

New Approaches to Learning & Teaching in Engineering

▶ **Five years ago the Department of Mechanical Engineering in the University of Strathclyde embarked upon a radical change in its teaching methods for first year students.**

The aim was to introduce active and collaborative learning in the large lecture room through the use of Peer Instruction – a version of Socratic Dialogue ('teaching by questioning') developed by Professor Eric Mazur at Harvard University.

The standard lecture/tutorial/laboratory format of traditional instruction was replaced by a series of two-hour active-learning sessions involving short mini-lectures, videos, demonstrations and problem-solving all held together by classroom questioning and discussion. A custom built lecture theatre, the "InterActive Class Room" (to hold 120 students) was designed with group seating and, to assist Peer Instruction, Personal Response System (PRS). Peer Instruction was initially used in introductory mechanics and thermo-fluids classes, but was quickly extended to mathematics.

The following year a version of problem-based learning (mechanical dissection) was introduced into the design classes. Now students work in groups of four in the design classes, working together in the same groups in the InterActive ClassRoom. In 2000 the University built the first of its new Teaching Clusters – a managed suite of teaching rooms that includes additional InterActive ClassRooms, seminar rooms and the first Teaching Studio in the UK. Students now use the Studio for engineering analysis classes and their learning experience is a mix of peer instruction, problem-based learning and studio teaching.



Overall the change to active teaching styles, with collaborative learning, has been a huge success – both in terms of student performance and retention. An independent evaluation was carried out last year – it's probably best to let the students speak for themselves;

" ... with 100 people in the class you normally just sit there without being involved... and add to your notes. In that class everybody's involved, you have to think about what's being said...you have to stay awake...but it's more fun, you get more from it...better than just sitting taking notes ..."

" ... think you can learn a lot easier from the people that are the same age as you...if they've just grasped it then they can explain it in sort of easier terms than the lecturer...you suddenly understand it when a minute before it was difficult ..."

Professor Jim Boyle, Head of Mechanical Engineering, University of Strathclyde

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LTSN Engineering Progress Report

February 2002 - June 2002

Resources

LTSN Engineering is pleased to announce the publication of two major resources:

- Needs Analysis Report: Compiled from over 900 responses to our questionnaire "Influence the Future of Engineering Education" from you, our community, this report highlights the biggest issues you see for engineering education and the priorities LTSN Engineering should concentrate on. Many thanks to all whom responded. A PDF version of the report can be found at: www.ltsneng.ac.uk/er/na
- Working with Students with Disabilities: A useful and practical guide to the new disability legislation (SENDA) and how it will effect your department. The guide breaks down the terminology used within the Act and discusses how the legislation will effect your learning and teaching provision. The Act could have implications on your current admissions processes and this guide explains the UCAS disability coding system so that admissions tutors can feel prepared before interviewing candidates. It considers provision in terms of the physical environment, including teaching accommodation, as well as access to general support facilities and complaint procedures. It places emphasis on planning ahead, making facilities accessible and developing suitable learning and teaching resources that could be of benefit to all students. Further information on disability and the report can be found at: www.ltsneng.ac.uk/er/dts/dispguide.asp

If you would prefer to receive a paper copy of either of these reports please contact us at enquiries@ltsneng.ac.uk

Events

- It's been a busy time for LTSN Engineering's Regional Events, with 6 being held in the past four months. The variety of topics (*Mathematics and Student Retention; Problem-Based Learning; Finding and Using Learning Technologies; Student-centred Learning; Supply and Demand*) have attracted over 150 delegates to the events to not only learn about the issues but also to network with engineering academics from their region. Delegates have found these events both stimulating and worthwhile: *"This LTSN event went a long way towards dealing with many of the practical and pedagogical issues involved. The speakers and many of the delegates had a wide-range of experience to disseminate, raising awareness and confidence for those still teetering on the brink - and was for me a valuable event."*
- The New Legislation, New Opportunities - Implementing the new disability legislation* workshop was a joint venture between ourselves and five other LTSN Subject Centres whose disciplines use labs and/or fieldwork in their teaching. The 80 delegates were given the opportunity to reflect on current teaching practices in their department and discovered how they could make their courses better for all students. www.ltsneng.ac.uk/nef/events/past_ltsn.asp

LTSN Engineering Team News

- LTSN Engineering would like to welcome Liz Willis to the team as Project Officer. Liz joined the Centre at the end of April 2002 and is a qualified design and technology teacher.
- Fiona Lamb, Centre Manager, is currently on maternity leave until February 2003. All the staff would like to wish her good luck with her imminent arrival.
- The LTSN Engineering team would like to send our congratulations to Rob Pearce (Web Developer) who became a first-time-father to Alexander Aiden on the 10 June 2002.

