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Title: Towards sustainable activity led learning innovations in teaching, learning and assessment

Article & version: Published version

Original citation: Wilson-Medhurst, S. (2008, July 14). *Towards sustainable activity led learning innovations in teaching, learning and assessment*. Paper presented at the Engineering Education Conference 2008 (EE2008), Loughborough, UK.

Link: <http://www.engsc.ac.uk/downloads/scholarart/ee2008/p008-wilson-medhurst.pdf>

Statement: This paper has been published by the Higher Education Academy Engineering Subject Centre, Loughborough University.

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Towards Sustainable Activity Led Learning Innovations in Teaching, Learning and Assessment

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Abstract

The faculty of Engineering and Computing at Coventry University is using Activity Led Learning (ALL) innovations in teaching, learning and assessment to promote student retention, engagement and achievement.

The Faculty want to further develop ALL and to do so need to understand, within a discipline framed context, what the challenges and issues might be when implementing, supporting and evaluating such innovations.

The first-stage of this initiative involves seven financially supported projects (with one located in each of the seven departments of the faculty) each of which will plan, do, then review and evaluate an ALL innovation. The outcomes of these project evaluations will help to inform and establish a 'meta-framework' within which future projects may be supported and evaluated. This is with a view to achieving sustainable curriculum innovation in ALL.

This paper reports on work-in-progress on this initiative, and the development of the 'meta-framework'. This 'meta-framework' development, supported by practice-oriented research, is being co-ordinated by the author who is the Faculty Teaching Development Fellow.

Introduction

The Faculty of Engineering and Computing (EC) at Coventry is a large multi-disciplinary faculty encompassing mathematics, computer science, knowledge management, mechanical engineering, civil engineering, aerospace engineering and engineering manufacture and management. Within many of these disciplines there is a strong emphasis on employer and profession focussed education.

The faculty wishes to develop and enhance the student learning experience to promote student retention, engagement, and achievement. Underpinning this ambition to enhance the student learning experience, is the recognition that learning is more likely to be effective when students are active participants in the learning process. That is, the learning experience is more likely to have significant positive gains for the learner if they are active rather than passive recipients within it (see e.g. Race, 2000 and McCowan and Knapper, 2002). As McCowan and Knapper point out:

“Learning in a passive system has a much greater tendency to be both superficial and quickly forgotten. Active involvement in learning helps the student to develop the skills of self-learning while at the same time contributing to a deeper, longer lasting knowledge of the theoretical material.....[and] ...it is almost the only effective way to develop professional skills and to realise the integration of material from different sources.”

(McGowan and Knapper, 2002, p.633)

Thus the faculty’s ambition to improve the learner experience is underpinned by a learning and teaching vision to build a community of learners, through employer and profession focussed activity led education. This teaching and learning vision (see Appendix A for further details) characterises the activity led learning experience the faculty wants its students to have. It also recognises that the learning experience is supported in a number of different ways and through a number of different ‘agencies’ including registry, academic, professional and technical functions. The Faculty’s planned £60 million new building design will be informed by this vision and the need to further integrate service functions to support the student experience.

For reasons indicated above, a key feature of the teaching and learning vision is Activity Led Learning (ALL). ALL (as defined by the Faculty) is a pedagogic approach in which the activity is the focal point of the learning experience and the tutor acts as a facilitator. An activity is a problem, project, scenario, case-study, research question or similar in a classroom, work-based, laboratory-based or other appropriate setting and for which a range of solutions or responses are appropriate. Activities may cross subject boundaries, as activities within professional practice often do. Activity Led Learning requires a self-directed inquiry or research-like process in which the individual learner, or team of learners, seek and apply relevant knowledge, skilful practices, understanding and resources (personal and physical) relevant to the activity domain to achieve appropriate learning outcome(s) or intention(s). To be appropriate, the learning outcomes or intentions must be consistent with the aims, outcomes and intentions of the programme of study with which the student is engaged.

