RE-SKILLING STAFF FOR PBL TEACHING IN A TEAM CONTEXT

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ABSTRACT

In 2002, the Faculty of Engineering and Surveying pioneered a suit of innovative integrated courses using a Problem-Based Learning methodology. These courses are delivered to both on-campus and distance education students across three programs (2, 3, and 4 year) and nine majors. These new courses required students to work in teams to solve a number of contextualised engineering and surveying problems delivered by a multi-disciplinary team of academic staff from two different faculties within the university. One of the issues faced by the course development team was the need to develop an appropriate staff development program focusing on the many new skills required to cope with the different learning paradigm. These skills not only included the need to understand PBL and to develop facilitation and conflict resolution skills but to also learn teamwork skills. A Facilitators Guide was written to document many of the course procedures including staff-student team communication protocols, and best practices for guidance to teams. As part of the staff-training program, a comprehensive workshop was developed dealing with teamwork, facilitation, problem development, assessment and feedback. This workshop was found to be effective in training the academic staff involved in these courses, especially those who are new to PBL methodology. This paper discusses the importance of the staff development program to implementing team-based teaching strategies.

INTRODUCTION

The University of Southern Queensland is a regional university in Southeast Queensland, Australia. Established in 1967 it has gone on to gain an international reputation for delivery of accredited programs via distance and online education. Approximately 75% of the university's students study via distance or online modes. The Faculty of Engineering and Surveying is one of five faculties of the university and is characterised by an integrated faculty structure, operating with no departments. It delivers a suite of programs to a diverse range of students via traditional face-to-face methods and distance education. In 2002 it became the first university in the world to have its distance education program *fully* accredited by the professional engineering body, Engineers Australia, and its programs are held up as 'worlds best practice' by the Washington Accord(1).

In 2000 the faculty began planning for its reaccreditation cycle and reviewed all programs and majors in the faculty to ensure they would meet the requirements, not only for discipline specific technical knowledge, but all the *graduate attributes* now required by both the University and professional accreditation bodies (2,3). The results of this review led the faculty to introduce a suite or strand of 4 new courses in which all students would undertake, regardless of their program or major. These courses would use Problem Based Learning (PBL) and students in multidisciplinary teams would work on a number of large, contextualised engineering problems. Each team would be allocated a facilitator who is a USQ academic and who would be responsible for guiding the team to reach a solution to the problem as well as helping to resolve any teamwork issues, which may arise(4).

The academic team for each course has ultimate responsibility for planning and designing problems, providing an appropriate level of resource material and adequate mentoring and assistance to each student team. An examiner is appointed to take responsibility for overall coordination of the course and administration matters. The courses also have a moderator and a strand leader to ensure the entire strand is coordinated and has progressive and sequential educational goals.

Due to the multidisciplinary nature of the problems undertaken by the students and the structure of the faculty, the staff team is drawn

from all discipline areas in the faculty and where necessary additional staff from other faculties, namely the Faculty of Science (discipline areas of physics, statistics and computing). An Instructional Designer/ Learning & Teaching Advisor is also a key member of the staff team, but does not undertake any student facilitation roles.

ISSUES FACED BY FACULTY

The major issues faced by the faculty in the implementation of the new courses were:

- Ensuring staff have an understanding of the philosophy and educational theory underpinning PBL.
- Changing staff mind sets towards focusing on educational outcomes and away from solely content transmission during the design and development of courses.
- Moving staff attitudes from traditional didactic delivery of content to facilitation of learning for both individuals and teams.
- Creating an effective staff team, which shares responsibility for a single course, its learning outcomes, continued development and resources.

Our first step was to invite a representative from another Faculty of another University to deliver a seminar on PBL in the medical disciplines. Following this, a small team of interested staff devised a one day training session for other staff during which the delivery and training in the basic education theory and philosophy of PBL was undertaken. Whilst this understanding was relatively easy to achieve, staff were still faced with the immense problem of designing and implementing PBL when the majority of students studied by distance education. In practical terms this meant that approximately 75% of students were distributed across Australia and the world. They are true distance education students, not simply those studying at satellite campuses or study centres. Students would have to work in virtual teams employing asynchronous and synchronous communication media to conduct meetings and assign tasks while staff would have to gain not only facilitation skills, but learn and practice facilitating online, mostly using asynchronous communication methods (such as discussion boards and email). Students mostly used Yahoo and Microsoft chat rooms for scheduled online sessions despite time zone differences, however, staff are not required to participate in these chat sessions.

The move to PBL also represented a huge cultural change to both staff and students. Previously, students had been sent a comprehensive study package, containing all resources needed to complete all assessments. While they could work through this material in a flexible manner, virtually at their own speed, provided assessment dates were met, they developed a 'study book' mentality – '*if it is not in the study book I don't need to know it*'. Staff predominantly conducted traditional lectures, tutorials and laboratory sessions for on campus students. Their lecturing style was largely didactic. The majority were largely sceptical of a move away from lectures and did not really believe that such a student centred approach would work for engineering and surveying students, particularly in the distance cohort. This preconception was a large barrier to overcome.

Whilst teacher knowledge and skills are important, positive attitudes are even more critical for student success particularly in the online environment(10). Clearly this requires convincing academics of the benefits and need for online teaching in the first instance, and for providing a supportive framework. Additionally, existing course structures and administration needed to be changed. The faculty had to move to a staff team taking responsibility for a course as opposed to an independent course examiner. This entailed staff learning to work as a team in a similar way to what was expected of the students. All problems initially encountered in forming a successful and functioning team were experienced by the staff – those of trust, communication, conflict resolution, workload allocation and differing motivation levels.

STAFF DEVELOPMENT

The transition from lecturing to facilitation remains the largest barrier for staff to surmount and has consumed a large portion of staff

development resources. There are many definitions of facilitation in the education literature and the following is a small sample of definitions which have application to PBL:

- 'coordinating rather than leading an exercise so that all group members are encouraged to participate in the discussion or activity'(5)
- 'helping others think through what they want and organising themselves to achieve it'6)
- 'Facilitation is a collaborative process in which a neutral seeks to assist a group of individuals or other parties to discuss constructively a number of complex and potentially controversial issues'(7)
- 'in education it is to help the learner forward, to manage a learner focused education process in an outcome based education model'(8)

The collective theme of these definitions is that facilitators should encourage participation in the solving of complex issues (or problems) by helping students identify common goals and the means through subsequent organisation to reach those goals. In our situation, facilitators must not only achieve this in the traditional face-to-face meetings, but also with distance students in an online (asynchronous) mode.

Literature reviews support the fact that teachers (or students for that matter) do not automatically know how to communicate or interact online(9). Many require professional development and/or mentoring in the skills and techniques of facilitating. The best way for teachers to learn how to be an effective online facilitator is for them to experience the process first-hand – undertake an online course themselves and experience what it's like from a student perspective (10,11,12). This option is presently being explored in the faculty with one staff member undertaking studies in a Graduate Certificate in Tertiary Education, which is offered online. However, for the majority of staff involved in PBL courses, the time and workload constraints do not allow this. We must rely on experimentation and shared experiences within the staff team as well as alternative methods and supportive networks to bridge this deficit.

This need was recognised early during the planning and development stage of the program restructure and a Facilitators Guide was written for use by all staff in PBL courses(13). This guide discusses the role of the facilitator, communication protocols and strategies, protocols for dealing with non participating students and administrative matters. However, this document was conceived only as a *guide* and more interactive and in depth professional development was clearly required. Moreover, this training was required regularly as the faculty has a policy of rotating all staff (where possible) through at least one of the PBL courses for profession development reasons. Workload consider-ations further dictate that each year there are also a number as sessional staff employed to act as facilitators.

