

## **Talking Teaching: Engaging Engineers**

### **Abstract**

In 2005 the Higher Education Funding Council for England (HEFCE) created 74 Centres for Excellence in Teaching and Learning (CETLs) in order to promote and investigate the excellence of teaching and learning in higher education institutions (HEIs). It is seen by some as a counterbalance to the Research Assessment Exercise (RAE) (Gosling & Hannan, 2006) which emphasises excellence in research including pedagogic research (hefcw, hefce, SFC, & DfEL, 2006), something which is a key part of the CETLs initiative.

HEFCE expects a CETL to “acquire and utilise a capacity to draw in pedagogic research and evaluation and to undertake research into its own practice” (HEFCE, 2004, p.2). This in effect means the building of a pedagogic research capacity which in the case of engCETL, the engineering and industry focused CETL based at Loughborough University, a research intensive university in the English East Midlands, has led to the creation of pedagogic research posts and a requirement to discuss teaching and learning with academics. This has brought about two sets of issues: a need to explain what pedagogic research is to colleagues who have little understanding of what this entails and engaging with engineering academics who do not view themselves as teachers or feel, because of positive student feedback, QAA teaching review scores, employer satisfaction and professional body endorsement (Loughborough University, 2004) there is little need to provide further evidence for their excellence. This paper will illustrate how we have begun to engage with colleagues within and without the engCETL.

## **TALKING TEACHING: ENGAGING ENGINEERS**

The Engineering Centre for Excellence in Teaching and Learning (engCETL) is one of the seventy-four Centres for Excellence in Teaching and Learning (CETLs) created by the Higher Education Funding Council for England (HEFCE) in 2005. The CETL initiative was created “to recognize, celebrate and promote excellence by rewarding teachers who have made a demonstrable impact on student learning and who can enthuse, motivate and influence others to do the same.” (Beaty, 2005, p. 9) and as such was intended to create some balance in a system where rewards (such as promotion and funding) are seen to be skewed in favour of those focusing on subject specific research rather than learning and teaching and research into learning and teaching. The funding was intended to provide opportunities for the enhancement of learning and teaching in order to support excellence, innovation and “the enrichment of student learning” (op. cit.).

Staff associated with departments located in the Faculty of Engineering at Loughborough University, a research intensive university located in the English East Midlands, together with engineering-related departments in the other two faculties, the Engineering Education Centre (EEC) and the Higher Education Academy (HEA) Engineering Subject Centre put together a successful bid submission which won funding for the engCETL. This paper explains the origin and focus of the engCETL and examines the role of pedagogic research within this before going on to illustrate how engCETL is beginning to comply with the HEFCE imperative to “acquire and utilise a capacity to draw in pedagogic research and evaluation and to undertake research into its own practice” (HEFCE, 2004, p.2).

### ***The engCETL***

***Origins.*** The engCETL evolved out of the Engineering Education Centre (EEC) which itself grew out of a support centre created by the Faculty of Engineering at Loughborough, towards the end of 1997. This centre brought together staff already working to support learning and teaching, mainly through the development of learning technology tools, within faculty departments; the aim was to create a critical mass of expertise and avoid duplication. The Faculty committed to funding three core staff members and wrote the centre into its strategy, but it was made clear that there was a need to bring in income in order to ensure longevity.

The support centre successfully bid for various learning, teaching and learning technology funds to grow from strength to strength and so evolved into the Engineering Education Centre (EEC). During this time the Engineering Faculty also became the home of the Higher Education Academy's (HEA) Engineering Subject Centre (engsc). The HEA is a centrally funded national body in the United Kingdom (UK) with a "mission ... to help institutions, discipline groups and all staff to provide the best possible learning experience for their students" (<http://www.heacademy.ac.uk/184.htm>). The HEA provides discipline-based support through their distributed network of discipline subject specific centres hosted by higher education institutions across the UK. In March 2005 the EEC and the staff expertise located there formed a key element of the Faculty's successful bid for HEFCE CETL funding.

