government has had in place an imaginative and major Government program to 'guarantee Chile's transition to a knowledge based economy' since 1997. This is known as the 'MECESUP' program and is supported with over one hundred million US dollars funding. Part of this program is aimed at 'Renewal of the Undergraduate Curriculum' and our project is to support the renewal of the engineering curriculum at UTEM (Universidad Tecnologica Metropolitana)



Engineering Staff from Wollongong and UTEM at Teaching and Learning Workshop Conducted by Wollongong staff held in Santiago, Chile, in July. (From Left: Assoc. Prof Paul Cooper, Prof Chris Cook, Prof Patricio Olivares (UTEM Vice-Rector), Dr Anna Carew, Tom Goldfinch, Prof Jorge Lahsen (UTEM), Prof Tim McCarthy) .

in Santiago. A specified aim of the contract is to assist in curriculum design to 'Improve Employability of UTEM Graduates' in an international context.

Universities anywhere in the world operate in a changing environment and so continuous updating of curricula is a never ending demand. Changes in the economy, in technology, and in the expectations of employers of graduates, from government, industry and commerce, all contribute to continual change. Engineers, for example, are now routinely expected to have, in addition to their technical skills, substantial skills in finance, business, management, etc. So in

a fixed length undergraduate course difficult decisions have to be made to prioritize the many different 'Graduate Attributes' now required. Engineers and Uni-

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Dean's Spot

The only subject in NSW High Schools which specifically mentions engineering in its title is 'Engineering Studies'. The other subject close to the profession is 'Design and Technology'. It is in the interests of the engineering profession to encourage school students to choose to study these subjects as they provide the best chance students will have in their school training to get a taste of engineering so that, hopefully, a larger proportion of them will go to University to study to enter professional engineering.



Our Faculty, and our University, have supported a major program to put in place a comprehensive system of awards and prizes which has influenced many students to study these subjects. Students submit the engineering projects they have carried out during their studies. Their projects can be in any area and have covered many interesting and exciting fields from renewable energy to robots, to innovative household products, industrial machines, equipment for sport, bike riding, etc. Both students and their schools receive prize money and awards.

This program has now been in place for over 7 years and has achieved increased success every year since its inception. For example, the numbers of entries from students, the number and value of awards available, and the number of

Industry sponsors willing to provide funding for the program, have increased each year. Total funding now exceeds \$10,000, and over 11 separate Industries contribute funds to support nearly 40 separate prizes being awarded in total each year.

In addition the influence and reach of the program now extends to cover a substantial proportion of NSW's Year 11 student population, and provides significant support to regional schools and their students who generally do not have access to the support systems available to city students. Most of the prize winners have enrolled in engineering at Universities, and the influence of the program has extended far beyond the prize winners to include a significant percentage of their friends and peers.

The program is a remarkably successful and sustained attack on one of the major problems besetting the profession of engineering in Australia – the lack of knowledge about engineering amongst that part of the population which has the potential to make the largest long term difference to the profession – high school students. I cannot commend highly enough the excellence and effectiveness of this work, and the skills of the organisers and founders of this project, Bob Wheway and Elaine Bailey.

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TAFE Teachers Visit UoW

Engineering Faculty's Manufacturing Research Laboratory

A group of 15 teachers were given a tour of the Engineering Faculty's Manufacturing Research Laboratory (MRL) on Thursday 26th July. The metal fabrication and welding teachers from NSW & SA TAFE were attending a three week training course run by the Welding Technology Institute of Australia (WTIA). As part of the course they attended tours at the University of Wollongong and ANSTO, getting a glimpse of some of the welding research activities currently being undertaken in Australia and meeting with research staff behind these activities.

In the MRL, they were given a demonstration of the ABB robot welding cell by Diego Rodriguez (PhD student) and Dr Alex Nicholson. Alex and Diego have developed the hardware and software that allows an operator to remotely control a welding robot to repair damaged hydroelectric turbine blades in-situ, thereby avoiding exposure of the operator to cramped and sometimes dangerous working conditions. The operator specifies the area to be welded through an interactive vision system, and then the customised software performs the tedious task of mapping the co-ordinates of the damaged surface using touch-sensing. and automatically generates dozens or hundreds of lines of robot code required to systematically fill the damaged area using the gas metal arc welding (GMAW) process.

Drs Dominic Cuiuri and Alex Nicholson guided the group through a number of other research projects being conducted in the MRL. These include high-speed hybrid laser/GMAW welding, twin-wire GMAW welding, magnetically impelled arc butt (MIAB) welding of gas transmission pipelines, and welding fume formation rate minimisation for improved health and safety of welders.

The teachers showed keen interest in all of the projects, but the greatest number of questions were for the robot welding cell. But despite the advances made in automation, we still agree with the teacher who said: "you won't replace welders for those really tricky one-offs – and not the teachers who train them". Nor would we want to.