We are now addressing these difficulties with annual training and planning sessions focusing on a number of key areas:

- Further refining the role facilitators will play within teams and developing communication strategies with teams which will work effectively.
- Identifying problems with current facilitation and developing skills to resolve them.
- Developing resources for facilitators to use both in the traditional face-to-face team meetings and with online asynchronous teams.
- Improving problem conception and design aspects of new problems together with related resources.
- Enhancing and reshaping assessment strategies.
- Fostering development of a *staff team* – understanding and learning to work as a team with a common goal, successful communication strategies and trust.
- Developing and maintaining positive attitudes both the within the team and to PBL.

Since the implementation of the PBL courses in 2002, we have rotated at least 44% of the faculty teaching staff through these courses. Many staff commence their period on the staff teams with a negative impression of PBL and the courses they are required to facilitate. Often this early attitude mellows during the course offering and some staff attitudes change to one of acceptance of the pivotal role these courses play in contributing to graduate

attributes of our students. A few resist the change to facilitation and remain wedded to didactic teaching strategies.

'. . . *Since I had no previous experience as a facilitator, I was very anxious about this role that I had never played before*.' – quote from facilitator.

A paramount concern for staff was the change in focus away from content delivery to appreciation of team dynamics and problem-solving. Many have expressed misgivings about particular content not being delivered by an expert (themselves) and relying on self-discovery and learning by their students. While these concerns may have had some real basis early on in the courses implementation, strategies have now been introduced to minimise 'passenger students' who benefit from the efforts of others and to identify students requiring counselling(14).

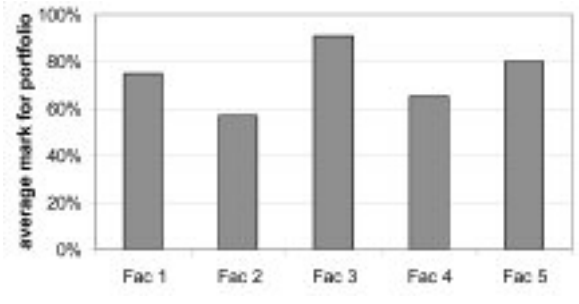
ACHIEVEMENTS

Spender and Stewart(15) indicate that if educational organisations are to survive, they must move from a didactic to a more student-centred approach to learning. Currently many academics are not comfortable with, nor have the skills, to move to using more cooperative learning techniques in the classroom and undertake the corresponding changes to assessment. The faculty has seen the staff training taking place in the PBL courses as an ideal mechanism to give staff skills, confidence and motivation to change current teaching practices within the faculty. To date 24 out of a total of 54 faculty academic staff have been rotated through the 4 problem solving courses and hence undertaken staff training. This list also includes the several senior staff (Dean and Discipline heads) plus 6 staff from the Faculty of Sciences. This has had a flow on effect with 6 other courses (e.g. Electronics and Hydrology) have now moved substantially to a more student centred approach in teaching and assessment.

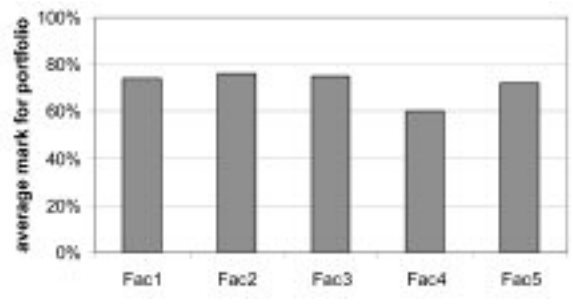
This move has the potential to provide significant benefits for our distance student cohort by giving them much more equity with on-campus students. Many distance students comment favourably on the increased contact with other students and more interaction with staff in their course evaluations. This in part is due to the staff training on using discussion boards and online facilitation(16). Many courses across campus now incorporate discussion boards as part of the educational package. Now staff understand the importance of 'seeding' discussions, and guiding and directing the discussion so that it has maximum benefits for the participating students.

One of the key objectives in staff training is continuous improvement in the course. Each year a problem area is identified and a strategy for improvement discussed, refined an implemented. An example of this is the assessment of the reflective writing portfolio undertaken by students in the first problem solving course.

Grading of the reflective portfolios revealed that facilitators as well as students were not comfortable with reflective writing. Facilitators were uncomfortable with the concept of grading personal thoughts and feelings. How can you mark a student wrong or deduct marks? The results of assessment of the portfolio by different facilitators are shown in **figure 1(a)**. The range of average marks by



(a) before training



(b) after training

Figure 1: Average mark for reflective portfolio by facilitators

individual facilitators was approximately 56% to 91%. Clearly facilitators had differing ideas and standards on what constitutes reflective writing(17).

To correct this inequity a team training session was planned and run. A Facilitators Guide to Reflective Writing was written, and assessment rubrics designed(17). The results of this training and development can be seen in **figure 1(b)**. There was much closer correlation in the assessment marks. It is interesting to note that the one exception (Fac 4) did not attend the training session.

The increasing emphasis on and interest in student learning experiences has generated a new area of research with in the faculty. Engineering Education research is now a significant research area for several staff, in addition to their area of technical expertise. These research areas include assessment strategies, reflective writing, student diversity, learning styles, PBL and cooperative learning. The results from this research and the success of the PBL courses have helped staff overcome initial concerns on course 'content' and student 'learning'.

The staff training sessions have gradually evolved as staff experience and confidence increases. When initial training sessions were planned they were conducted by only one or two staff. Now the staff team has developed to the extent where the training sessions themselves are conducted by a team. This development of a staff team, both at the individual course level and on the strand level has been a significant achievement with benefits for the faculty. Staff not only have a better understanding of issues which students are facing, but staff development and research areas have also benefited.

There remains a miss-match between student expectations of facilitators and the facilitation delivered by the staff team. Students often expect singular guidance towards a solution to the problem, whereas the facilitator's role is to suggest alternatives that need to be explored and evaluated by the student team. Failure to provide the 'answer' is often interpreted as unhelpful by students that resist development into independent learners. The problem is more frequently encountered amongst the on-campus student teams that consist predominantly of school leavers. Conversely, distance students have acquired greater maturity in the workplace and are better equipped to be independent learners.

There is still room for enhancement in the area of staff training and professional development. However, feedback from facilitators indicates that the achievements to date are substantial.

'*This one-day workshop covered several activities including the introductory team-building activity aimed to simulate a team environment within the workshop participants, introduction to PBL at USQ and detailed information on facilitation, including sharing of experience from experienced facilitators. I found the workshop to have been well organized and the contents to be very valuable especially to a new facilitator like me. The workshop materials included the 'Facilitators' Guide' which I found to be a very useful reference manual in my day-to-day facilitation. The training and experience gained by attending this workshop gave me the confidence to fulfil my duties as a facilitator throughout the semester* . . .' – Quote from a new facilitator.

CONCLUDING REMARKS

The successive offerings of the PBL courses by the faculty confirm the following major conclusions;

- Staff must be convinced of the benefits of PBL. The best way to be convinced is to be involved in a PBL course and have first hand experience of student centred learning.
- Both students and staff could mis-understand the role of facilitator. Facilitation is an acquired skill, which can only be improved by continuous training.
- More effective training is required to produce staff with greater confidence with this instructional strategy.
- All staff training needs effective evaluation and follow up to determine its longer term effectiveness – Have training benefits flowed on to students?
- Students receive the benefits of PBL, only when staff team is committed to its implementation.

- The overall benefit to student learning through PBL courses can only be achieved though consistent integrated goal/s that are supported by all staff and management.