History and development of activity led learning

The Faculty of Engineering and Computing has a long history of thoughtful and experimental learning design with programmes designed specifically to enhance employability and professional skills (see also Wilson-Medhurst et al, 2008). This thoughtfulness however has never been on a cross-discipline, whole Faculty scale, however a large investment in a new faculty building has provided just such an opportunity to do this. The Faculty has therefore been exploring its own history and experience, viewing excellent examples of teaching and learning around the world and through this has begun a debate to define a strategy, and the operationalisation of that strategy, for future teaching and learning.

The history of the Faculty includes innovative learning programmes such as problem-based approach to learning in Automotive Engineering Design (Griffiths et al, 1993). This was the first time that a UK mechanical engineering derivative was accredited at Chartered Engineer level with no examinations. More recently, building on past work, there has been innovative curriculum development within Motorsport BEng course (Booth and White, 2008). Other examples are the work done by the department of the Built Environment on engaging part-time learners in the support and professional skills development of full-time students (Davis and Davies, 2008). This work built on earlier research by Davies on the part-time student experience and

their better average achievement levels (scores) when compared to full-time students (Davies, 2008). In computer science there has been a radical review of computer science learning resulting in moves into new subject areas, while the Faculty's excellence in mathematics support is recognised as a national centre of excellence in teaching and learning with two national teaching fellowship holders.

In support of this Faculty members have been engaging in a major review of international examples of thoughtful teaching and learning in engineering, computing and mathematics. By way of illustration of this, discussions have taken place with colleagues at the University of Strathclyde, Department of Mechanical Engineering, where radical thinking was applied to the physical act of teaching in order to address issues about retention and engagement. With the University of Aalborg, Denmark, who are internationally renowned as a centre of problem-based learning and the University of Southern Denmark, who make interesting use of building space to facilitate learning activities. Queen's University, Canada, who have designed space to much better develop professional skills development in engineering students, and where very interesting 'use' is made of the students to effectively engage them in the whole process of learning. Links and discussions are taking place with the University of Colorado, Boulder, the University of Queensland, Brisbane, the University of Sydney and the Laurea University of Applied Sciences in Finland. In relation to the latter, see for example Vyakarnam et al's, 2008 report on Laurea's 'learning by developing' pedagogical approach.

In the 2006/2007 academic year, armed with much of the above evidence, a small group developed an initial vision statement to set out the aims and principal objectives for the changes to the Faculty learning and teaching approach. This was developed in parallel to the initial brief for the design of the new Faculty building. This document then provided a base for the development of a working group, comprising interested, enthusiastic members of the Faculty's academic community. This working group met in November 2007 and then January 2008 to further refine the vision – as summarised in appendix A.

Building capacity in researching and evaluating ALL

Following on from the above developments, the fundamental research question this paper focuses on is how to build capacity in researching and evaluating activity led learning, within engineering and computing and the allied disciplines. Capacity building is here defined as 'enhancing people's awareness and capabilities, individually and collectively, to produce the results they truly care about' (Senge and Scharmer, 2001). It is also important such capacity building is sustainable. A useful exploration of sustainability is provided by McNiff and Whitehead:

“Sustainability refers to the idea that living systems have the capacity for inter-dependent self-renewal, which is indispensable for continuing development. Reliance on an external agency means that a system may collapse if the agency is withdrawn, whereas internal capacity means the interdependent creation of renewable resources for growth.”

(McNiff and Whitehead, 2006, p. 18)

To achieve sustainable capacity building a key mechanism being investigated is that of supporting the development of a community of practice (Wenger 1998). That is, a community of practitioners researching and evaluating their ALL teaching practice. The focus of the rest of this paper is on explicit frameworks for supporting capacity building through the development of such a community of practice. A community of

practice provides a mechanism for promoting sustainable innovation whatever the faculty structure. This is important as the faculty is currently reviewing its departmental groupings and overall structure.