Metallurgical Research Facilities

A tour of the metallurgical research facilities was conducted by Dr Kristin Carpenter. Each group was first taken to the metallurgical lab in building 1 for a quick overview of materials preparation equipment, precision cutting machines and the advances optical microscopes. The group was awed by the power- and expense- of the Transmission Electron Microscope (TEM); particularly with the TEM's ability to resolve down to the 'nano-scale' and seeing images of atomic lattices. Due to their studies in the welding field, they appreciated being shown TEM images of welding fume particles.

The tour moved on to the Gleeble 3800, Thermomechanical Simulator. Here, the teachers were shown a range of samples to highlight the versatility of the machine. They were impressed with the Gleeble's ability to simulate a HAZ in welding, without doing a weld, which helped the teachers to understand the value of research.

The tour ended with a demonstration of the High Temperature Laser-Scanning Confocal Microscope in the BlueScope Steel Metallurgy Centre. A number of videos were shown of common reactions and solid-state transformations in steel. This was the highlight of the tour; many commented that the ability to see these transformations in real time would be a tremendous teaching aid, both for them and their students. The TAFE Teachers were full of questions and they thoroughly enjoyed the tour of the metallurgical research facilities.

Research Online

Congratulations to the following authors and co-authors: Buddhimma Indraratna, Alex Remmenikov, Sakdiract Kaewunruen, Cholachat Rujikiatakamjorn, I. Sathananthan, and A. S. Balasubramaniam. Their research publications have joined Top 10 Most Popular Articles available on Research Online.

Research Online is an open access digital archive promoting the scholarly output of the University of Wollongong, Australia. A large number of technical publications from all faculties and research institutes at UoW have been uploaded to Research Online System dating back to those published in 1991 (<http://ro.uow.edu.au>). The recent statistics updated as at 25 July 2007 showed two from Engineering have now joined the hot list of the Top 10 Most Popular Articles in Research Online. These are:

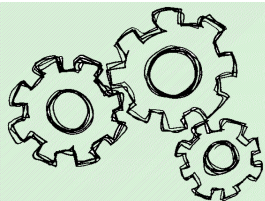
Rank #3: Nonlinear finite element modelling of railway prestressed concrete sleeper, by S. Kaewunruen and A.M. Remennikov from CME, which has been downloaded worldwide for over 1,800 hits, and

Rank #6: Analytical and Numerical Modelling of Soft Soil Stabilized by Prefabricated Vertical Drains Incorporating Vacuum re-loading, B. Indraratna, I. Sathananthan, C. Rujikiatkamjorn, and A. S. Balasubramaniam also from CME, which has been clicked for over 1,300 times.

All research students and staff are encouraged to upload their publications to UoW Research Online at <http://ro.uow.edu.au>.

Diary Dates

21 Aug	Faculty Research Committee
28 Aug	Faculty Postgraduate Research Student Committee
4 Sept	WAC
11 Sept	Faculty Committee



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versities also operate in an International environment and so curriculum designers must take into account changing developments world wide, such as the Bologna process in Europe, ABET in USA, and various international engineering accreditation systems such as the 'Washington Accord'. Individual Universities will also usually be seeking ways of developing features of their degrees which distinguish them from their peers. So there is no single right answer or single 'best' solution for all Universities-every one must find a set of 'Graduate Attributes' which best fits its own particular aspirations in its own particular national and international contexts.

At Wollongong we have recently undergone our own comprehensive curriculum review. We have now developed a number of methodologies and principles underlying the systematic development and implementation of a course which delivers the Graduate Attributes which we, after consultation with employers, government, industry and other 'stakeholders' have decided is right for our Faculty. To be effective this process takes considerable time and involves and engages all staff in much discussion and controversy. The basic course structure, the subject content, and just as importantly the teaching and assessment methods, for every single subject in the Faculty, has been examined and questioned, and coordinated changes made where required. At the end of this lengthy process we will be able to demonstrate that every graduate attribute we claim has been rigorously addressed and quantitatively assessed at some stage in every students' course.

The steps and methodologies we have used have been tailored to UTEM's requirements in consultation with UTEM. A team of 5 people from the Faculty gave an intensive workshop on this methodology in Santiago last week. The team consisted of the Dean, Professor Chris Cook, the Discipline Leaders of Mechanical and Civil Engineering: Assoc-Professor

Paul Cooper and Professor Tim McCarthy, our educational specialist in engineering curriculum, Dr Anna Carew, and Tom Goldfinch, the Project Officer (and also a Mechanical Engineering graduate). This team conducted workshops with UTEM academic staff to develop a curriculum review process appropriate for UTEM's unique environment. This included workshops with UTEM 'stakeholders' including UTEM graduates and their employers, to start the process of defining UTEM's Graduate Attributes. Many sessions were also held with UTEM academics to demonstrate some of the teaching techniques used around the world to develop in

graduates skills in problem solving, team and group work, a culture of lifelong learning, and so on.