***Focus.*** The two-stage engCETL bid focused on addressing recent criticisms levelled at engineering education by various national reports. These reports advocated greater

involvement of employers in the curriculum (Lambert, 2003) and found that a skills shortage was being created by among other things:

“poor experiences of science and engineering education among students generally, coupled with a negative image of, and inadequate information about, careers arising from the study of science and engineering; [...] science and engineering graduates’ and postgraduates’ education does not lead them to develop the transferable skills and knowledge required by R&D employers.” (Roberts, 2002, p. 2)

The engCETL focus therefore is on capturing the way in which industry inputs into the curriculum and student learning in order to make these processes sustainable and transferable. It is tasked with “build[ing] on the existing experience of the Engineering Education Centre transforming a development and support centre to a research, development and support centre that is a beacon of excellence in learning and teaching.” (Loughborough University, 2004, p. 1) Its goal is to be “recognised as the UK centre for excellence in the research, development and provision of engineering education through an active involvement with industry” (engCETL Strategic Plan 2007/8, May 2007).

A key aim for the engCETL is the development of “the pedagogy of engineering education and engineering employment” (Loughborough University, 2004, p. 10) and as such pedagogic research is listed in the bid documents as one of the seven strands of engCETL work alongside: Curriculum Design and Development, Learning Support, Student Impact, Industry Impact, Transfer of Practice and Evaluation. The job roles of those who were expected to undertake the work (a post-doctoral researcher and three PhD students) were also listed, as were the initial research areas (the themes of excellence that characterise the engCETL: design

projects, skills development for industry, sandwich placements, sponsorship schemes and work in resource development).

### ***The role of pedagogic research at engCETL***

I took on the role of pedagogic researcher defined in the bid and right from the start I was told that pedagogic research was “central to what we do”. However, because it was in essence characterised and understood as a discrete area for work, rather than something that informs and underpins other work (although that was not the intention), it was a problematic concept for many of my colleagues working within the engCETL and some of the academics working with us. Typically I would be told that they did not understand what the term meant, what my role was and that they could not say the word pedagogy; this despite many of them having previously attended an introductory workshop on pedagogic research methods. My task was clear: I had to help both colleagues and academics see the relevance of pedagogic research to their work and explain how it should inform and underpin what we do. I began by trying to unpick what is meant by pedagogic research.

***Defining pedagogic research.*** Pedagogy is recognised as a contested term (Cannon, 2001), for some androgogy (Brookfield, 1986; Knowles, 1984; Smith, 1996; 1999) is the preferred term in the context of higher education. While Stierer and Antoniou “define pedagogy simply as ‘the processes and relationships of learning and teaching’.” (2004, p. 277) Shirley Booth uses pedagogy “to signify particular sorts of meetings between students, teachers and knowledge, where there is an intention to learn. [... and she intends it] to be less encompassing than ‘education’ which can include institutions, political and professional regulations, and the needs and demands of society, as well as pedagogy.” (2004, p. 22)

engCETL aims seem to encompass not only pedagogy but ‘education’ as explained in Booth’s definition because of the link to professional qualifications and a desire to impact across the institution. Our work is also highly contextualised within our institution and the focus we have been set: working with seven engineering-related departments across three faculties with an industry focus. Stenhouse defines educational research as “systematic activity that is directed towards providing knowledge, or adding to the understanding of existing knowledge which is of relevance for improving the effectiveness of education.” (1984, p. 211)

Nevertheless we have stuck with the term pedagogic research at engCETL, perhaps because that is the term favoured by HEFCE, other funding bodies and the Research Assessment Exercise (RAE, see [www.rae.ac.uk](http://www.rae.ac.uk)). An engCETL aim is to be returnable under a future RAE so the definition used by the current RAE documents is an important indicator.

Pedagogic research in higher education (HE) is defined as:

“research which enhances theoretical and/or conceptual understanding of:

- teaching and learning processes in HE,
- teacher and learner experiences in HE,
- the environment or contexts in which teaching and learning in HE take place,
- teaching and learning outcomes in HE,
- the relationships between these processes, outcomes and contexts.

