



“Loughborough University hosts both the Engineering Centre for Excellence in Teaching and Learning and the Engineering Subject Centre and therefore represents a current centre of gravity for engineering education in the UK.”

Dr Ruth Graham, ‘UK Approaches to Engineering Project-Based Learning’, White Paper, Sponsored by the MIT Leadership Program, 2010



## 13 years supporting engineering education at Loughborough University

**Celebrating the achievements of Loughborough University's engCETL in supporting engineering education spanning three decades**

This publication marks the culmination of five years of engCETL funding and a total of thirteen years of specialist support in engineering education at Loughborough. The Centre continues to build on its successes and is looking forward to future opportunities. It has demonstrated its impact and effectiveness in enhancing the learning experience of many thousands of students and of making a real and positive difference to the staff it supports within the seven engineering related departments. The engCETL's impact can also be felt across the University as it reaches out to all departments, each benefitting from staff members' expertise and their professional outputs.

The Centre's influence has now spread beyond the University, having widespread recognition of its achievements nationally and internationally both within higher education and industry. The engCETL is at the heart of activities, developments, connections and know-how in engineering education at Loughborough University. The key to success has been to co-locate and establish a team of professionals working in partnership with academics for the benefit of staff, students and the University as a whole. Over the past thirteen years the Centre has gone from strength to strength and continues to be an essential component of the broader University support services.

## The emergence of a highly effective focus for engineering education activity

In 1997 the University invested in a centre for engineering education named the Engineering Teaching & Learning Support Centre (EngTLSC). This Centre adopted an approach that was distinct from the more conventional support offered by central services by providing timely and subject-specific expertise at the point of need. Its modus operandi was to meet academics' needs directly, save them time and solve real problems. This proved to be a unique, highly effective and popular method of supporting academics.

Within a few years, the Centre had successfully gained major funding from several national teaching enhancement streams such as the TQEF (Teaching Quality Enhancement Fund), the FDTL (Fund for the Development of Teaching and Learning) and the Teaching and Learning Technology Programme (TLTP). Significantly, the team subsequently succeeded in a bid to host and establish the national Higher Education Academy (HEA) Engineering Subject Centre, which has generated an annual income of around £0.5m per year since 2000. Based at Loughborough University, its remit is to, "work in partnership with the UK engineering community to provide the best possible higher education learning experience for all students and contributing to the long term health of the engineering profession".

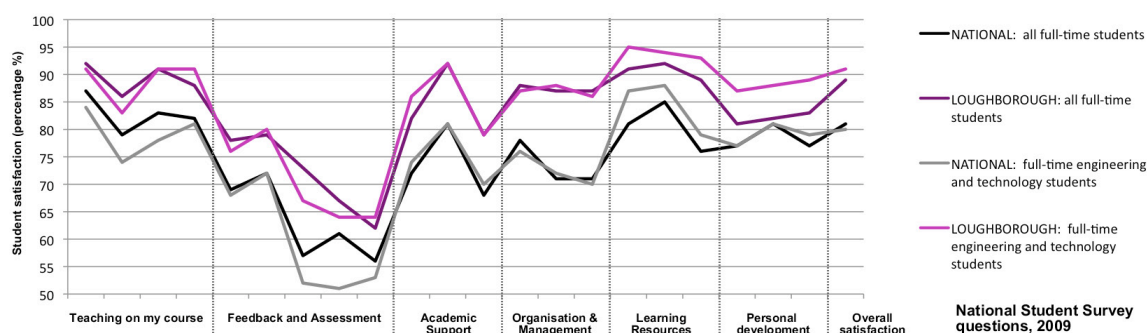
The University's internal centre was rebranded as the Engineering Education Centre (EEC) in 2002 and was co-located with the national Subject Centre in the Faculty of Engineering. It continued to develop high quality outputs and tailored support, helping to enhance the University's first class reputation for teaching engineering, forged through a close relationship with industrial partners and a proactive approach to teaching. The team's success continued when in 2004 HEFCE awarded Loughborough funding of over £4m to create the Engineering Centre for Excellence in Teaching and Learning (engCETL) in recognition of the University's exceptional work in teaching engineering, its collaboration with

industry to deliver a rich and relevant educational experience bolstered by this highly successful engineering education support centre.