REFERENCES

1. **Dowling, D. G.**, (2004), *Studying Engineering by Distance Education: An Australian Case Study*, Proceedings of the International Conference on Innovation, Good Practice, and Research in Engineering Education, pp 1.3-108, University of Wolverhampton, Wolverhampton.
2. **Dowling, D. G.**, (2001). *Review at USQ – Redeveloping the Bachelor of Engineering Program for 2002*, Towards Excellence in Engineering Education, Proceedings of 12th Australasian Conference on Engineering Education (pp 309 – 314) QUT, Brisbane, Australia.
3. *http://www.usq.edu.au/resources/425.pdf* accessed 12/1/06
4. **Brodie, L. M. and Porter, M. A.** (2004) *Design, Implementation and Evaluation: an entry level Engineering Problem Solving course for oncampus and distance education students*. 5th Asia Pacific Conference on Problem Based Learning – Pursuit of Excellence in Education, Petaling Jaya, Malaysia, 15-17 March, 2004
5. *www.evaluateit.org/glossary/* accessed 12/1/06
6. *www.scottishmediation.org.uk/smn/fxcseven/pgz/six.htm* accessed 12/1/06
7. *nativenetwork.ecr.gov/* accessed 12/1/06
8. *hagar.up.ac.za/catts/learner/ameyer/glossaryoflearningtheory.htm* accessed 12/1/06
9. **Coghlan, M.**, (2001), *eModeration – Managing a New Language?* Paper presented at NET*Working 2001 Conference. http://www.chariot.net.au/~michaelc/nw2001/emod_newlang.htm
10. **Kempe, A., et al.**, (2001), *Putting the Teacher Online – TEC's Learnscope Project*, paper presented at NET*Working 2001 Conference. http://flexiblelearning.net.au/nw2001/01_attending/papers/4_6Kempe.doc
11. **Salmon, G.**, (ed) (2000), *E-moderating: The Key to Teaching and Learning Online*, Kogan, London. ISBN 0 7494 3110 5
12. **Ambrose, L.**, (2001), *Learning Online Facilitation Online*, Moving Online Conference II, 2-4 September, Gold Coast, Australia. http://flexiblelearning.net.au/leaders/fl_leaders/fll00/lyn_ambrose.htm
13. **Gibbings, P. and, Morgan, M.**, (2005), '*A Guide for Entry Level PBL Courses in Engineering'*, International Journal of Continuing Engineering Education and Lifelong Learning, vol. 15, nos. 3-6, pp. 276-290, Inderscience Enterprises Ltd.
14. **Aravinthan, T., Fahey, P. and Worden, J.** (2005), '*Assessing Individual Student Performance in a Team-based Engineering Problem Solving Course*' Proc. of the 2005 ASEE/AaeE 4th Global Colloquium on Eng. Education.
15. **Spender, D. and Stewart, F.**, (2002), *Embracing e-learning in Australian schools*, Brisbane, Commonwealth Bank.
16. **Aravinthan, T. and Worden, J.**, (2006). *Effective use of WebCT in a PBL Course for a dual mode delivery*. EE2006 Conference, Liverpool, UK. (submitted).
17. **Brodie, L. M.**, (2004). *Reflective Writing By Distance Education Students In An Engineering Problem Based Learning Course*. 5th Asia Pacific Conference on Problem Based Learning – Pursuit of Excellence in Education, Petaling Jaya, Malaysia, 15-17 March, 2004.

STUDENT ATTITUDES TO ACTIVE LEARNING

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SUMMARY

Active learning is being embedded increasingly in Engineering programmes, stimulated by international movements such as CDIO and local attempts to enhance student engagement. In this paper we report studies of student attitudes both before and after their experience of active learning at university. Two active learning exercises were studied, which shared common features such as team working while they differed in their specification of outcomes. One experience was essentially open-ended ('wild') while the other was a closed well-defined ('tame') exercise.

INTRODUCTION

Active learning is a well-established concept in education, although the term itself, since its initial use in the 1950s(1), has had more currency in the context of schools than universities. The idea might be thought to be embedded in higher education, with a journal entitled Active Learning in Higher Education established since 2000(2) and a series of workshops on Active Learning in Engineering which has been running since 2001(3). There appears to be no generally agreed definition of active learning but it is widely accepted to embrace all learning techniques and styles which involve non-passive intervention by the student – in other words everything except the standard one-to-many lecture. Examples of student interactivity range from keypad responses during lectures ('interactive lecturing') to projects, practical work and field work. There has always been an element of active learning in engineering; it is inconceivable that a professional engineering education would not involve practical work, design work and a project. However the main technique for transfer of knowledge to the engineering student has traditionally been the lecture. This is now being challenged by the introduction of problem based learning (PBL) into modules or complete degree programmes(4). International movements such as CDIO (Conceive, Design, Implement, Operate[5]) also promote many types of active learning.

In this paper we report on student attitudes before and after two active learning experiences in undergraduate programmes at the University of Liverpool.

PRIOR EXPECTATIONS

All students entering the first year of Engineering programmes at Liverpool were encouraged to complete a questionnaire designed to elicit their expectations and prior experience. The questionnaire was completed during their first week of study, and about 250 responses were submitted from a cohort of about 270 students. Three of the questions related specifically to active learning in teams, and responses were on a five-point scale, from strongly agree to strongly disagree. 69% of respondents agreed or strongly agreed with the statement 'I am looking forward to practical work more than lectures', 68% were positive about 'I would learn more if I could try things for myself rather than simply be told about them', while only 22% responded positively to 'I would prefer to study on my own than in teams or groups'. This appears to indicate a strong preference for active learning.

In a separate exercise, two focus groups of a dozen students drawn from all years of Engineering undergraduate programmes at Liverpool were interviewed about their attitudes to the use of a proposed active learning environment and to working in teams. About half the students already had some experience of team work during their studies, but none had any experience of active learning apart from project work and laboratory exercises.

The groups were asked about their attitudes to an increased emphasis on active learning in

their programmes, and in particular what requirements this might imply for work spaces and hours of study. They all assumed that an increase in active learning would imply an increase in team or group work, although this does not necessarily follow. The most frequently mentioned issues were:

- Availability of space to meet in the evenings and on Sundays
- Security of access to such spaces, especially after dark
- The need for deadlines
- Access to computers during team meetings
- Facilities to practice presentations
- Quiet write-up space
- Availability of food and drink
- Need to establish student 'ownership' and to see the space as a 'base camp'

Positive suggestions to emerge from the groups included:

- Competitive projects between programmes or universities
- Longer project activities, spanning more than one academic year
- Company-sponsored 'real life' projects
- Multidisciplinary teams

To be fair to the academic staff, all of these ideas were already under consideration!

Both groups also identified similar lists of their perceived pros and cons of working in teams. Frequently cited advantages were:

- Opportunity to share workload
- Adds variety, stimulates, is fun
- Opportunity to learn from others, brainstorming as a group
- Opportunity to develop a variety of interpersonal skills – communication, collaboration, listening, problem solving, time management
- One group spontaneously mentioned active learning

The commonly-agreed disadvantages were seen to be:

- Dealing with weak input from team members
- Fair assessment
- Difficulty of allocating responsibility
- Selection of the team
- Potential for conflict
- Potential for team-work modules to absorb more time than conventional modules

There are no surprises in these lists, except perhaps that the relatively small groups readily identified them all. The overall attitude of both groups was to welcome the opportunity for teamwork.