Reports of studies providing descriptive and anecdotal accounts of teaching developments and evaluations do not constitute pedagogic research. Pedagogic research is firmly situated in its relevant literature, and high quality pedagogic research makes a substantial contribution to that literature.” (hefcw et al., 2006, p. 8)

The key phrases in the RAE documents is “descriptive and anecdotal accounts of teaching developments and evaluations do not constitute pedagogic research. Pedagogic research is firmly situated in its relevant literature.” (ibid.) Prosser, during his tenure as Director of Research and Evaluation of the HEA, used Boyer’s (1990) influential analysis of

research and teaching in higher education to draw a distinction between pedagogic research as defined by the RAE and other “evidence-informed scholarship that can inform our understanding of, and help [...] to improve student learning experiences.” (Prosser, 2005, p. 8) These other categories of scholarship were listed as: “investigations and evaluations, literature reviews and the scholarship of teaching and learning (ibid.). All of them are described as evidence-based and informed by the literature, for example, “Investigations and evaluations [can] enhance our understanding of a local problem or issue, providing recommendations for policy and / or action firmly situated in the relevant literature.” (Prosser, 2005, p. 8) This would describe much of our current work.

*Convincing our academics.* For those of us in the pedagogic research community the importance of using the literature on teaching and learning to inform or reflect on practice (Brew, 2003; Ramsden, 1992) may be obvious. However many of our academics remain to be convinced: they know they teach well, they can prove this with reference to student feedback, QAA teaching review scores, employer satisfaction and professional body endorsement (Loughborough University, 2004). From their point of view there’s plenty of “good reasons” not to: workload related time pressures, an imperative to prioritise subject-based research, unwillingness to change teaching that is working, innovation fatigue and perhaps more fundamentally, a perception that pedagogic research is not rigorous, serious research.

Brew offers us a range of definitions for research, all culled from the literature:

- “Research is finding out something and making it public
- Research provides the means of generating, testing and validating knowledge
- Research is a systematic process of investigation, the general purpose of which is to contribute to the body of knowledge that shapes and guides academic and /or practice disciplines ...
- Research is about advancing knowledge and understanding ...” (2001, p. 21)

She goes on to say “There is no one thing, not even a set of things, that research is.” (ibid.)

However Ashwin and Trigwell (2004) help us understand the nature of pedagogical scholarship and the place of “research” within this. They describe a hierarchical relationship between research (which is externally verifiable and contributes to public knowledge) and other forms of investigation or scholarly activity (which contributes either to personal knowledge and is verified by oneself or local knowledge and used to inform a group within a shared context and therefore verified by those within that context) (Ashwin & Trigwell, 2004, p. 122).

Another difficult issue for our academics is the realisation that pedagogic research can be messy and quite difficult to measure because it involves, among other things, the study of people, their actions and their perceptions, and as such “it is infused with assumptions about the social world and is influenced by the researcher.” (Burgess, 1984, p. 2). Although there are some tools and inventories that can help with measurement, for example the Course Experience Questionnaire (Ramsden, 1991) and the Approaches to Teaching Inventory (Prosser & Trigwell, 1999) and familiar research methods that can be used (for example questionnaires, interviews and focus groups) data that is collected needs careful interpretation and contextualisation to enable others to understand the methodological approach taken. That is, “the ways in which techniques, theories and processes [have been] developed by the researcher in relation to the experience of collecting, analysing and reporting data.” (Burgess, 1984, p. 2).

### ***Building research capacity***

The key elements to building research capacity are: understanding and engagement. At engCETL we have employed a variety of strategies to aid understanding and increase engagement. This section explains how I have endeavoured to explain “pedagogic research” to

colleagues and academics and how we are encouraging increased engagement with pedagogic research.

*Explaining pedagogic research to academics.* I adopted a practical, person-centred approach in seeking to explain pedagogic research to those who may wish to work with us. Our primary means of communication with this audience is through our Web site and we need to find academics to work with as well as develop our evidence base of excellent practice. I developed a description of the type of work we were seeking to support, reminded them of the RAE definition and addressed the way in which this work could be carried out:

“When we talk about relating what the engCETL does to pedagogic research we mean grounding what we do in relevant teaching and learning literature. It is necessary, as a Centre for Excellence in Teaching and Learning, that we demonstrate awareness of and evidence for good practice that enhances the student learning experience. Any activities we undertake need to have a teaching and learning rationale, something we will discuss with and develop in collaboration with the person who proposes a piece of work.