In March 2005 the engCETL was established and within a year a space within a brand new building was designed and built to house the new Centre alongside state-of-the-art teaching facilities. New appointments brought additional expertise and experience to the team in the form of learning technologists, pedagogic researchers, academic and industrial co-ordinators, educational consultants, PhD studentships and, perhaps most importantly, Loughborough University academics seconded from 7 engineering-related departments.

The result of having 13 years of specialist support is the emergence of a highly effective focus for engineering education activity. Results from the National Student Survey (NSS) in 2009, which reports on students' satisfaction with their courses in a number of different areas, are unequivocally positive for engineering at Loughborough. The national average for overall student satisfaction within their courses in engineering and technology related subjects is 80% compared to 81% in all subjects, however, at Loughborough this average jumps to 91% for engineering and technology subjects - 2 percentage points higher than the Loughborough average of 89% for all subjects. Loughborough University bucks the national trend, scoring higher than all subjects in 4 out of 7 of the survey categories in engineering and technology related subjects.

The NSS forms part of the revised Quality Assurance Framework (QAF) for higher education and is used by future applicants to higher education to help inform their choices. The outstanding NSS results for engineering at Loughborough are perhaps indicative of the success of Loughborough's long term strategic decision to invest in engineering education.



\* Data taken from the HEFCE report, 'National Student Survey: Findings and Trends 2006-2009'

## Achieving success and recognition by building on excellence

The engCETL continues to demonstrate the many ways in which it is achieving success and recognition in the engineering education community and beyond. This is evidenced through: its effective management and operation; the generation of a significant amount of external funding; high quality learning spaces; a wealth of learning technology development, curriculum development and enterprise activities; a record of publication in national and international outlets on the pedagogy of engineering; strong links with industry and employers; a wealth of connections and know-how, built up over the years.

**“I have been able to work with your Centre for Excellence in Teaching and Learning in studying engineering education over the last year or two and I have found everything about the University’s engineering activity to be of the highest possible standard.”**

**Professor Sir William Wakeham (Vice-Chancellor, Southampton University 2001-2009) on receipt of a Loughborough University Honorary Doctor of Science, July 2010**

### Management, operation and revenue from external funding

Professor John Dickens, from the Department of Civil & Building Engineering, became the Associate Dean for Teaching in the Engineering Faculty in 1999, the Director of the HEA Engineering Subject Centre and later, the Director of the engCETL. Having strong leadership and mutually beneficial roles within the University and nationally - for example, in 2006 he was a member of the panel that revised the QAA Engineering Benchmark Statement - he has been integral to the success of the Centre, enabling it to respond to national issues and opportunities in enhancing engineering education at Loughborough.

The management and operation of the engCETL is carried out by a management team and a number of advisory panels, specifically created to get operational input from academics and senior management as well as from students and representatives from industry. Many of the activities of the engCETL are linked into University initiatives such as the academic practice and mini project awards and the work of the E-Learning Team. However, the majority of activities are initiated by the academics themselves who respond favourably to having friendly, subject-specialist staff who can respond quickly to their needs.

The engCETL always aims to operate in the most effective way possible, ensuring every member of staff can benefit from the range of services on offer. This not only includes one-to-one support but more generally from development projects and guidance for busy academics including: over-the-phone advice; drop-in sessions; help with funding applications; a varied events programme and individualised projects. The annual call for projects invites academics to submit ideas for undertaking support, development or research activities in conjunction with engCETL staff. A panel, consisting of the Dean and representatives from departments and support services contributes ideas and makes recommendations on the proposals. This panel ensures effective communication and transfer of practice across all of the engineering-related departments, solving common problems and gaining efficiencies through sharing of resources and expertise. Staff time to work on the projects is offered free of charge.

The management team has a strong track-record for sourcing external funding and managing the resulting projects, including not only the HEA Subject Centre and the CETL initiative, (together bringing in over £11m in external funding) but also from many more smaller but nonetheless substantial amounts of money. For example, between 2005 and 2008 around £365k of JISC (Joint Information Systems Committee) funding was achieved through sole, joint and consortium projects. \$100k of in kind funding was gained from Hewlett Packard for the Design School to enhance research and teaching in digital design. Even during this current austere financial climate, the team have successfully bid for 5 HE STEM funded projects (£50k), are through to the final round of bidding for another 3 proposals (£80k) and are currently submitting expressions of interest to match the latest HE STEM call for curriculum development projects (£60k).