THE ACTIVE LEARNING EXPERIENCES

What's it made of? (WIMO)

This is an introductory module for first-year students of materials science and product design. It assumes no prior familiarity with the concepts of materials science, nor any familiarity with specific materials. The module is organised around a series of workshops and the students operate entirely in teams of five or six. For the first three cohorts this was their first experience of studying in teams, but in future the exercise described below will precede WIMO and the students will gain prior experience of team working. The single deliverable from each team at the end of the module is an individual scheme for classifying materials, which has to be presented to their peers. There are almost no constraints on the nature of this scheme and the problem is thus completely open or 'wild'. The students are led through a series of workshops which explore issues such as:

- What is the range and type of possible answers to the question 'What is it made of?'?
- What material properties are important to a specific industry?
- How can we assess or measure material behaviour and properties, either in the classroom or in a properly-equipped laboratory?
- What does a 'conventional' classification scheme deliver? We use the CES software to illustrate this, and a subsidiary intended learning outcome (ILO) is that students learn how to use CES Edupack – the Cambridge Engineering Selector.

- What vocabulary is needed to discuss the nature of materials and their properties?
- How does our preliminary classification scheme work in practice, on a variety of materials chosen by the lecturer?
- How to present our results to the rest of the class.

At one level this is a very simplistic set of tasks, but with little or no background experience the students find it difficult in a number of ways. Many students regularly have difficulty separating a classification scheme from a quality framework: The very fact of identifying density as a characteristic, for instance, seems to imply that high (or low) density is in some way good.

The active learning aspects of this module occupy the largest part of the students' time. They have to interact in their teams, respond in workshops, learn to interrogate a database, practise and deliver presentations and question two external lecturers. No specific handouts are provided but a large number of resources are placed on the University VLE (virtual learning environment), to which the students have free and unlimited access. Assessment is via four reports, with the team marked by the lecturer but with individuals marks moderated by the team members. There is also a written open-book examination, in which the students, individually, have to describe and use their own team's classification scheme. The feedback from 21 students was generally positive about the module as a whole but the following summary of comments indicates some of the issues around the more active elements:

Team working:

- group work – working beyond my group of friends is good(4)
- I have realised that working in groups is really hard, and an age gap does exist
- varied, not boring

but suggested changes included:

- less teamwork(2)
- having friends as group members
- not having to listen to other students' presentations
- attendance sheets to spot team defaulters

and comments antipathetic to student-owned or active learning included:

- give us more information about materials rather than students having to find it
- revision related to exam(2)
- more questions relevant to exam(2)
- present more about materials
- handout every lecture(3)

Although one of the principal motives for running the module in this active style is to encourage the students to take ownership of their own learning, it is evident from the comments that this is not entirely successful.

Icebreaker bridge

This is an introductory team-building design-build exercise taken by 270 first-year engineers during their first week in the Department of Engineering. Over a five-day period the students, working in teams of six, model, build and test a girder bridge. The exercise serves to introduce tutor groups to each other, to introduce the concept of design-build-test and to give every student the experience of team-working. The icebreaker is a closed or 'tame' exercise in that the basic design of the bridge is given to the teams, who have to make its components, test them, assemble the bridge and then test it. The available laboratory space was minimal and the groups were perforce working in a confined space, close to other groups.

Twelve weeks after the end of this exercise a sample of 24 students were interviewed by an individual who was not involved in their programme in any way. By this time they had all taken part in a further, more substantial, team exercise. The sample was unanimous in declaring the 'icebreaker' hands-on experience to have been enjoyable. Among the main issues to arise from the students are:

- They did indeed get to know their fellow tutorial group members well, and they met their tutor in a non-threatening environment,
- They recognised that they had to use, and did develop, organisational and team-working skills, such as time management and work sharing.

- Several students commented that they had been 'forced' to operate in groups which did not necessarily contain their friends, but that this was eventually a useful experience.
- Despite the fact that the task, building a bridge, might have been considered less appropriate for students registered on for example an aerospace engineering programme, students from all programmes reported that they learned about some ideas that were relevant to their programme. Among these were factors of safety, tension and compression.
- The density of packing of groups in the laboratory, instead of being a problem, in practice meant that they got to know, and learned from, neighbouring teams.
- Some students, especially those majoring in design, commented that the prevailing attitude to safety was inhibiting compared to the more relaxed attitude in their previous school or college. 'I should not need a risk assessment to use scissors'.

In addition to these comments from the students themselves, staff made a number of pertinent observation about the more extended team activities which took place later in the semester. These involved designing, building and testing a product in two intensive week-long sessions and were called Two Week Creations (TWCs). The three products (each tackled by fifteen or more teams of five students) were a remotely controlled aircraft, a water-powered rocket and a cardboard load-bearing bridge. The water-powered rocket had to be tested outdoors (in December and January). Students from these groups tended to disappear to a warmer place as soon as their test was over, thus depriving later groups of an audience and substantially reducing the opportunities for networking and casual learning. This was in sharp contrast to those building bridges or aircraft, who were testing indoors and who tended to stay around to support, and learn from, other groups. Active learning can only take place if the activity is tolerated by the students!

DISCUSSION AND CONCLUSIONS

Our survey of attitudes on entry indicates very strongly that students registering to study engineering are positive about many aspects of active learning. They appear to relish participating in hands-on activities and they are equally positive about working in teams.

Following exposure to active learning in groups – in this case a hands-on design build test (DBT) exercise – the students are more alert to the difficulties of team working.

'*The Icebreaker gave you group time-keeping skills that were quite important for the TWCs [two week creations] later on; so there were a lot of similarities in the ways of organising our group activities for both, which was a good thing*.'

They are positive about their enjoyment of the exercise, but aware of some of the potential problems. A recurrent issue is the selection of groups. In none of the Liverpool exercises was self-selection of a group of friends allowed. In every case the team membership was determined by staff. While several students commented that they slightly resented being 'forced' to work with a pre-determined group, many of them conceded that it was a rewarding experience, and almost all accepted that it was more realistic as a simulation of their future environment in the world of work.

'*I don't normally like working in groups (and many of my classmates feel the same, I'm sure). But I know that for the modern engineering profession working in a team is very important. So being involved as a team member in the Icebreaker and TWCs did push me to address this issue personally, and did help me create (and learn) more of these vital skills*.'

A significant difference in attitude was detectable in the students who had completed the 'What's it made of?' exercise. 14 of 21 respondents reported some type of antipathy to active and/or team learning. In most cases this was a request for more passive 'spoon-feeding'. More student concern related to assessment of their performance in a team, than to any other group work issue. Many students were concerned about the behaviour and grading of others ('why should A get marks for doing nothing?') and now perceived that it was necessary to work at being a team member.

The many positive aspects of our surveys and feedback lead us to conclude that active learning and team working are worth pursuing. This is preliminary work and in future studies we will be able to assess more effectively the learning outcomes from these and other active learning experiences.

REFERENCES

1. **Harkins, William E.**, 1952 *Modern Czech Grammar*, Columbia University Press
2. **Active Learning in Higher Education,** 2000 onwards, Sage Publications, London
3. **Active Learning in Engineering Education**, 2006, www.ale.tudelft.nl
4. **Hansen, P. K.**, 2003, Int J Engineering Education, 19, 177-182
5. **CDIO** – Conceive, Design, Implement, Operate, www.cdio.org

A PRACTICAL APPROACH TO DEVELOPING GOOD ENGINEERING TEACHING PRACTICE

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ABSTRACT

In the busy world of Higher Education where the academic is constantly juggling teaching, administrative and research requirements, it is all too easy to allow the development of good teaching practice to take a lower position on the list of pressing priorities.

Through what would at first seem to be two unrelated initiatives, we will discuss a practical approach to the development of good teaching practice in an engineering school. One of the key features of the two initiatives is that they were self-organising – a programme review and the setting up of a teaching and learning support group. Neither is weighed down by university process, and the enthusiasm of those involved is helping to drive the initiatives forward. Although it is early days, the issues being discussed are proving both topical and essential. By reviewing the pedagogical foundation and looking for opportunities to build on it, the aim is that the continuous improvement of teaching practice will become part of the school culture.