Our UTEM colleagues were a delight to work with and the workshop produced much lively and constructive discussion about modern engineering curriculum development and the crucial importance of how we teach, as well as what we teach. It was very heartening to see how another tertiary system deals with these challenges, and to observe how much we can learn from each other as we, in common with academics all over the world, strive to produce the 'best' teaching and learning environment for our students.

Reinforced Polymer Conference

Muhammad Hadi recently visited the University of Jordan where he gave a small presentation about the University of Wollongong and his research relating to the use of fibre reinforced polymers (FRP) to strengthen reinforced concrete columns. Muhammad also met with the Head and academic staff of the Dept of Civil Engineering as well as the Dean of the Faculty. As a representative of UOW, Muhammad also visited UoW's agent in Amman, where he discussed further initiatives for increasing UOW's international student intake.

Muhammad also participated in The 8th International Symposium on Fiber Reinforced Polymer - Reinforcement for Concrete Structures, FRPRCS-8, organised by the University of Patras, Greece. This is an extremely important conference in the field of fiber reinforced polymer. He presented a paper on the eccentric loading of FRP wrapped reinforced concrete columns. Due to the number of conference delegates



The Rion-Antirion Bridge, Greece

there were four parallel sessions over three days.

The conference organised a site visit to the Rion-Antirion Bridge. This bridge was suggested by Prime Minister Charilaos Trikoupis on 29 March 1889 and was finally built and opened on 7 August 2004. Currently the bridge is the longest cable-stayed bridge in the world at 2252m, consisting of three central spans of 560 m and a span of 286m at each end. The bridge links the western part of Greece and the rest of the country. It links two major roads: The Patras-Athens-Thessaloniki road and The Kalamata-Patras-Igoumenisa coastal road.

Uow Students Wins International Prize

University of Wollongong budding engineer Rhyannon Ratz has won first prize as best student and the prize for writing the best journal at the course run by the International Institute of Women in Engineering in Paris.

This year's course topic was "Women in Global Engineering: Creating an Energy Efficient Future". Forty seven engineering students, male and female, from 17 countries attended the course.

Financial support for Rhyannon's trip came from the Faculty of Engineering and from Study Abroad.

During her three weeks in Paris she attended seminars by engineers from a range of countries and participated in three industry visits.

The main seminar material was on history and cultural dimensions of engineering, sustainability in engineering and business in different global regions, negotiation skills and women in engineering.

The industries that she visited were IBM France, Schlumberger and Peugeot. There were also other industry visits for groups of students to L'Oréal and Société Générale.

These industry visits gave an introduction to the different companies and allowed the students to talk with the engineers, particularly the women, and hear how they have developed their careers.

The faculty members also took the students on a tour of Sceaux Park (a public park designed to function sustainably) and the Musée des Arts et Métiers (a museum of engineering history and development).

Students also had to prepare three presentations and a reflective journal during the course. Each student prepared a personal poster presentation to introduce themselves and their country to the other course members.

They were also divided into area groups based on geographic region and energy groups made up of students from different regions. The area presentations were to research and present the origins and development



University of Wollongong Engineering student, Rhyannon Ratz.

of engineering and education in different regions of the world and how each country will approach engineering in the future.

"The energy assignment was to develop an area for a client that promoted energy efficiency and would be functional considering climatic uncertainty," Rhyannon said.

"I felt that the course was very worthwhile for my engineering studies and it was a lot of fun. It was good to meet other young engineers from all parts of the world, to visit industries and hear from female engineers about their experiences in the engineering world."

Reference: <http://media.uow.edu.au/>

Student Profile

Yulin Tu came to the University of Wollongong in 2006 after completing his Bachelor of Environmental Engineering at Shenyang Institute of Chemical Technology. "I had heard that Wollongong offered a better study environment than comparable universities in Sydney and I had been told that the quality of the University and program was very high which I found to be absolutely true once I had arrived".

Yulin progressed through the Master of Engineering Practice (Environmental Engineering) and elected to combine this

qualification with the Master of Engineering (dissertation) in order to gain a more intensive research element in a subject of his interest. Under the supervision of Associate Prof. Sivakumar, Yulin is undertaking a research project titled Greywater Treatment Using Ultrafiltration and Ultraviolet Technologies at Weerona College. "The onus was really on me to initiate the project, however, once I

had begun my professor (A/PR Sivakumar) was extremely supportive in helping me with the design and construction methods".



Masters student, Yulin Tu

"The professors are working on real-life research. By working on this project I have had to work with industry, purchase equipment from companies all over the world and hire professional staff (such as plumbers) to complete the job. These practical and management skills are certainly beneficial when looking for a career in Water and Wastewater Treatment/Water Distribution Engineering".