### Connections and know-how

The experience, connections and know-how that has been built up by the staff in the engCETL and members of the engCETL community are a vital component of the success of the Centre. It has working relationships with many international academics from the engineering education community as well as links to national organisations, professional bodies, funding bodies, other HEIs and industry. Loughborough academics are well placed to be kept up-to-date with current and emerging topics that will impact at a local level.



Jointly funded posts with other support services such as IT Services, the Teaching Centre and the Maths Education Centre (MEC) help to maximise communication between colleagues across the University and allows engCETL to form a natural hub for many cross-institutional projects. Expertise from staff has also fed into many committees and University initiatives including; the Programme Quality Team, the E-learning Advisory Group, the Institutional Repository Advisory Group, the Virtual Learning Environment project team and the Employability Award steering group amongst others.

## Learning technology and curriculum development

The engCETL is renowned for producing high quality, evidence-based, bespoke teaching, learning and assessment resources and developing administrative tools that achieve real efficiencies with regard to saving academics' time and lessening the administrative burden, whilst enhancing the student learning experience.

The project-led approach allows academics to develop their ideas within an inter-disciplinary team consisting of technologists, researchers and teachers, all of whom bring specialist knowledge and experience and, more importantly, time to explore the problem and come up with robust and timely solutions.

Centre staff have the skills to develop or implement technology to support teaching and administration that is built into institutional systems and a noteworthy example of this is the online system called Co-Tutor (<http://co-tutor.lboro.ac.uk>). Originally conceived in 1998

### Examples of the wide range of developments that have been undertaken include:

- ◆ Case studies on industrial practice in project management, including ARM and Vodafone.
- ◆ Virtual laboratories for distance learning students which replicate on campus experiments testing photovoltaic solar panels, a hydropower lab and biomass energy generation.
- ◆ An electronic system to support the physical hand-in of paper based coursework to departmental offices.
- ◆ A system to support the specification, selection and allocation of UG and PG dissertation projects.
- ◆ A series of programming tasks together with a Matlab interface to automatically mark a series of Matlab functions submitted by students.
- ◆ University-wide attendance monitoring system that feeds into the Co-Tutor system
- ◆ Learning resources to support students using Arduino and Flash to build fully working prototypes in their industrial design projects.

by Dr Bill Forsythe in the Department of Electronic and Electrical Engineering, Co-Tutor started life as a spreadsheet to help keep track of personal tutorial meetings with students. The use of the online system Co-Tutor slowly spread as it was found to be an invaluable aid for the monitoring of departmental tutor and tutee meetings.

The first ten years saw iterative small-scale developments, but in 2008/2009 a University-wide user needs analysis was undertaken. Working closely with a number of key members of academic and administrative staff on their specific but broader set of requirements, a major redevelopment was undertaken. In 2009/2010 a significantly improved Co-Tutor was implemented as an embedded University-wide system for pastoral care, placement monitoring, dissertation and research supervision. It is now used by over 800 members of staff and contains important

### Bringing added value to the curriculum

The Centre supports academics in providing a first class learning experience for students at Loughborough





metrics on student welfare, progression and attendance. In the last academic year over 54,000 separate entries were made relating to around 12,500 students across all departments.

Student satisfaction and the student experience play an increasingly important role in the University's strategic development. The relationships that the students build up with their tutors, supervisors and support personnel are vital to the enhancement of the student experience. Co-Tutor plays a vital role in helping to build and support this relationship. The innovation and impact of Co-Tutor has recently been internationally recognised when it gained a global Leadership Award at the IMS (Global Learning Consortium) Learning Impact Conference in Long Beach, California, in May 2010.

**“Computer Science made the decision to move to Co-Tutor as the main method for tutoring and recording information about students. (...) A list of over 20 major changes were successfully negotiated (...) we are now working to integrate Co-Tutor into more of our student support processes, including dissertation, research and placement students.”**

**Dr Iain Phillips, Head of Department, Computer Science**

Another major success of the engCETL is an online system for peer-moderated marking called WebPA. It started from a project proposed by Dr Peter Willmot in the Wolfson School of Mechanical and Manufacturing Engineering developing a paper-based method he was using to award individual marks to students working on group projects. The system continued to benefit from small-scale developments with input from academics around the University who were researching into peer-moderated marking and feedback methods.