[RAE criteria as quoted above, goes here]

Doing pedagogic research means using various research methods to understand and enhance your teaching and your students' learning. It means being aware of 'the teaching and learning literature', that is, showing that you can relate what you do to what is understood by good practice; it is not necessary to agree with that literature, you could of course critically comment with reference to your own experience.

The research methods used can be qualitative (e.g. interviews, focus groups) or quantitative (e.g. questionnaires) or a mixture of qualitative and quantitative. You may decide to draw from different methodologies (e.g. ethnography, case study, grounded theory, phenomenography, action research, activity theory) in designing your research and analysing your data.” <http://www.engcetl.ac.uk/research/pedagogic/>

The aim was to invite engagement with engCETL around the area of teaching and learning and to demonstrate that pedagogic research could also be categorised as serious, RAEable research.

Academics who think they have examples of good practice they would like to share, those who

are interested in undertaking some pedagogic research or any who would like to chat about what this might involve are asked to contact me at the engCETL.

My next task was beginning to engage with interested academics (to provide examples of how we could work together) and to help colleagues within the engCETL see how pedagogic research was relevant to them. The following sections illustrate how this has been attempted.

***Making pedagogic research (and evaluation) relevant to colleagues.*** Once more I adopted a practical, person-centred approach in order to make the idea of research and evaluation real for colleagues working in the engCETL. I was asked to develop a research and evaluation strategy so I began by trying to understand the legacy procedure (left over from the days of the previous centre, EEC) for working on projects and activities. One of the main areas of work was the development of learning technology tools for our academics. The focus of these tools was usually portrayed as created in order to save time and make life easier for the academics. The process involved little or no thought about improving or enhancing the student learning experience, even though this may have been an outcome.

Using an action research model (McNiff & Whitehead, 2002; Wellington, 2000), typically adopted by those seeking to research into their own practice, I developed a framework to try and explain how research and evaluation could fit into what people were already doing as well as trying to emphasise the need to make sure what we do focuses on the enhancement of teaching and learning. An action research approach, that encourages reflection on and the development of practice, fits with our aim to change what we do, reflect and feed our findings back into the process of developing projects and undertaking activities.

Evaluation is listed in the engCETL bid documents as something that should be integrated into all our activities and that we should encourage all academics to do, with respect

to their teaching (Loughborough University, 2004). While it is dealt with in a separate section of the bid document I see it complementary to and allied to pedagogic research because of our focus on engineering education and a requirement to identify examples of good practice.

Indeed the interplay between research and evaluation is something Baume writes about (2005) as an informative relationship and Bennett (2003) classifies it in terms of differences in intent, scope and agenda, among other things. The interplay between research and evaluation in the engCETL context is illustrated on the diagram in Figure 1 where the research literature informs the intended objectives of projects or activities, and the methods used to investigate the conduct of our evaluation and the impact of any activity. The ultimate aim being that we should be able to generate research outputs and ideas for future research from those outputs.

Evaluation may be an ongoing, iterative process (in which case it is formative - the findings will inform the next iteration or instance of activity or development), but in some cases it will be summative (particularly in the case of one-offs). Evaluation needs to:

- be informed by research - methods, link to good practice identified in the literature
- show we are delivering what we said we would and link to our overall aims
- show how teaching and learning practice is developing and good or innovative practice is transferring to other locations or impacting on other areas (departments or across the institution)
- should be embedded in everything that we do, that is, part of the ongoing work