INTRODUCTION

Albert Einstein once said:

'I never teach my pupils, I only attempt to provide the conditions in which they can learn.'

An admirable attitude, and one that we should all aspire to. In the fast moving world of higher education and with an increasingly diverse student body, we are constantly challenged to enhance the quality of our endeavours in the classroom, be it a lecture hall, laboratory or design studio. Dutifully we take this on board and work to emulate the idea so eloquently described by Einstein many years ago.

But what about us? How much time do we set aside to explore our development, our successes and failures and to explore opportunities with colleagues? The argument proposed by this paper is that we often don't take the time to reflect as much as we should. We all know why. In the world of research and teaching, research is king and quite often exploring the challenge of developing good engineering teaching practice comes a distant second place in the whole scheme of things.

This paper is not rooted in theoretical ideas, it is very much written as a practical contribution to the literature. As engineers and scientists we can relate to the physical more easily. In fact, this feature may help to explain why we often struggle in the world of teaching and learning.

BACKGROUND

If we explore the literature for suggestions as to how to promote and more importantly sustain a teaching and learning dialogue within our institutions, the pickings are lean to say the least. Entering the words 'engineering teaching support' into Google yields many possible websites, mainly fairly anaemic university staff development sites, but by item 15 the offerings are getting decidedly obscure. We would consider the Higher Education Academy website as an exception as it is a rich source of practical ideas(1). There are copious papers on teaching and learning theory, often sprinkled with case studies to tempt us to try something new, but many are not particularly accessible. Although focused on the USA, Bok makes clear the value of good teaching practice when he clearly articulates that it is how courses are taught that has the most impact on students rather than what the course is or the material the course contains(2).

Taking a postgraduate qualification in teaching and learning can be like entering another world (3,4). The language verges on the incomprehensible and the new lecturer is left wondering how on earth they are ever going to

glean something useful from the masses of material they are being introduced to. This may sound very cynical but it raises the question as to how we develop a love of teaching and learning in staff who are becoming increasingly hard pressed to juggle the many tasks they are charged with.

'We love teaching' you say, and we are sure you do. How often though are you able to really reflect on what it is you are doing in the classroom without feeling guilty? There are always research proposals to write, meetings to attend and students to see . . . then there is your e-mail!

It is perhaps no wonder that we often turn a blind eye when it comes to developing a better teaching and learning practice. 'We can teach' we convince ourselves, so why take the time to explore new or different approaches. Change is not something we tend to enjoy as humans, so avoidance seems a good strategy.

That isn't good enough. We must find time to reflect, regardless of the competing priorities. That is the subject of this paper.

CASE STUDIES

Reflect - to think quietly and calmly.

This definition taken from Webster's Dictionary(3) offers a good starting point for our journey. Accepting that an academic's time is very precious, the philosophy behind both case studies has been to accept this value, but at the same time to encourage the use of some time to explore teaching and learning on a regular basis.

Case Study 1 will explore an entity that has become known as the 'Teaching and Learning Support Group'.

Case Study 2 will look at the process adopted for a programme review that has encouraged teaching and learning development.

Case Study 1

The Teaching and Learning Support Group was set up in January 2005. The group's function has evolved over the initial months of its existence, and it still has more to achieve before it really reaches the point where it can be considered as a success.

First thoughts were about a group that would act as a support network for the members of the Engineering School engaged in gaining a teaching certificate, either at Postgraduate level or at Associate level. Although these people were targeted, it was felt that a wider invitation to all teaching staff in the School was a better approach. This would make the group inclusive and hopefully promote interaction between new and more seasoned academics.

There were other key group characteristics that needed to be considered. Rather than having the group as an Engineering School entity, the group was set up with the support of the Centre for Staff Development. This collaboration and element of independence from the School was helpful in marketing the group as not 'just another School committee'. It was made clear to everyone that the objective of the group was not to influence School teaching policy or to act in place of an existing teaching committee. By taking this approach the group was able to differentiate itself and gain the support of the School's senior management.

Staff Development also opened the doors to the use of different facilities, suggestions for and access to a range of speakers for the group to invite and the all important 'carrot'. It sounds very unimportant, but in a play on the words from the Hollywood blockbuster 'Field of Dreams' – 'if you feed them they will come'. By offering a light lunch, people can often be persuaded to attend events that they would ordinarily not consider. This helps to create a friendly atmosphere and a degree of informality that is important for people to relax, listen, reflect and hopefully contribute.

The initial selection of topics was chosen at a preliminary session that was arranged to discuss the group and explore how it would work. The attendees needed to have an opportunity to input to the programme, so a brainstorming session was used to bring some ideas together. These related to issues and areas of interest within the School, so were likely to be relevant and attractive to the target

audience. Hour long sessions once a month, with a break in July and August, were chosen as the preferred meeting frequency. Lunchtime was seen as the most appropriate time to optimise the attendance.

The hour was broken down as follows:

10 minutes to assemble, network over lunch
30 minutes for the presenter to talk about the subject after a very brief introduction from the group convenor
20 minutes to ask questions, discuss issues and exchange ideas, accepting that some people may start leaving 10 minutes before the end of the session in order to get to afternoon classes in time.

The overall duration of 1 hour was strictly enforced to ensure that people didn't feel trapped and could confidently fit the meeting into their busy schedules.

E-mail alerts are sent out prior to each meeting and for the current academic year, a full programme was published in September and circulated to all teaching staff. The School teaching staff numbers 85 people. Most Support Group meetings tend to attract somewhere between 12 to 18 individuals. This is not many, but quite often the people can be different. We estimate that to date somewhere between 25 and 30 different individuals have attended at least one meeting. This is encouraging as it indicates our reach is a little greater than the number of attendees each time would suggest.

The group speakers are drawn from the School, other parts of the university including Staff Development and from outside the institution. Topics to date have included Problem Based Learning, Assessment Load, Working Smarter, Group Work, Student Behaviour, Mentoring and Research Skills for Research Students. The Higher Education Academy Engineering Subject Centre attended a lunchtime session to introduce what they had to offer and in the Autumn of 2005 they returned to facilitate a half day event that focused on Student Retention.

The range of topics has maintained a level of interest that has been important for the group to remain fresh. Now with the group into its second year it has also shown that it is not just a 'flash in the pan'. Acknowledging that it is not always possible for colleagues to attend sessions, a short review of each session, along with any slides or references are posted on the group's WebCT site for people to refer to when they have an opportunity. This in its own right is starting to become a valuable new resource as an archive of teaching and learning tips and ideas.

Verbal feedback from colleagues to this point has been encouraging, although it is still early days.

Case Study 2

Reviewing programmes can often become a very bureaucratic exercise, where the focus can be more on compliance rather than on being creative. This is not to negate the value of formal procedures(5), but the time for true reflection on a programme can be short.

This case study discusses an approach to the review of a suite of design programmes in the Engineering School. Although the formal review was initiated by university procedures, there was a desire amongst certain staff to explore the programmes more deeply and to look at the teaching and learning aspects in particular. Goldberg(6) is one of many references that can be helpful when presented with an opportunity such as this.

To do this an 'away day', truly away from the university, was arranged. The staff teaching on the programmes were brought together and an intense day of exploring ideas relating to the programme was conducted. The programme for the day was as presented in **figure 1**.