In 2006 the Centre gained nearly £200k of JISC funding to develop WebPA as an open source system available to any higher education institution (<http://www.webpa.ac.uk>). The project involved the collaboration of Loughborough University, the University of Hull and the HEA Subject Centres for Engineering and Physical Sciences.

**“WebPA is now embedded in our first year and will be for the next five years. Typically 180-200 students will be subjected to [WebPA] every year.”**

**Dr Bob Cherry, Senior Lecturer, Manchester Metropolitan University**

As a result of the project, over 20 HEIs have implemented WebPA, including institutions in the USA and Australia. An active community of practice has evolved around the use of WebPA with academics who are researching and developing peer assessment methods for marking and providing feedback to students. Findings from their research and updated or new code are fed back into the open source tool which benefits the whole community of users, including those at Loughborough.

In 2008, the WebPA tool gained international recognition by winning a prestigious Bronze Award at the IMS (Global Learning Consortium) Learning Impact Conference in Austin, Texas and was also named the ‘Best Assessment Support Tool’ out of all the entries. It is evolving to be a very well known and accepted method for the peer-moderated marking of group projects.

## Pedagogic research

EngCETL activities are underpinned by research into the method and practice of teaching (pedagogic research). The engCETL draws upon pedagogic literature as well as conducting rigorous evaluation to support its activities and developments. The Centre is committed to facilitating engineering education research with academics at the University, including providing support and advice on specific areas of investigation and co-authoring journal articles.



**Prof George Brown**, Pedagogic Research Consultant to the engCETL

A varied programme of support for the engineering education research community has been delivered, including pedagogic research workshops and symposiums in engineering education. Over the past 5 years, 7 large events have been organised, attracting over 400 delegates in total. Many of the events have been run in conjunction with the HEA Engineering Subject Centre which has increased the number of external visitors to Loughborough, enhancing the University's reputation and providing our academics access to a wider network of researchers.

Outputs from research activities carried out by the engCETL engineering education community at Loughborough have been disseminated at national and international conferences, events and within peer-reviewed publications. As well as engCETL staff, authors include the 7 seconded academics, their colleagues involved in project work, 6 PhD students (who have been either full- or part-funded by the Centre) and their supervisors. 100 peer-reviewed outputs (including journal articles, conference papers and edited works) have been produced in the past 5 years and staff have increasingly been involved in the organisation of national conferences in engineering education or have been invited to present at national workshops.

### Industrial and employer links

The engCETL has been committed to supporting, enhancing and encouraging the involvement of industry in the design and delivery of the curriculum throughout its activities and a significant amount of its work has been in this area. Strong foundations have been laid to enable relationships between employers and University staff to be built and enhanced, benefiting the students who choose to study with or without a placement year and strengthening Loughborough's reputation for employer-linked education.

A critically important way in which high level input is achieved is through the engCETL Advisory Board, which meets twice a year. Chaired by Dr Robert Ditchfield (former Director of Education Affairs at the The Royal Academy of Engineering) it includes members from industry, professional institutions, the Higher Education Academy, other CETLs, University senior management, external academics and students. The meetings provide both informal and formal time to discuss topical issues, providing insightful material for current engCETL research projects as well as feeding into national consultations and developments at a local level.

Chris Boardman, MEng Innovative Manufacturing Engineering student on a placement at Indesit in Yate



Both curriculum development and research activities have been carried out to enhance the University's links with industry. An example of development work undertaken is the 'EngSkills' website, which is a series of department-specific webpages and documents used in placements for staff and students. From the expertise gained, the team led the production of a nationally available guide, 'Industrial Placements for Engineering Students: a Guide for Academics', and has contributed to the consultation on the information technology systems and processes required to administer and manage industrial placements across the University. One of the specialist guides, provided to all engineering academics, has been written by the team and entitled, 'The Involvement of Industry in Teaching: A Guide For Academics' (2010). This guide contains 22 case studies of current industrial engagement with the 7 engCETL departments and is now the focus of an HE STEM bid to publish the guide nationally.