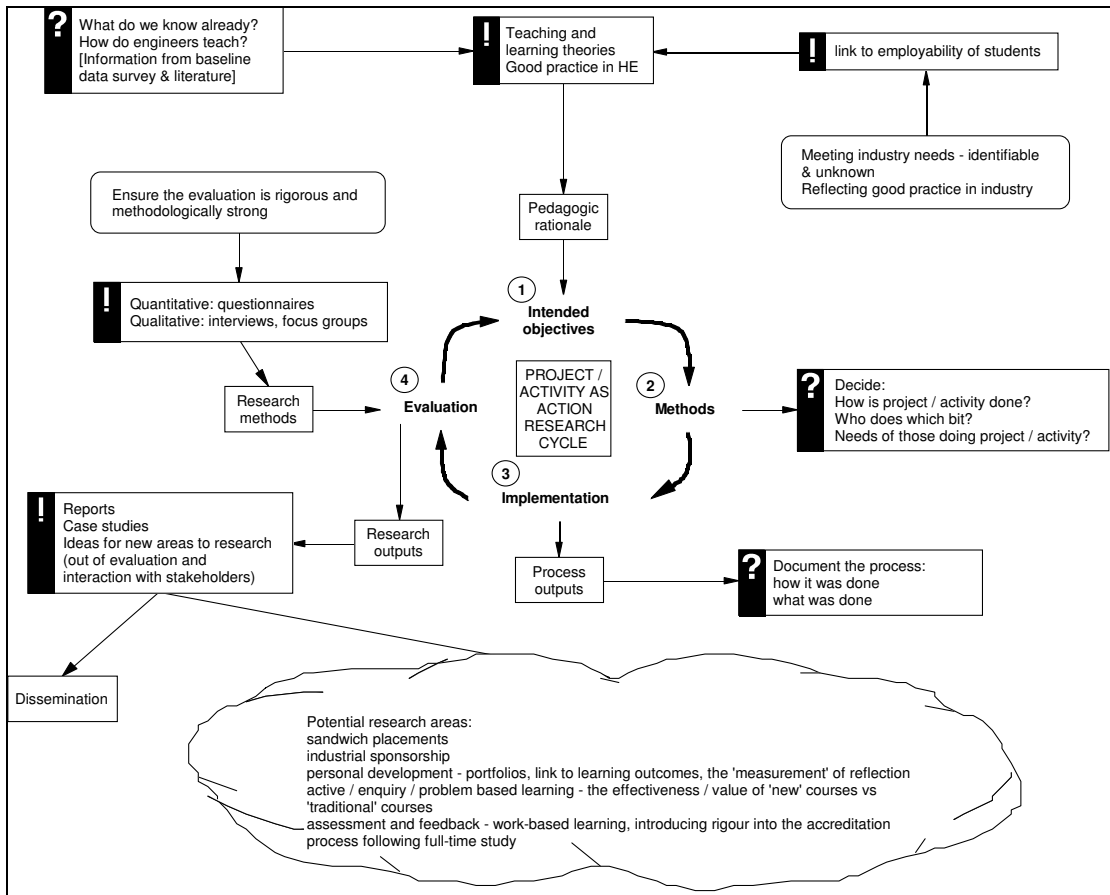


Figure 1: engCETL draft research and evaluation strategy

**Increasing engagement with pedagogic research.** We have adopted a number of strategies working closely with external consultants and interested parties from across the university. We provide support and advice to academics who want to investigate their practice and their students' learning and a forum for people to share teaching and learning experiences and research into teaching and learning through a seminar series. We have funded studentships to explore engineering education topics (see below) that align with engCETL aims and objectives. The studentship topics were developed in consultation with myself and the pedagogic research consultant, in response to a call for interest and involve other academics in the supervision teams, some of whom had not been involved with us previously.

I have worked with a colleague from the HEA engineering subject centre and our external pedagogic research consultant, to conduct pedagogic research workshops for engineering academics and provide pedagogic research resources. This workshop has brought further Loughborough academics into contact and collaboration with us. The engCETL has secured funding to create a second pedagogic research post (shared 50:50 with the university's professional development department, a central support unit where university-wide learning and teaching support for all staff is located); so I am no longer the lone voice.

Our funding of institutionally led academic practice awards and mini practice awards for academics in our associated departments will provide the opportunity for more collaborations as we work with these academics to capture their practice and evaluate the impact of the awards (much as I did for a recent design & build activity, briefly outlined below).. Future sources of collaboration and engagement will arise from colleagues' work to support academics' use of the institution's virtual learning environment (VLE) and the social networking tool created by staff at engCETL to facilitate the sharing of teaching and learning knowledge and materials (this arose out of an investigation into the potential use of a repository, similar to the one used for research outputs).