Levels of rigour in inquiry

The capacity building definition above can be framed within a 'levels of rigor in inquiry' framework outlined below:

Level of inquiry	Attributes of that level
Level 1: Excellent Teaching	Involves the use of good content and teaching methods
Level 2: Scholarly Teaching	Good content and methods <i>and</i> classroom assessment and evidence gathering, informed by best practice and best knowledge, inviting of collaboration and review.
Level 3: Scholarship of Teaching	Is public and open to critique and evaluation, is in form that others can build on, involves question-asking, inquiry and investigation, particularly about student learning
Level 4: Rigorous Research in Engineering Education	Also is public, open to critique, and involves asking questions about student learning, but it includes a few unique components. (1) Begin with a <i>research</i> question not an <i>assessment</i> question. Assessment questions often deal with the "what" or "how much" of learning, while research questions more often focus on the "why" or "how" of learning (2) Tying the question to learning, pedagogical, or social theory and interpreting the results of the research in light of theory. This will allow for the research to build theory and can increase the significance of the findings. For example, studies about teaching thermodynamics can be redesigned to become studies based on cognitive theory, which can help explain why certain concepts in thermodynamics are so difficult to learn. (3) Paying careful attention to design of the study and the methods used. This will enable the study to hold up to scrutiny by a broad audience, again creating a potential for greater impact of results.

Table 1: Levels of rigour in inquiry (source and further attributions: Borrego, 2007, p.94)

Hence, within EC at Coventry, capacity building can be seen as supporting researcher practitioner in moving 'up' the levels, but also supporting an exchange between those operating at different 'levels of rigour'. It should be emphasised at this point that the author does not subscribe to the view that one level is necessarily 'better' than another, but certainly recognises that for research and evaluation capacity building purposes, having practitioners who can operate at all four levels is important.

Faculty context

The EC faculty at Coventry is currently comprised of seven departments (although this structure is currently under review) as shown in the table below:

EC Department	Indicative disciplines (not exhaustive)
Built Environment	Civil Engineering Building Surveying Built Environment Studies
Computer Science	Computer Science Network Computing Multimedia Computing Creative Computing
Engineering & Manufacturing Management	European Engineering Business Management Manufacturing Systems and Technology Manufacturing with Management
Knowledge and Information Management	Business Information Technology Information Management
Mathematical Sciences	Mathematical Sciences Mathematics
Mechanical Engineering and Design	Automotive Engineering Mechanical Engineering Motorsport Engineering
Systems Engineering	Aerospace Systems Engineering Aerospace Technology Electronics Technology Digital Forensics & System Security

Table 2: Departments (and indicative disciplines) within Engineering and Computing as at Jan 2008

As indicated in the above history and development section, the Faculty leads one of Coventry University's three HEFCE (Higher Education Funding Council for England) funded Centres for Excellence in Teaching and learning (CETLs) and has two National Teaching Fellows. The CETL in question - Sigma - is a HEFCE-designated CETL in University-wide support in Mathematics and Statistics. More specifically in relation to ALL, there are also substantial pockets of good activity led teaching practice/scholarly teaching see e.g. Booth and White, 2008, Lambert et al 2008, and Davis and Davies 2008.

There is therefore a strong basis for building a community of practice of practitioners researching and evaluating ALL and so contribute to the body of knowledge about learning within the engineering, computing, mathematics and allied disciplines indicated in table 2 above. Such a community of practice, cutting across subject/departmental boundaries, provides a mechanism for sustainable innovation in activity led learning practice that meets the needs of staff and students.

Continuous improvement

The framework for building this community of practice in researching and evaluating ALL, relies on a continuous improvement change management model as in Senge's notion of the 'learning organisation' (Senge, 1990). Such a change model aligns

well to the community of practice framework for supporting capacity building, as the following quote from Senge attests:

“The organisations that will truly excel in the future will be the organisations that discover how to tap people’s commitment and capacity to learn at *all* levels in the organisation.”