**"Since joining the engCETL, the Department of Materials has observed a significant increase in the rate at which innovative and industry linked teaching and learning resources have been introduced to our curricula. (...) Additional benefits have included (...) new practical resources secured by capital funding and benefits to our teaching staff in being able to liaise with highly-skilled professionals within engCETL."**

Barry Haworth, Department of Materials



### Keith Green Building

550m<sup>2</sup> of popular, high quality and innovative learning and teaching space.



Many academics who have worked with the Centre agree that they would not have the time to follow up important initiatives or side projects, which enhance the student learning experience and the reputation of Loughborough, if it were not for the time and commitment of staff in the engCETL. For example, this year the Centre has helped to facilitate and organise Loughborough's involvement with the UNITECH International Society's industrial placement and exchange programme. This prestigious programme aims to develop future senior engineers in the global marketplace. It brings together international higher education institutions and corporate partners to prepare top engineering students for their professional future by spending a semester studying at a leading European university and providing a work placement with a top multinational engineering company. This scheme is exclusive with only one university partner from each host country. Loughborough is pleased to be a member alongside other top European Universities such as RWTH Aachen, Chalmers and ETH Zürich.

### Learning spaces

The engCETL team helped to design the new learning environment within the Keith Green Building and funded a substantial amount of the construction and fitting out costs. Following consultation with students, industry and academics, the space was created predominantly to enhance the teaching and learning environment for group design projects. The result is 550m<sup>2</sup> of popular, high quality and innovative learning and teaching space, which may be booked by staff and students from the 7 supported departments. Its occupancy rates have increased year on year and achieves over 70% of capacity (with significant bookings made directly by students).

**“The Keith Green Building rooms provide an excellent platform from which to deliver our message, offering excellent natural lighting, first class multimedia services, and flexible furniture arrangements. Several visitors commented positively on the financial investment the University had made in the building.”**

**Dr Russell Coggrave, Wolfson School and MD of Phase Vision Ltd.**

### National and international reputation

The engCETL has gained a national and international reputation for excellence in supporting and delivering the advancement of engineering education. For example: members of the team have been invited to speak at national conferences or to organise the International Engineering Education Conference; winning 2 top global learning impact awards and spending a week at the University of Queensland in Australia working with engineering academics using WebPA.

The Centre has strong links with the HEA Engineering Subject Centre, the Royal Academy of Engineering, Engineering Council UK, Engineering Professors Council, professional institutions and engineering departments worldwide. The team has received over 15 delegations of overseas senior staff looking to redevelop their own institution's learning and teaching. All of these visitors comment on the excellent work of the Centre and the quality and innovation of the engineering education curriculum at Loughborough University.

## Rewarding our commitment to engineering education

### International reputation, connections and know-how

The University has benefited enormously over the past 13 years by having a focus for activities in engineering education. From humble beginnings, a small group of dedicated and subject specialist staff have worked tirelessly to support academics and to create a strong community of engineering education professionals at Loughborough.

The Centre's achievements are down to: the many successes it has had in securing funding; building links within academia and industry; the development of innovative learning technology and curriculum development which is embedded in pedagogic research; and first class learning spaces. The connections and know-how that have been built up are absolutely invaluable to Loughborough University and its influence can be felt through the connections that it has within the University, scholarly networks, professional and funding bodies and industry.

Having a focal point and outward reputation for excellence in engineering education, Loughborough University is in an enviable position to exploit the current stream of government funding activities in the enhancement of Science, Technology, Engineering, Mathematics and Medicine (STEMM) education. The engCETL provides a strong knowledge conduit and outward brand that will further develop local, national and international esteem in STEMM education and drive the Loughborough 2016 strategic vision of being known for "leading edge curricula including cross-campus specialist support."

The payoff from the success and wealth of activities engaged in is an enviable reputation and invaluable critical mass of expertise, which will continue to benefit the University in the increasingly competitive global higher education market.



#### Working with students

engCETL helps fulfill the University's mission, "[to] provide the highest quality of educational experience and the widest opportunities for students, advance industry and the professions, and benefit society."

#### Contact the Centre

The Engineering Centre for Excellence in Teaching and Learning (engCETL)  
Keith Green Building,  
Loughborough University,  
LE11 3TU  
Tel: +00 (44) 1509 227191  
Fax: +00 (44) 1509 227181  
Email: [engcetl@lboro.ac.uk](mailto:engcetl@lboro.ac.uk)

# engCETL