Engineering Mini-Projects



The 2nd Phase of LTSN Engineering's Mini-Projects has again raised a great deal of interest from the engineering community, with 23 proposals received. The following 5 Mini-Projects were successful and are funded up to a max of £3000. Further details on all our Mini-Projects are available at:

www.ltsneng.ac.uk/hec/mini_projects

Working as Part of a Balanced Team

Dr Daphne O'Doherty, Cardiff School of Engineering, Cardiff University

This Mini-Project will consider the effects of defining groups by using a systematic and rational method that identifies balanced teams as defined by the Belbin technique. Students undertaking two design studies will be divided into groups using the Belbin technique for one study and an undiscerning method for the second study. Comparisons will be made between the behaviour, development and workings of the individual groups throughout the design studies.

Challenging the Role of Mathematics in Engineering Education

Prof Jack W Ponton, Chemical Engineering, The University of Edinburgh

Engineering educators are concerned about the ability of today's students to handle the mathematics which traditionally underlies the teaching of engineering. At the same time engineering as practiced by graduates is becoming increasingly less dependent on a knowledge of classical mathematics, as the tools become embodied in computer packages. This Mini-Project will explore the idea that since most graduates no longer use classical mathematical skills, engineering teachers could substantially rethink the whole approach to their subject in order to eliminate the need for much of the classical mathematics, without damage to the quality of the 'engineering' element of students' educational experience or to their final performance as professional engineers.

Portable Learning and Assessment - Towards Ubiquitous Education

Dr Jane Magill, Robert Clark Centre for Technological Education, University of Glasgow

This Mini-Project explores the use of portable computing to increase the flexibility of access and delivery of course material in higher education. It develops a system for learning and assessment delivery via Personal Digital Assistants (PDAs) and evaluates the benefits of such delivery for engineering and technology undergraduate students.

Self and Peer Assessment of Group Projects in a Virtual Environment

Dr Edward Lester, School of Chemical Environmental and Mining, The University of Nottingham

As new technologies are introduced into education of undergraduate engineers, we need to understand how they can be effectively implemented to maximise the learning outcomes and ensure fair assessment. Students will be arranged into small groups, based on character types, and given tasks to perform in a newly developed virtual reality environment. Students will evaluate their own performance and that of other students in the group. By screening for character type then creating control groups the behaviour and relative success of each group can be compared with the character type profile of each group. Group tasks for which peer and self-assessment are most and least appropriate will be identified.

Enhancing Transferable Skills Development in Group Projects

Dr Colin Smith, Civil and Structural Engineering, The University of Sheffield

This Mini-Project is concerned with an enhanced approach to the development of transferable skills within group projects. The students undertake a series of focussed participative skills training exercises before embarking on the main project. The expectation is that through repetition of these exercises, students develop skills more deeply and approach their application within the project more confidently. Debrief and reflection sessions during the exercises/projects ensure that the students engage more positively with this process. This Mini-Project seeks to trial this approach in further projects in the context of negotiation and running meetings, and to evaluate indepth the overall approach through focus groups and questionnaires.

Look out for a further round of themed Mini-Project funding in autumn 2002



Project Page

The following are projects which are based in a range of engineering disciplines and are funded under various national initiatives, such as TLTP (Teaching and Learning Technology Programme), FDTL (Fund for the Development of Teaching and Learning) and the HE Innovations Fund. Each project is producing resources that will be available nationally, with most of these resources being either free or at heavily subsidised rates.

A full listing of funded engineering education projects can be found at:

www.ltsneng.ac.uk/er/fund_projects

EASEIT-Eng

The EASEIT-Eng project assists engineering academics in selecting computer-based learning material that is right for them and their students. The EASEIT-Eng methodology has been used for almost 70 evaluations over the last three years. In March 2002, the project made its first Gold Awards to academics using computer-based learning materials or publishers of such material to recognise exceptional innovation in learning and teaching. The ten recipients of EASEIT-Eng Gold Awards 2002 can be seen below.