(Senge, 1990, p.4)

A community of practice tries to ‘tap’ such learning.

A ‘hub and spokes’ structure also aims to support this endeavour. Thus at the ‘hub’, set within the context of the faculty’s learning and teaching vision, there is a recently formed faculty learning teaching and assessment (LTA) group, chaired by the faculty TDF with an explicit teaching quality enhancement remit especially supporting innovation in teaching, learning and assessment. To support research and evaluation activity around ALL innovation, the faculty has provided funds to support a mini-project in one of each of the faculty’s seven departments. Each mini-project has a £2000 fund (see appendix B for further details of the terms of reference for the fund bidding process). These mini-projects are the ‘spokes’ and are connected to the ‘hub’ via the project leader who is a member of the LTA group. Mini-projects are shaped and defined by the participants (LTA project leader) with the support of the TDF and other faculty members.

This structure allows the ‘bottom up’ enthusiasm of the LTA project leaders to be supported by the LTA group i.e. for sharing, analysing and discussing findings, with the aim of supporting the emergence of a community of practice. Additionally the researcher practitioners are also supported by an appropriate research and evaluation framework of action research (as discussed below). To encourage dissemination beyond the LTA group, and so cast the ‘community of practice’ net wider the LTA group also has a dissemination remit (see appendix C for the terms of reference of the LTA group). This structure sits well with the findings of Arlett et al 2007 whose “..paper suggests that small-scale funding aimed at improving learning and teaching is more likely to succeed when ‘top-down’ institutional support coincides with ‘bottom-up’ enthusiasm from funded academics.”

Therefore to achieve sustainable innovation within a continuous improvement change management model, this paper is arguing certain key things should be in place including: clear teaching and learning vision; commitment from Faculty and University Senior Management to provide financial and other resources such as ‘thinking space’; bottom up engagement supported by an appropriate framework. This paper now concentrates on outlining the methodology for supporting the bottom up engagement set within the current overarching vision and framework (as outlined above). The framework for supporting bottom up engagement is an action research model (see e.g. McNiff and Whitehead, 2006) as outlined below.

Research methodology for sustainable capacity building

Action research “..is a form of enquiry that enables practitioners everywhere to investigate and evaluate their work. They ask, ‘What am I doing? What do I need to improve? How do I improve it?’ “ (McNiff and Whitehead, 2006, p. 7). The action-reflection cycle of action research is a suitable framework for the kind of pedagogical research and evaluation activity that the EC LTA projects are/will engage in. A similar action research framework has been encouraged for example by the engCETL at Loughborough (Moron-Garcia, 2007).

Action research provides an opportunity for a sustainable framework for pedagogical research and evaluation activity centred around ALL. This since it provides a route for those who are good teachers, and perhaps moving into scholarly teaching and beyond, to link this kind of research into what they are *already doing* and at the same time keep their focus on enhancing learning and teaching. As indicated above this particular model also aligns with Senge, 1990's notions of continuous improvement and the learning organisation (see Wilson-Medhurst et al, 2008 for further exploration).

Meta-framework

Each of the above mentioned LTA mini-projects is an action research project and the EC LTA group, chaired by the TDF, provides a mechanism for sharing, analysing and discussing research plans and findings. Additionally at the meta-level the TDF and LTA chair (and author of this paper!) is themselves conducting an action research 'project' on how to build capacity in researching and evaluating activity led learning. In this case the action or intervention is the above described methodological framework, and linking support structures, for building capacity through the development of a community of practice. So the fundamental question for this researcher is, what aspects of the above interventions (if any) is influencing other people's learning and what am I learning about capacity building as a result? This to refine the interventions (actions) and/or generate a more focussed research question.

Evaluation

This paper has explored a methodological framework for building capacity in activity led learning research and evaluation activity. Thus the action after a period of reflection and investigation has been to put in place the above outlined structures and supporting frameworks. The next stage within the action-reflection cycle is to evaluate the action taken.