***Research topics at engCETL.*** There are a large number of research projects underway at engCETL, these include funded studentship research as well as collaborative research conducted by named researchers together with CETL colleagues and academics from our associated departments. Our research areas have to align with the mission and aims of engCETL, with the intention of providing an evidence base, demonstrate excellence and grow the capacity to conduct pedagogic research.

We currently have four funded students working with us in the following areas:

- the impact of work placements on transferable skills before, during and after work placements,
- the impact of sponsorship on students, academic departments and industry with the aim of developing sustainable models of effective practice,
- the development of a web-based Telelaboratory for Process Control Education with the aim of enhancing teaching and learning,
- an appraisal of the benefits of project-based learning in engineering education.

Other named researchers and collaborating colleagues are conducting or developing research in the areas of internationalisation, the accreditation of work-based learning, personal development portfolios, peer assessment (the use of technology-supported peer assessment) and the use of social software to facilitate the sharing and creation of teaching and learning knowledge and resources. While I have been tasked with investigations into the use of design projects in departments affiliated to the engCETL and into the experience of students on work placements.

My design projects work also encompasses evaluation work carried out for a mini project holder and involved an in depth evaluation of a design & build project with a focus on observation of the conduct of the block and the collection student feedback. The aim of the evaluation was to inform the development of a new part of the curriculum. The major part of it is an investigation in to the use of design projects in departments affiliated to the engCETL. Myself and a colleague are interviewing academics to ascertain: the way design projects are taught, the rationale, the involvement of industry, the teaching approach adopted, the place in

the curriculum, the assessment method and the collection and use of student feedback. The questions we are using to bound the study are:

- What role do design projects have in the curriculum?
- How do design projects involve industry in the curriculum?
- What approach to teaching is used by lecturers using design projects?

Work on the student experience of work placements is being conducted with a researcher located in one of our associated departments. We are investigating the way in which higher education prepare students for the world of work, with particular reference to the work placement experience of engineering-related student at Loughborough University. The questions that bound this study are:

- How do students think the work placement enhances their learning experience?
- What are students expected to gain from a placement experience?
- How do students say departments prepare them for a work placement?
- What kind of work placement experience do students report they have?
- How could the work placement experience be improved according to students?

Once again we using interviews as our method of data collection although discussions about the use of student narratives within one of the networks I belong to are currently challenging me to adopt alternative modes of capture.

### ***Concluding comments***

Elsewhere (Morón-García & Lamb, 2007) we have characterised the process we are undertaking as a “change journey” recognising that “Initially this might involve major diversions and engagement at a very low level, the key is to establish a relationship and to

promote the benefits gained by those academics who do so.” (op. cit.) It is clear from conversations with academics and colleagues that we still have a way to go in reaching a shared understanding of pedagogic research, what it is and how you do it. In particular we need to help those unfamiliar with it to understand the language and terminology of pedagogic research and continue to explain the difference between teaching & learning methods and the methods we might use to research into teaching and learning.

Our location and name mean that we have a strong disciplinary identity which has both a positive and a negative effect: we are a support centre that academics in all our associated departments can call on and we can count on strong support for our work from a team of “seconded academics” and senior faculty and department members, however we are also working within a culture that is “generally sceptical about the benefits that can be derived from generic pedagogic research.” (Loughborough University, 2004). It is noticeable that there is a reluctance to discuss and examine practice in some areas.

The various ways in which we have tried to engage with people using a range of strategies (from learning and teaching focused calls for supported projects and funded studentships to building networks with other researchers and CETLs and working with the engsc to run workshops on pedagogic research for engineering academics) seems to have started to generate more interest and awareness although it is still early days. In addition during the first year of operations there has been a focus on evaluation due to a need to examine the process and progress made in the early days of engCETL existence rather than on research as defined by the RAE. This is something that will need to be addressed in the long term if we are to contribute to the pedagogic research community and achieve job satisfaction as researchers.

This is obviously a work in progress as both I and those working within and with the engCETL develop our ideas about pedagogic research and our contributions to the field, but I hope I have been able to give you a flavour of the work that is being conducted and situate it within some of the relevant literature.

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