Funding for EASEIT-Eng comes to an end in August 2002 but LTSN Engineering will provide access to the project's resources through integration into our existing services; dissemination and transference of the methodology; publication of the evaluation methodology; and by providing evaluator training to enable further evaluations to take place. The Gold Awards will continue to be awarded on an annual basis as LTSN Engineering Gold Awards.

"MATCHING SECTIONS" for Civil Engineers

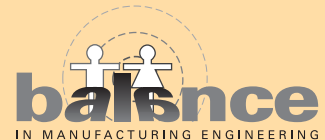
The Fund for Developing Teaching and Learning (FDTL) EMSIE Project – Embedding "Matching Sections" in Engineering – aims to provide guidance information to companies, universities and candidates on the Engineering Council's SARTOR 3 requirements for further learning to extend BEng and HND Civil Engineering knowledge.

The first BEng and HND students requiring Matching Sections will graduate this summer and a range of processes (accredited, approved and self-managed) are possible. Joint Board of Moderators' Guidance is available and the EMSIE team has written project guidelines for a sandwich-year or post-graduation works-based Project, which counts for 30% of the Matching Section.

The EMSIE project is concentrating on civil engineering and the team are holding a one-day Workshop at Nottingham Trent University on Friday 28 June where the latest information will be presented by a range of speakers.

The Workshop is free but by invitation as places are limited.

Contact Professor Roger Hawkins on e-mail: roger.hawkins@ntu.ac.uk or see the EMSIE website: www.ntu.ac.uk/emsie for further details on any of the above.



BALANCE

Balance is working to encourage, attract and retain a more balanced number of women and men into engineering in Higher Education across the country.

We are coming to the end of our first implementations with engineering departments across the country. These have worked very well and been highly beneficial to all involved. We are also looking for new partner institutions to work with us over the next year to bring WES groups and schools liaison to your engineering department.

The project is also working on case studies of existing practice in engineering departments in relation to recruitment and promoting engineering along with profiles of prominent female (and male) engineers. We are also looking for existing mentoring schemes to report on, especially those working with industry.

If you would like to get involved or find out more information about any of the projects above please visit our website at: www.balance.ac.uk or e-mail Kerry at: k.baker@lboro.ac.uk



MathComm: Inspiring the Next Generation

MathComm is a DfES Innovations project which is

- **EDEC software from the Electronic Design Education Consortium**
In recognition of an innovative and comprehensive approach to electronic design teaching that has met with widespread success.
- **Wolf Früh, Department of Mechanical and Chemical Engineering, Heriot-Watt University**
In recognition of innovation in the enhancement of student laboratory activity
- **Chris Hicks, Department of MMME, University of Newcastle upon Tyne**
In recognition of innovation in the development of an ambitious scheme to manage teaching to a large and diverse group.
- **MERIT, the Construction Management computer simulation**
In recognition of an innovative approach to management simulation that has succeeded on a local and national basis.
- **PSpice circuit simulation software from Cadence**
In recognition of its proven suitability for use in innovative learning and teaching contexts
- **Gethin Roberts, Institute of Engineering Surveying and Space Geodesy, University of Nottingham**
In recognition of innovation in the development and successful use of the SurCAL package
- **Elaine Smith, School of Engineering, Science and Design, Glasgow Caledonian University**
In recognition of sustained commitment to innovation in learning and teaching
- **Barry Beggs, School of Engineering, Science and Design, Glasgow Caledonian University**
In recognition of sustained commitment to innovation in learning and teaching.
- **Dave Whittington, The Robert Clark Centre for Technological Education, University of Glasgow**
In recognition of innovation in the integrated use of industry-standard software in a learning and teaching context
- **John Williams, Electronic Engineering, Aston University**
In recognition of innovative and creative developments to encourage student participation and independent learning

currently sending out multimedia CDROMs to every A-level mathematics class in England. These aim to encourage students to consider applying their mathematics to a career in electronics or communications. The team at the University of Westminster have worked on the principle that there is little time in schools for extra material, so examples are closely tied to the curriculum. Teachers and pupils have commented on how helpful it is to see how A-level subjects can be applied to real problems.