Within the above framework one appropriate indicator might be the number of LTA project leaders, or their associates, who are now, in relation to activity led learning, moving from one 'level of rigour' to the next and/or are able to operate comfortably at various different levels. Early indications are for example, that one member of staff is moving between level 1 and 2 and another between level 2 and level 3. A more complete evaluation will be possible by the end of the first full year of operation (the LTA projects are just starting in the Spring term of the 2007/8 academic session).

However this kind of intervention requires more than one source of evidence (for triangulation benefits) and interviews with researcher practitioners will be an important source of further information. For example, the interviews will examine what features of the above interventions might have helped or hindered the researcher-practitioners in developing their learning about how to operate at the different 'levels of rigour' and in supporting knowledge exchange between researcher-practitioners.

There is also the question of sustainability in terms of this researcher practitioner's resources. That is, what are the set-up 'costs' in terms of time, effort, required expertise and so on and this is also an interesting area for further analysis. As is to what extent any community of practice benefits are realised for all the researcher practitioners.

Conclusions

This paper has described methodological framework for building Activity Led Learning research and evaluation capacity. A continuous improvement change management model and an action research methodology have informed the design of support structures that aim to facilitate the emergence a self-sustaining community of practice (and so build capacity). This 'project' is at the 'action' stage of the action-reflection cycle and the evaluation phase will seek to examine what features of the interventions the researcher-practitioners found useful. This evaluation will use a 'levels of rigour' framework and researcher-practitioner interviews. The resources required for this kind of intervention, and its sustainability, will also be investigated and evaluated.

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Appendix A

A vision for learning and teaching in the Faculty of Engineering and Computing

Introduction

The aim of this summary is to present the Faculty's vision for learning and teaching. The Faculty wishes to maintain and develop its national and international reputation for high quality professionally focussed graduates and the learning experience that it provides. This approach to learning and teaching is motivated by the desire to produce graduates who have

- Confidence in their ability
- Capability to achieve
- Capacity to reflect, innovate and renew

To achieve this the Faculty wishes to develop a reputation for a radical activity led learning culture, building on existing areas of good practice. All students will experience a development of their professional skills through activities related to their subject.

The Faculty has a one-off opportunity, through a £60,000,000 project to create an environment planned and designed to support the delivery of this high quality experience which will incorporate leading-edge learning and teaching practice.

Vision

The Faculty is committed to developing communities of learners through employer and Profession focussed, activity led education. In this stimulating environment students will become fully engaged in the learning process, resulting in them becoming highly employable graduates who are able to lead and develop society through their enhanced research, team working and project management skills.

The key aspects of this statement are:

- Communities of Learners – An environment for learning comprising students and staff where all members contribute to their own learning and the learning of others.
- Employer and Profession focussed education – A close partnership between the Faculty, employers and Professional bodies to develop appropriate curricula and learning environments through inputs from practising professionals, student placements, sponsorship, part-time study, projects, case studies and visits and ultimately leading to employment opportunities.
- Activity Led Learning – Our students will be engaged through challenges requiring them to develop and apply their technical and scientific knowledge, simultaneously developing their team working, leadership, problem solving and life-long learning skills and utilising life-wide learning.

The key benefits of this approach will be:

- Better engagement of students and staff in the learning experience
- Improved student retention and progression
- Enhanced standards of student achievement
- Increased graduate employment rates
- Confident, self-motivated and successful members of society
- Enhanced reputation leading to increased student recruitment
- Greater staff and student satisfaction
- A vibrant learning community attractive to students and staff

This vision acknowledges the explicit links between research and teaching:

- Applied research (pedagogical) to inform teaching practice and applied research (within discipline) to inform teaching, with parity between the two.
- Researchers as contributors to the teaching practice and part of the learning community.