Figure 1: Away day programme

Figure 2: Vision for the design programmes

Each of the workshops comprised group work, with an initial period of brainstorming, followed by discussion and prioritisation. This took up 30 minutes of the hour, the remaining 30 minutes being for each subgroup to feedback to the main group, and then for the items raised to be discussed, documented and for preliminary decisions to be made. By being clear from the outset that outcomes were required, each workshop reached a productive conclusion. An example for the Vision workshop is shown in **figure 2**.

The workshops were chosen to ensure that the majority of key topics had a chance to be discussed and that there was a degree of coherency to the day. To avoid complacency, the afternoon groups were different to the morning ones, and some sessions covering multiple aspects of the review were shared between the groups.

The culmination of the day was a Paired Comparisons analysis(7) focusing on the main issues needing attention. The analysis ranked the issues, thus allowing everyone to leave the meeting with a strong impression of the actions needing to be taken. The sense of satisfaction expressed by all of the attendees was encouraging, making the energy expended worthwhile.

Cynics voiced the belief that there would be no follow through, but, unfortunately for them, this has not been the case. Several hour long follow up sessions have taken place to monitor the action list and at the time of writing, the next meeting is imminent. After giving the attendees time to reflect on the day, it became apparent that some of the identified actions needed to be subdivided into smaller tasks. This has subsequently lead to the formation of small subgroups of interested people charged with exploring particular areas of action.

DISCUSSION

None of what has been presented here is ‘rocket science’. The aim was to explore, with reference to our experience, a pragmatic approach to keeping teaching and learning visible in a research led institution. The common thread between the two case studies is that they each present an opportunity for teaching staff to reflect on their practice in a friendly, energetic and stimulating environment, with essentially no strings attached.

The next steps for the Support Group are to reach out to those parts of the School that are currently untapped. The opportunity to network brings together colleagues who may well have never met before. Although teaching and learning is the focus of the meeting initially, it does not preclude a discussion about areas of research interest and possibly even the potential for collaboration.

Building up momentum and establishing the group as a serious entity may well allow meetings to start to take on a slightly different form. Examples may be a Question and Answer panel, a surgery in a particular issue or some other creative approach that will promote a greater degree of inclusion. The idea of opening the meetings up to members of other Schools is also being considered. Again this has the potential for networking and collaboration opportunities to be explored.

It is hoped that the group may also promote some increased effort in the area of teaching and learning research either through internal funding or through external sources such as the HEA Engineering Subject Centre mini project initiative.

The Programme Review work is still ongoing and, as with any strategic exercise, has its ups and downs. The success will ultimately be measured in terms of taking steps towards the stated vision and through positive student feedback. The work continues as does the monitoring. The key point though is that the review has brought people together to explore

best practice. All the time the dialogue continues, the work will be worthwhile. An encouraging step in this area has been a request to conduct a similar workshop session for a different set of programmes. Although this will focus more on strategic issues in general, developing good teaching and learning practice will form an integral part of the discussion that takes place.

In both case studies a key element has proven to be a champion for the approach being taken. The champion needs do no more than act as a focus and a reminder. With persistence and discipline thrown in for good measure, the initiatives have every hope of succeeding, with good teaching and learning practice becoming ever more visible.

Over the coming months a key objective will be to look at the success of the two different initiatives. This will take the form of asking staff about any changes they have made to their teaching practice through the application of tips, ideas or agreed actions. The perceived benefits (or not) of these changes will also be explored.

CONCLUSIONS

This paper has discussed the situation within one particular research led university. The culture within other institutions will be different, with some more successful than others at keeping the development of good engineering teaching and learning practice high on the agenda. Despite these differences, the overriding message is to find time for quality reflection, explore opportunities with colleagues, act on your ideas and most of all, despite the conflicting demands on your time, don't give up.

ACKNOWLEDGEMENTS

Thanks to our many colleagues for their input and support, but most especially to Dr Ann Morton in Staff Development who quietly never gives up and doesn't allow us to either.

REFERENCES

1. **The Higher Education Academy Engineering Subject Centre** website at www.engsc.ac.uk
2. **Bok, D.**, 2006, '*Our Underachieving Colleges: A Candid Look at How Much Students Learn and Why They Should Be Learning More*', Princeton University Press
3. **Aston University** *Learning and Teaching Strategy*, March 31st 2003
4. **Aston University** *Postgraduate Professional Certificate in Learning and Teaching Programme Handbook*, Version 7, September 2004
5. **Aston University** *Programme Review Document*, REG/05/247(2), September 2005
6. **Goldberg, D.**, 1995, '*Life Skills and Leadership for Engineers*', McGraw Hill
7. Paired Comparisons Explanation at www.mindtools.com

CREATING A RICH LEARNING ENVIRONMENT IN A RESEARCH LED UNIVERSITY

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ABSTRACT

One of the weaknesses of a research-led strategy is that a high proportion of staff see their research performance as more important to the University, and themselves, than their teaching duties. However, in an age of widening participation and weaker average mathematical abilities of entrants, students and therefore Universities actually need a more supportive learning environment than those deployed in the past. Obvious tactics are to increase staff accessibility and to give more, fast, formative feedback. However, our conjecture is that this alone is not enough. Staff need to recognise that a degree programme is a whole unit and cannot be delivered as a set of distinct units in the hope that students will piece together the links themselves. Increasingly, staff need to recognise in their practise the need to work as a team rather than individuals working in parallel. The first aim of this paper is to share some of the experiences at Sheffield of tackling this problem. A second aim is to engage the conference audience in sharing with each other the perspective, best practice and barriers to progress from their own institutions.

INTRODUCTION

It is well known that the pressures and potential rewards associated to RAE (Research Assessment Exercise) have forced Universities to put significant emphasise on research output. It has been widely reported that a typical consequence is large-scale movements of high performing staff, but moreover, departments aspiring to a high research rating have increasingly recruited solely on the research credentials of applicants. A rather obvious consequence of this trend is that the staff make up becomes heavily skewed towards staff whose prime interest is research; their views of teaching may vary significantly but several would rather avoid undergraduate teaching altogether and the majority, although conscientious, desire to keep teaching time to a minimum. This leads us to a dichotomy, that is, although research led teaching can be very rewarding and stimulating for the students, the staff with the ability to deliver this may not be enthusiastic to do so, especially in the earlier years where the material is more fundamental and introductory and, moreover, there is a recognised need for more formative feedback (Brown 2006), which is time consuming.

Within engineering this problem is increased further due to the changing makeup of the student body. There have been well reported (Kent and Noss, UCAS, Engineering Council, mathcentre) problems with numbers studying A level mathematics and also with application levels to engineering in a time where departments have also been encouraged by the Government to expand. This has resulted in several Universities dropping the entry requirement for A level maths altogether, and many other high standing institutions are accepting students with far lower grades than they would ideally choose. In Sheffield we have also noted an increase in students with non-standard entry qualifications such as the national diploma. This ‘drop’ in standards actually goes in line with pressure to widen participation, but ultimately requires a substantial change to the traditional view of what a student can do, or expects, on arrival (Laurillard, 2002, Race 2005).

A further trend that seems to have speeded up in recent years is the growth in the number of degree programmes available through UCAS. For instance, our department (Automatic Control and Systems Engineering - ACSE) trebled its portfolio by adding *with Business Skills* or *with Management* to each of the existing portfolio; many other departments have gone about similar changes. Underlying this is the belief that ‘student choice’ is of paramount importance, so both in the choice

of programmes offered and in the options included within programmes, there should be ample choice to meet every student's wishes. Unfortunately, one argument made in this paper is that student choice is not necessarily a good thing; students of 18 years of age may not be able to make wise choices, and too much choice also makes it hard to retain a fundamental core within a programme, thus weakening student experiences.