We believe that HE institutions are particularly well-placed to help bridge the school subject – career application gap in this way. This project is now almost finished, but there has been interest in applying similar techniques to other subject areas, and particularly in trying to interest younger pupils. We will be holding an exploratory meeting on "Inspiring the Next Generation" on Wednesday, July 3rd (see events listing). Here we will share feedback and lessons learned from this project, and work out ideas for future directions with possible sponsors and collaborators.

More details are available on the website at:
www.mathcomm.co.uk



PBLE

PBLE (Project Based Learning in Engineering) was set up to increase awareness of student based learning, through project work, in all branches of engineering education and to develop support material for academics based on a review of existing practice.

Dissemination of the material generated is an essential part of the project and a series of events is planned, including a competition during the 2002/3 academic year for academics involved in project based learning activities.

The competition is introduced by a flyer distributed with this newsletter and features not only prize money but also an opportunity to attend a conference in 2003 where awards will be made (winners will have their expenses paid).

A workshop, to be held at the University of Nottingham on the 6th November 2002 will introduce the initial volume of the manual which covers, in detail, the setting up, running, assessment and evaluation of engineering projects. In addition to presentations on these topics, the event will provide an opportunity for entrants to meet the competition organisers and obtain a copy of the manual.

Information on PBLE can be found at: www.pble.ac.uk
and details of the competition including the entry forms from:
www.pble.ac.uk/competition

M⁺ Maths for Engineers

Maths for Engineers WebDisk

In the January issue of Translate we invited comment on the Maths for Engineers WebDisk.

We heard from lecturers and students, and LTSN Engineering hosted a review day in April. Students had liked the webdisk, even without tutor mediation, and all agreed that it helped them learn maths. All would use it again. But lecturers wanted a bit more information. They were impressed, but the webdisk is a non-linear exploration rather than a course. A printed content guide would, they said, be useful. We shall provide this with the free webdisk to every HEI which asks for one.

The M4E WebDisk's fame is spreading and not just in mathematical and engineering circles. A distinguished medical radiologist, toying with the idea of e-training of radiologists borrowed a disk and declared "The DVD you lent me is stunning. I am contemplating a second career in engineering now that I can understand the maths!".

Jim Stevenson, Co-ordinator Maths for Engineers WebDisk,
e-mail: jim@ebstrust.u-net.com

SLICE

The SLICE project is an exciting new initiative based at the University of Plymouth promoting effective student-centred learning in construction related courses.

SLICE (Student-centred Learning in Construction Education) is a 3 year FDTL project which commenced in March 2001. The SLICE project is about encouraging and empowering construction lecturers across the country to produce effective student-centred learning materials and learning activities. The SLICE team comprises largely of building and civil engineering lecturers who are busy researching and developing the most effective ways of creating independent learning opportunities for students. The team's key messages are that student-centred learning works and that students (as well as lecturers) enjoy the variety it can introduce.

SLICE's first major output, a staff handbook on how to maximise the effectiveness of student-centred learning will be made available free to all building and civil engineering departments in England. The handbook will be followed by a suite of subject-specific "toolkits" which will be examples and production aids to help staff produce student-centred learning materials within their particular specialist areas.

If you would like to receive a copy of the handbook, or would just like to find out more please contact Melanie Parker,
Project Officer on 01752 233655,
via e-mail: mcparker@plymouth.ac.uk
or visit the Slice website: www.plymouth.ac.uk/slice

RAPID

RAPID 2000 Project

At present 9 Higher Education Institutions are engaged in the RAPID 2000 Project (FDTL Project 34/99). During this academic year (2001-2002) over 2000 students in the Built Environment and Civil Engineering disciplines will have begun to record their achievements, audit and develop their skills by using a version of the RAPID Progress File specifically developed for them.

Each version of RAPID is based upon the competence requirements set out by the respective Professional Institution (e.g. the Civil Engineering version has been developed with direct reference to the Core Objectives of the Institute of Civil Engineers (ICE)). Students develop skills compatible with these competence requirements and become accustomed to the processes (planning, reflection, documenting evidence) required to successfully complete a competence-based assessment programme.