Appendix B

Faculty of Engineering and Computing Learning Teaching & Assessment Projects

Introduction

A major element of the Learning and Teaching Strategy for the Faculty is to develop new approaches to pedagogy. These approaches will be instrumental in guiding the design and use of the new Engineering & Computing Building. The aim of this short paper is to propose a methodology for encouraging innovation and the further development of existing good practice, for evaluating the success and fitness for purpose of these new approaches and for encouraging a more widespread adoption of these new approaches within the Faculty.

Approach

1. A small fund will be made available to support one innovative pilot project in learning, teaching and assessment based in each of the seven departments in the Faculty.
2. Each department would be allocated an additional £2000 to their part-time staffing budget. This would be used to give nominated permanent members of staff in the department time that would be dedicated to the LTA project.
3. Each department will be asked to submit a brief outline of their proposed project on one side of A4 for approval by Deans Advisory Group (DAG) and Faculty Teaching Development Fellow (TDF) before the funds are made available. The project should satisfy the following criteria:
 - Focus on some aspect of improvement in student retention, engagement and achievement.
 - Be consistent with the general aims to develop a Communities of Learners, encourage Employer and Profession focussed education and engage in Activity Led Learning.
 - Have a clearly defined approach and outcomes that can be evaluated.
 - The project outline must include a paragraph that describes the evaluation approach and identifies the resource required to complete this evaluation.
4. Each project would be guided and monitored by the EC LTA group chaired by the TDF. An aspect of the TDF role is to provide guidance and advice for these projects. Regular progress updates would be made to the LTA group for evaluation and dissemination.
5. On evaluation of the project at completion a short report would be submitted to the LTA group who would act as a key vehicle for review and wider dissemination of effective developments.
6. The results of the project should be disseminated at ELATE and/or other appropriate fora such as an HE Academy subject centre conference see e.g. <http://www.ee2008.info/>.

An LTA project may focus on (but is not limited to) one of the following, and, as outlined above, is appropriate as long as it is consistent with the general aims to develop a Communities of Learners, encourage Employer and Profession focussed education and engage in *Activity Led Learning*:

1. Improving engagement of students and staff in the learning experience
2. Improving student retention and progression
3. Enhancing standards of student achievement
4. Increasing graduate employment rates
5. Encouraging the development of confident, self-motivated and successful members of society
6. Engendering greater student and staff satisfaction
7. Developing a vibrant learning community attractive to students and staff
8. Utilising learning technologies (beyond the CUOnline minimum standard) to enhance the student and staff learning and teaching experience

The development of the outline project brief within each department should derive from open and inclusive debate within the department. The TDF is keen to be involved in these discussions.

Appendix C

Faculty of Engineering and Computing (EC)

Learning Teaching and Assessment (LTA) Group

Terms of Reference and Statement of Membership

Membership

Chair: EC TDF;
Deputy Chair to be selected from the members at the first meeting;
Up to two representatives per EC department (or nominee if the dept rep(s) can't attend)¹;
One representative from the Sigma CETL;
EC Academic Manager for the Student Experience;
Secretary.

Meetings

Normally one per term.

Purpose and scope:

Over-arching purpose is to promote innovation in teaching, learning and assessment as well as educational development activity / research and scholarship into HE practice by:

1. Supporting the implementation of those aspects of the EC L&T strategy that focus on the above innovation, development, and pedagogical research areas, and advising the EC QL&T committee of any key issues for their attention and action.
2. Receiving and discussing reports on key L&T projects within the faculty that seek to pilot and subsequently embed innovative practice within the curriculum, and referring key learning points to EC QL&T committee for consideration and action.
3. Acting as steering group for EC L&T events for staff. These events will bring in internal and (where appropriate) external speakers to highlight good practice and what has been learnt about the 'perils and pitfalls' of implementing L&T initiatives. Internal presenters are likely to include those involved with the L&T projects mentioned in (2) above.
4. Other activities consistent with the group's over-arching purpose and scope.

¹ In 2007/8 session (and subsequently for review) one of these departmental representatives will normally be the project leader for the faculty funded departmental LTA project