National HE STEM Programme

www.hestem.ac.uk

IMPROVING RETENTION: THE CURRICULUM DEVELOPMENT PERSPECTIVE

An evidence-based approach to improving transition, induction and retention.

Mike Bramhall and Chris Corker

Contents

About the authors

Professor Mike Bramhall has been teaching in higher education for 25 years. He is a Professor of Engineering Education and is the Head of Learning, Teaching and Assessment for the Faculty of Arts, Computing, Engineering and Sciences at Sheffield Hallam University. As well as being a National Teaching Fellow he is also a Senior Fellow of the HEA. Mike was also an Associate Director of the Centre for Promoting Learner Autonomy at Sheffield Hallam from 2005 to 2010. He has interests in not only learner autonomy, but also in enquiry based learning, the use of media and technology in teaching and learning, and the personal and professional development of engineers. He has published widely in all these areas. He has recently developed an institutional policy and framework for 'Retention and Student Success' for Sheffield Hallam.

Chris Corker worked as a student intern at the Centre for Excellence in Teaching and Learning at Sheffield Hallam University for two years from 2008 to 2010, working on two projects focused on enhancing learner autonomy, and on enhancing student employability. Since the closure of the CETL Chris has gone on to teach work based learning with humanities students at Sheffield Hallam, and has been involved in research into the critical thinking skills of international master's degree students in engineering. He is also working on his PhD part time in the field of business history, and is a committee member of the national Student Learning and Teaching Network.

Ideas and examples of effective practice from the following Authors and collaborators have been essential in assembling the contents of the guide: Charmaine Myers, Chris Short and Jeff Waldock , Sheffield Hallam University; John Parkin, James Barnham and Ken Smith, London South Bank University; Ella-Mae Hubbard, Loughborough University; Sarah Wilson-Medhurst, Coventry University.

Published by
The National HE STEM Programme
University of Birmingham
Edgbaston
Birmingham
B15 2TT
www.hestem.ac.uk / www.hestem-mea.org.uk

National HE STEM Programme

UNIVERSITY OF BIRMINGHAM

Foreword

I am delighted to introduce to you this suite of transition and retention guides which have been produced under the National HE STEM Programme.

While increasing the supply of students to STEM Higher Education is important, ensuring that they experience a smooth transition to university and that as many as possible complete their studies successfully is of equal importance. There is a wealth of initiatives in this area that have reported on effective practice to help achieve this. The purpose of the guides is to collect and present effective practice models specifically from STEM departments. An important feature of this suite is the student perspective, which the authors have emphasised.

The issues related to induction, transition and retention are multi-faceted and therefore may have been addressed in slightly different ways in the different guides to take account of the specific context.

The suite consists of eight guides:

- Using data: an evidence-based approach to improving transition, induction and retention
- Happy landings – an introductory guide for students considering studying a STEM subject in Higher education
- STEMming the doubts – enhanced transition and induction to HE programmes
- Critical moments in the first year at university – towards a framework for effective transition
- Promoting social engagement: Improving STEM student transition, retention and success in higher education
- Improving retention: the curriculum development perspective
- Setting up a Maths Support Centre
- Optimising the part-time experience

My thanks go to the authors of the guides for distilling their knowledge and expertise and to the Steering Group for their valuable guidance. The group consisted of Professor Liz Thomas, Director for Widening Participation Research Centre (Edge Hill University), Hal Igarashi, Project Director Employer Engagement (Royal Academy of Engineering), Henriette Harnisch, Director of Academies and Trusts (University of Wolverhampton), Fiona Lamb, Associate Director (Engineering Education Centre), Ed Stevens, Regional Officer for Widening Participation and Outreach (South West) and Sadaf Alvi, Regional Officer for Higher Level Skills (Midlands and East HE STEM Anglia regional spoke).

Our collective hope is that the wealth of case studies and the student perspective presented will stimulate colleagues to consider improvements to the transition processes where they find it appropriate for their institution.

Professor Kamel Hawwash
Regional Director
National HE STEM Programme
(Midlands and East Anglia)

Introduction

Research on student withdrawals shows that there is no single reason why students leave (Yorke (1999), Yorke and Longden (2008), National Audit Office (NAO, 2007) and House of Commons Committee of Public Accounts (2008)).

The issue is complex, but this research indicates many factors that help to explain why students leave and others that enhance their success.