In September 2002 the project team will hold a seminar to develop a policy and process to transfer the various versions of the RAPID Progress File to their respective Professional Institutions. Ownership of the original (Construction Management) version has already passed to the Chartered Institute of Building (CIOB), who will host it on their Website and promote its use by students on their accredited courses in the coming (2002-2003) academic year.

For further information on the RAPID 2000 Project visit the project website at: rapid2k.lboro.ac.uk
or contact the Project Manager, Alan Maddocks,
e-mail: A.P.Maddocks@lboro.ac.uk

REMIT: Reassessing the Roles of Mathematics and IT in the University Education of Engineers

The present moment is a turning point for university engineering education. IT tools have totally transformed the professional practice of engineers and this poses challenges and opportunities for education, not least in the area of mathematics.

The professional institutions in Civil, Structural and Building Services Engineering are clearing a path for change by relaxing the long-standing entry requirement of A-level mathematics. This will open up engineering career paths to students with a broad range of creative abilities, but who may have a limited mathematical background. Therefore many of these departments will need to consider some possibly deep-seated revisions of the mathematics they teach. Now is a crucial time for universities to consider how to continue to produce skilled engineers through reassessing what are the necessary mathematical skills and adopting novel ways to teach them.

This research project is a small-scale study to:

- look closely at the role of mathematics in university (civil and built environment) engineering courses and offer a vision of future directions for its teaching
- take a radical view of the kinds of mathematical knowledge and skills, that in the future, will need to be taught in engineering courses
- take detailed account of the possibilities of IT based teaching and learning methods

If you have any information, ideas or opinions on this topic REMIT would be pleased to hear from you! To find out more, visit the project website at: www.ioe.ac.uk/moss/REMIT
or contact Phillip Kent, e-mail: p.kent@ioe.ac.uk

**SearchLT
ENGINEERING**

Search LT can be used to search a catalogue of electronic learning and teaching resources relevant to UK HE engineering. It can be used to find material such as CD-ROMs of computer-based tutorials (e.g. the TLTP materials) and websites which contain texts and educational simulations. These may provide a few minutes material suitable for a lecture demonstration or cover an entire course. All the material is specifically designed for educational use or widely adopted in UK HE engineering.

To browse the SearchLT Database of over 100 records please see:

searchLT.engineering.ac.uk

Key Skills in Engineering

1. Does your department have any programmes designed specifically to help students develop any Key Skills?
2. Are the students' Key Skills developments formally assessed or recorded?
3. Does any other engineering department in your faculty have a Key Skills programme?
4. Does your university have a university-wide Key Skills programme or has it any plans to put one in place in the next year?

LTSN Engineering would very much like to get a national overview of developed good practice in embedding, assessing or recording Key Skills in any undergraduate engineering programme. By sending your answers to the above questions to enquiries@ltsneng.ac.uk you can help to inform this national picture.

The outcomes of this survey will be used in the "Key Skills in Engineering" guide currently being developed by Dr Roy Montgomery of the School of Civil Engineering at Queen's University, Belfast, on behalf of LTSN Engineering. The information gathered from the responses to the above questions will lead to the commissioning of specific engineering case studies on key skills to enhance the guide.

Further details on this project can be found at:
www.ltsneng.ac.uk/hec/key_skills

The EPC Engineering Graduate Output Standard

▶ **The EPC Engineering Graduate Output Standard was devised following widespread consultation both within higher education and with other key stakeholders, such as employer organisations and accrediting bodies. It defines the expectation of the attributes of all engineering graduates in terms of 26 generic statements of graduates' "Ability to..."**

The standard and methodology have been tested by nine 'pilot' universities who developed examples of benchmark statements, illustrating expected level of 'Ability to..' for a range of their engineering programmes in the main engineering disciplines. The Standard, its methodology and exemplar benchmarks are fully described in 'EPC Occasional Paper Number 10, December 2000 – the Interim Report of the EPC Output Standard Project'. Subsequently, five working groups were set up to undertake specific additional tasks, reporting to an overarching co-ordinating group :