So, in summary, there are several key pressures acting on departments, all of which could cause a deterioration in student experience, either due to inappropriate expectations of staff, inadequate time spent on student feedback or simply creating too much choice so that students lose sight of the core. In this environment it is essential that academic departments change (Ramsden 1992), not just the content of their programmes to reflect changes in entry levels, but even more importantly, how programmes are organised and delivered, to help students develop and gain a sound overview of their given field (Oliver 2003, Roblyer 2000). It is on this latter topic that this paper is focussed.

Specifically section 2 discusses some reflections and student feedback from within the authors' department and how this led to a drive for change. Section 3 presents our experience of trying to implement change and section 4 gives some preliminary reflections and looks to the future.

THE NEED FOR CHANGE

The focus of the project discussed hereafter was to consider what improvements could be made with the first year. The main pillar of the project is an aim to embed an ethos of teamwork much more strongly into the teaching undertaken by the department. This section describes how this focus was identified and then taken forward.

Student comments

The project arose from a desire to improve student retention, performance and satisfaction for undergraduate programmes delivered by ACSE. Indeed, as with many engineering departments there was a particular desire to optimise student retention and performance in the first year. For instance, in early years typical student comments had included: '*At the moment, none of the modules really link together to make me feel I am being trained as an engineer'; 'My main concern with regard to this course is the level of cohesion between the xxx and ACS modules*.'

The reader will note that a key issue was not the quality of the individual modules or for that matter of the teaching within any module, but rather the links between modules. This has obvious links to widening choice; students may be able to choose from a wider range of modules than formerly but hence need more help to see why these form a coherent whole.

Details and relevance of project to aim

The above statements, made by students in course evaluation surveys, seemed to indicate that the department could improve retention, performance and satisfaction by tackling the perceived lack of cohesion and relevance of material. As with most Universities, individual module leaders usually deliver their own modules without direct reference to the content of other modules. A strategic plan for linking module content across a programme is limited by the fact that, with increased student choice of modules/themes, explicit linkages to other modules are not practical. In consequence we all teach independently and cohesion is dealt with only at the level of module or programme content/descriptions rather than in a more proactive manner. While staff may understand how several modules inter-relate, students often do not have the experience to do this and are less wont than in the past just to take it on trust until older.

Thus, it was immediately clear to the authors that there is a need to facilitate and promote communication and information sharing amongst teaching staff (here focussed just on those teaching in the first year). The essence of their proposed solution was the creation of a 'first year staff team' concept. This in itself may not be novel elsewhere, but required a significant culture change within ACSE. As other research led Universities may be experiencing similar issues, the authors thought it

worth reporting what they have learnt from attempting such a project.

Aims and objectives

The main aim of the project therefore was to form a first year staff team with responsibility for creating an integrated first year programme, but in the first instance, without substantive change to module organisation and student choice. The team is a new staff structure within the department and has been given a specific remit from the department's learning and teaching committee to support the first year and to ensure the quality of the first year programme. If the project is successful, the team concept may be applied to the second, third and fourth years in the future later.

The team was given some specific objectives (below), although within its remit it could adapt these as appropriate in response to new scenarios and information:

- to establish and embed unifying material across all first year modules, including ACSE modules and modules provided by service departments.
- to demonstrate the real-world context of the first year as a whole.
- to monitor/regulate workload and skills development over the first year programme.
- to monitor/assess the first year curriculum with a view to ensuring a cohesive set of modules, including ACSE modules and modules provided by service departments.

In order to facilitate these objectives, the most important change was a need for regular and effective communication and team working amongst staff. In parallel, there was a major cultural change, that is staff lost some autonomy over their modules.

Desired outcomes and impact

The main outcome of the project is the establishment of a first year staff team as an integral part both of the department's structure. It is hoped that further outcomes will originate from the team; these may include an improved first year curriculum and improved delivery. In particular, one intent is to focus on improving integration by establishing links between modules or cross-modular activities. The team should also facilitate monitoring/coordination to ensure student workload balance and consistency across modules; these are two things which are harder to implement when a lecturer owns a module rather than a team. The impact on the students learning environment and hence learning is self-evident.

PROJECT IMPLEMENTATION

This section will discuss the initial plans for forming a first year team and making the required cultural change within ACSE. This is followed by a self-evaluation of current progress and consideration of successes and also barriers which continue to exist.

Project initiation

The motivation for the project arose not just because of student feedback discussed earlier, but also due to an increasing awareness of the importance of teaching quality. For instance HEFCE (Higher Education Funding Council for England) through TQEF (Teaching Quality Enhancement Fund) is putting targeted money into Universities, and in fact it is TQEF money that has funded this project. The head of the departmental Learning and Teaching committee (LTC) and the authors agreed to look at year one on behalf of the department. At the institutional level, they were supported by the Learning and Development Media Unit (LDMU). LDMU acted as mentors in the planning stage of the first year staff team project, and helped write a workable proposal to obtain an internal grant to contribute resources (mostly staff buyout time) to the initiative.

It should be emphasised that institutional support was essential to this project, both because it gave some validity to the underlying aims, and also the availability of cash to buyout staff time gave 'overworked' academic staff an inducement to make full involvement a priority. Our experience is that without such incentives, progress would be far slower.

Project plan

Due to the timescales required to write a project and release funding, it was decided to pilot a few innovations in parallel with seeking institutional support. The success, or otherwise, of these would also be useful evidence for future developments. Hence, a timetable of events was set up as follows:

2004–2005	Project in limited form and informal evaluation.
Aug. 2005	Identify training[1] needs for team members.
Sept. 2005	Training of team and sub-sequent meeting to plan key objectives.
Oct.2005 – June 2006	Monthly progress meetings[2]. Small groupings to work on specific deliverables[3].
July 2006	Evaluation and final meeting with LDMU. Plan for 2007.

[1]Forming an Effective Team, Managing Difficulties Within a Team, Working Productively Within a Team.
[2]These would include evaluation of and planning for semesters at logical dates.
[3]These may include new assignments, design of inter-module tasks or overview of entire curriculum.

Training requirements

First, although only three members of staff proposed the project, it was paramount that all staff members who taught in the first year and the head of the department, signed to indicate their support of the project. This pledge of commitment proved to be important.

Secondly, in order for there to be an effective change in culture, it was important that staff were fully aware of the benefits and potential pitfalls of working in a team. Hence there was a need to encourage and support staff in the development of the requisite professional skills to make the staff team effective.

The team numbered seven persons, which introduced severe difficulties in getting everyone together simultaneously for a day and half's training. Hence, it was decided to make use of e-resources available from staff development, thus making staff engagement more convenient. As a consequence, 6 out of 7 staff participated fully in the training.

Monthly meetings

The first meeting was used to agree the modus operandi and the remit of the team. As expected, this raised the issue of workload and while staff accepted the underlying aims there was a desire to keep any 'extra' loading to a minimum and be very targeted in any implied work. In fact this issue of time is a fundamental barrier and does not sit well with the need to introduce regular formative feedback (Brown, 2006), but nevertheless it is also not easily resolvable when staff are also put on great pressure to be productive researchers. Nevertheless, some key principles were accepted, not least of which was a commitment to effective communication between team members and personal tutors with respect to the ordering of module content and assignment design. This involved the need for module specifications to be modified to be more consistent in presentation and more precise about scheduling of material within the semester. Significantly, staff also agreed there was a need to negotiate coursework deadlines.

Thereafter, contact was mainly via email and small groups meeting informally to progress specific projects. Formal monthly meetings were also introduced to monitor progress or evaluate and commission developments as required; these are usually kept to an hour maximum and have a highly focussed agenda to ensure effective use of staff time.