- **Incorporated Engineer Working Group (IEngWG)** – tasked with determining whether the EPC Output Standard is applicable to and can be benchmarked for degree programmes for IEng aspirants
- **Professional Bodies Working Group (PBWG)** – tasked with exploring the benefits to accrediting bodies of an output standard applicable across all engineering disciplines
- **Employers' Working Group (EWG)** – tasked with clarifying the benefits to employers of the EPC Engineering Output Standard and with identifying significant omissions or modifications necessary to better reflect the needs of employers
- **Compatibility Working Group (CWG)** – a joint working group with QAA, tasked with demonstrating the compatibility of the EPC Output Standard with the QAA benchmark statement for engineering graduates
- **Assessment Working Group (AWG)** – tasked with supporting engineering departments in the development of effective and efficient assessment processes appropriate to the implementation of EPC Engineering Output Standard

The Interim Report and reports from all working groups have recently been published and distributed through the EPC Representative Members network. These, and a statement of the Standard are also available on the EPC website at:

www.engprof.ac.uk/pap/pap04.html

The work of the Assessment Working Group is not yet over and the EPC is continuing to collaborate with LTSN Engineering on assessment issues through the popular Output Standards and Assessment Workshops. We are pleased to announce that the Engineering Employment Federation have donated funds to allow this 5 day workshop to be repeated in 2003. Further details can be found at:

www.ltsneng.ac.uk/nef/events



translate translate

issue five

June 2002

transferring learning & teaching throughout engineering

about

LTSN Engineering is one of the 24 subject centres of the Learning and Teaching Support Network. The Centre provides subject-based support to promote high quality learning and teaching in engineering education.

If you would like to express your own opinions on this edition of **translate**, then please write to us at: enquiries@ltsneng.ac.uk and we will publish a summary on our website and in future editions of **translate**.

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contacts

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Talking Point

Widening Participation

► **Widening Participation (WP) is a key Government target and the funding councils have earmarked funding to universities to implement WP strategies. What are the implications of this for Engineering Departments?**

John Dickens, Centre Director, LTSN Engineering

WP means taking in students from social groups/communities that have not traditionally entered Higher Education. Most Engineering Programmes have had difficulties in recruitment as the numbers applying to study engineering have declined nationally. Therefore most engineering departments would welcome a new source of students. However these students are likely to have different learning skills/expectations and research suggests they are likely to need additional support if they are to succeed. Studies have indicated figures of up to 30% of additional resources may be needed. As another key government target is good retention rates, there has to be a commitment to ensuring good student progression.

Departments will need appropriate Learning, Teaching and Assessment strategies and appropriate support systems to deal with the increasing diversity of the student intake. To some extent engineering academics have had to deal with this trend already related to the declining Maths Skills of students from traditional backgrounds so academics have experience in this area.

What is clear is that WP should not equate to a lowering of standards. Engineering academics will have to face an increasing challenge of educating an increasingly diverse student group effectively whilst maintaining the output standards that the profession demands.

► **Would you like to receive multiple copies of this and future editions of **translate** for distribution within your department? If the answer is "Yes" please e-mail us at: enquiries@ltsneng.ac.uk stating how many copies you require and we will send them out to you.**

future events

A more comprehensive listing of events can be found on our website:

www.ltsneng.ac.uk/nef/events/

30 June - 5 July 2002

3rd Global Congress on Engineering Education

Glasgow Caledonian University

3 July 2002

Inspiring the Next Generation

University of Westminster, London

8 July 2002

Accessible Curricula: Good Practice for All

LTSN Generic Centre, London

18-22 August 2002

ICEE 2002: International Conference on Engineering Education

UMIST

5 September 2002

Learning and Teaching Support in Engineering

LTSN Engineering, Loughborough University

6 September 2002

Learning and Teaching Resources for Engineering

LTSN Engineering, Loughborough University

9-11 September 2002

ALT-C 2002 - Learning Technologies for Communication

University of Sunderland

1-4 October 2002

Global Changes in Engineering Education - 2002 ASEE/SEFI/TUB International Colloquium

Berlin, Germany

6-7 January 2003

Engineering Education 2003 - Access, Retention and Standards

Southampton Institute

8 January, 8-10 April & July 2003

EPC Output Standards and Assessment Workshop

TBA

1-3 April 2003

IMA Mathematical Education of Engineers Conference

Loughborough University