During the first semester the team had two main priorities. The first priority, to improve liaison with our service departments, was set because of problems identified in student feedback and by exam results, and was particularly important with regard to the Mathematics service teaching. Moreover, modularisation has created programmes which rely heavily on service modules throughout, and hence it was necessary to get a better process for managing this and in particular to take account of student performance and feedback. The second priority, to engage the students in their degree course so that they explored for themselves the nature and relevance of their subject, was addressed by planning several small assignments which required students to engage personally (to encourage deep learning [Ramsden 1992]) in

the relevance of their modules to a career as an engineer.

Integrating assignments

A major failing of modularisation is the loss of formal integration between modules. In fact, a bigger issue is that this role, that is ensuring integrating assignments, is not assigned to any member of staff because workload models tend to be based solely on individual modules. In our view, this is an ongoing problem and has been solved here by a few staff voluntarily taking on extra work without receiving formal credit for doing so.

The team tackled this issue from two angles. First some small assignments were added to the laboratory module (thus counting as an additional laboratory but also focussing on transferable skills). These included: (i) a group design and presentation of a poster on systems engineering[4] and (ii) writing concise (one side A4) summaries of visiting industrial speakers' insights on engineering careers. Student feedback on these is discussed later.

Towards the end of the first semester, the team began to plan the second semester, with a view to improving links between modules and eliminating unnecessary overlaps between modules. Small groupings of staff looked at links between the three core modules only and considered where their lectures and individual assignments could be modified to put more emphasise on these links, including deliberate repetition of material where appropriate and shared examples. The proposed changes are planned for spring 2006 and evaluation of this should be ready for July. The second semester will also include a new student group project involving project planning and management.

EVALUATION AND FUTURE WORK

This section summaries evaluation and feedback available so far, with the pointers this gives to the future. Also, some space is given to a discussion on the authors' perceptions of both successes and barriers to progress.

[4]Being open-ended, students on different programmes could tailor this around their own module selection.

Staff commitment

Throughout the year, a major problem was the level of commitment that each team member could give, which varied according to his/her other commitments. In a busy academic environment, with many other significant initiatives active in the department during the year, it was extremely difficult to meet regularly, to plan and to implement changes.

The team found that it was important to be flexible and if necessary meet in small groups to discuss specific issues. Over the term, all staff would attend some meetings and hence have an input on overall direction. Moreover, different groupings attended to different deliverables so that three staff focussed on semester one assignments and a different three staff considered semester two integration.

The biggest issue however is convincing staff that involvement is time well spent. Many did not want to be party to generic discussions and would happily defer to the others. The team found that best progress was made when specific staff were asked to consider specific issues. Moreover, research active staff were content to attend only with a promise that a meeting would be highly focussed and brief: make a decision quickly, decide on the actions and give a deadline. It was not so much a lack of willingness to contribute, but a desire to not waste time in meetings.

In conclusion, research active staff will always be overstretched and have limited time, although often they are enthusiastic teachers. It is important to facilitate their input by, if necessary, carrying extra load on their behalf to ensure they can make an effective contribution in the time available. From this point of view, the team ethos needs a small core prepared to carry the brunt of the co-ordination and assessment activities.

Student feedback

The following summarises typical student comments on the first integrating assignment, to produce a group poster and then present, via an interview, to the entire department during a social event. *(i) It was useful and interesting. I did not know exactly what systems*

engineering as I know it now. Certainly broadened my mind and hopefully now I know the aim of the course in general. (ii) This assignment was very useful in developing team-working skills. (iii) The assignment was a magnificent test. It helped me to further earn knowledge of the broadness of systems engineering. It also helped me to further develop communication skills and how to work in a team.

Comments on the guest speakers and summaries assignment include: *(i) The guest speakers' choices of the presentation was really good where they have chosen subjects which are related to the modules we took. (ii) These parts were very helpful for understanding what we really do as engineers and what prospects do we have in the future.*

Success and barriers to progress

The project is in its first full year, although some preliminary changes were instituted the previous year. So far student feedback has, by large majority, been highly favourable. Moreover, the LTC has formally approved the first year team as having official status which means that change is becoming embedded and is likely to outlive the lifetime of the project funding. In fact, some of the implicit aims of the project have been taken on board by LTC as part of proposed structural change.

The key barriers to progress are twofold. First, it is accepted that students need formative feedback and without this any integration will have a much smaller impact. However, formative feedback requires substantial staff time and this will always be a problem when staff feel overstretched. Secondly, research active staff, on the whole, will not want to facilitate such initiatives. Where a department is 100% RAE returnable staff, such a project may become untenable without the HOD endorsing involvement. This may be an argument for a small number of staff being on teaching only posts.

There is one more barrier to progress which is not discussed in detail in this paper due to lack of space, but constitutes a major part of on going talks. Part of the difficulty with integrating a student experience is that increasing programme flexibility means that modules must be designed without interdependency, as students all take slightly different mixes. Thus modularisation imposes a structure that impedes the provision of an integrated student experience.

The future

Now that the team is established, it intends to tackle some bigger issues affecting the first year. A small group is looking at the topic of mathematics and how learning can be best facilitated within ACSE. A separate group is considering the impact of recent industrial trends and the impact on a group of the four core modules which contribute to this theme (simulation and modelling) but so far had been delivered independently. In the longer term, the team hopes to engage the whole department in tackling the issue of student choice, as we feel too much choice is not in the student interest.

CONCLUSIONS

This project may, at first sight, appear incremental, certainly when measured against what many departments would want to publicise about their practise. However, our view is that, in practise, a major cultural upheaval is required to achieve real team working, as opposed to tokenism, in delivery of the curriculum. There are substantial barriers to overcome, which, in the first instance, we have tackled by getting institutional support and staff buyout time to get the process moving. We anticipate that this will be enough to change the culture, or to establish a trend, which will become the norm hereafter, especially as student feedback has been very positive concerning the innovations brought about by the team.

However, we have progressed thus far only because the authors have put in considerable extra time to facilitate the project, to keep it moving and to mark any extra assessments. For any department considering this approach, we would recommend due credit is given to staff who perform such a role. In fact, one might suggest that teaching only staff are best suited to such a role.

Finally, to make such a project work, it is essential that one gets the most out of research active staff, and this means having brief but highly focussed and well prepared meetings leading to transparent, but not onerous, actions. It is also necessary to ensure staff see enough of a benefit to put up with the small increase in workload or they will not prioritise attending team meetings.

Acknowledgements

Thanks to David Staniforth and Neil Mort for help with the initial project design.

REFERENCES

1. **Brown, S.**, *Using formative assessment to promote student learning*, University of Leeds Learning and Teaching conference, 2006, Keynote
2. **Engineering Council**, *Digest of Engineering Statistics* 2002, www.engc.org.uk/publications/statsdigest
3. **Kent, P. and Noss, R.**, *Mathematics in the University Education of Engineers,* http://www.engc.org.uk/publications
4. **Laurillard, D.**, *Rethinking University teaching*, Routledge, 2002
5. **Mathcentre** (Loughborough, UK), www.mathcentre.ac.uk, www.lboro.ac.uk/research/helm/index.html
6. **Oliver, R. and Herrington, J.**, *Exploring technology mediated learning from a pedagogical perspective*, 2003, Journal of interactive learning environments, 11,111-126.
7. **Race, P**., 2005, *Making Learning Happen: A Guide for Post-Compulsory Education*', publisher: Sage (Paul Chapman Publications)
8. **Ramsden, P.**, *Learning to teach in higher education*, 1992, London, Routledge
9. **Roblyer, M. D. and Edwards, J.**, *Integrating educational technology into teaching*, 2000, Saddlebrook, Prentice Hall.
10. **UCAS web site**, secure.ucas.com/figures/archive /download/index.html