The main reasons why students withdraw are:
- Inadequate preparation for Higher Education
- Poor institutional and course match
- Not coping with academic demand/making poor progress/ lack of engagement
- Poor social integration with their peers and academic/support staff
- Financial issues and personal circumstances

The factors that enhance retention and success are:
- The provision of adequate pre-entry information and preparation
- Relevant courses
- Induction and transition support
- Active learning and inclusive teaching and learning strategies
- Formative assessment
- Personal tutoring and study support
- Social engagement
- Student support, both centrally available and integrated within the curriculum
- Effective collection and use of retention and achievement data, and monitoring

Other booklets in this series deal with some of these issues, such as 'Transition', 'Promoting social engagement' and 'Building on data'.

This booklet is concerned with what we do in the curriculum, how we deliver it, how students engage with the curriculum, how we support them and how we facilitate delivery to enhance student success.

A key success factor is relevant, active learning that promotes student engagement and belonging. In STEM disciplines, as in many others, it is also important to develop inter- and multi-disciplinary skills. These can be achieved by careful development of the curriculum for their inclusion.

Prompt and good quality feedback to students is also an important factor which can be used to encourage students to reflect on their progress and feed forward in their subsequent learning. A good support structure that is embedded in their learning experience can help them develop the appropriate professional and personal skills to reach their full potential.

Student mentors can be used to help students in this respect. This guide provides some case studies incorporating examples of active learning and student engagement in real world situations, and showing how student support and their regular reflection on their learning within the curriculum can be used to improve retention and success.

Project background

Much of the work in this guide derives from a team of academics that came together in a National HE STEM project: 'Engineering for Professional Engineering Practice'.

Whilst developing our multi-disciplinary project work we realised that, not only were we enhancing the employability of our students, but we were also improving their success in their studies and hence their retention.

In this guide, therefore, we present several case studies that have proven to be beneficial to students in helping them to reach their potential and achieve success. Design projects for active learning described by Professor John Parkin and his colleagues at London South Bank University, and Sarah Wilson-Medhurst's activity-led learning project at Coventry University, make study more closely aligned with practice and hence of greater relevance to students.

Active learning is highlighted as good practice in terms of retention, so their work fits in with the retention framework at Sheffield Hallam in that they describe project work that furthers this. Dr Ella-Mae Hubbard promotes the use of mentoring to support project work, which is another facet of what can be done to improve motivation, and hence retention. Dr Chris Short's case study focuses on interdisciplinary project work that offers realistic ways for students to develop learner autonomy and active engagement, again a key to success.

The Venture Matrix at Sheffield Hallam is also described. This takes students into an internal organisation that helps them to develop enterprise and employability skills through active engagement in real world projects. Dr Jeff Waldock's use of on-line progress files shows how these reflective journals can be utilised to aid student engagement within the curriculum and their success.

The ideas presented here demonstrate how these activities can be embedded within the curriculum in order to engage students, not only to improve their potential and success, but also enhance their employability.

Developing the curriculum

Making study more closely aligned with relevant and real engineering practice, and integrating curriculum content from across a range of modules into 'active learning' project work, means that students can be challenged and motivated, which in turn leads not only to improved employability, but also to enhanced success on the course.

As an example, the 'Design Projects for Active Learning' at London South Bank University, below, demonstrates that modifying the curriculum and incorporating 'Design for practice' motivates students and improves their success. Following on from this is a case study from Sheffield Hallam that presents interdisciplinary project work in themes of 'Aerospace' and 'Engineers without Borders'. The case study from Coventry University promotes 'active learning'.

The active project work in all these examples, that integrates several aspects of the curriculum, is shown to engage and motivate learners, reduce drop out rates and also improve student satisfaction.

Case Study: Design Projects For Active Learning

John Parkin, with James Barnham and Ken Smith,
London South Bank University

Outline of the curriculum development

London South Bank University decided to dramatically change the way it delivers its curriculum to first year engineering students as part of a so-called 'curriculum modification project'. One aspect of this change has been the introduction of project work forming part of a module called 'Design and Practice'. Other skills developed in the module include communications and drawing skills and laboratory work. This module is the Level 4 (first year degree level) component of a trio of modules taken in each year of the three year full time degree. At Level 5 there is an integrated project involving the Constructionarium, a fieldwork-based learning experience based in Norfolk. At Level 6 there is a creative 'Innovation and Enterprise' module involving market research and original scheme design in a commercial context.

Each module involves teamwork and attempts to integrate curriculum content into one super-sized module instead of distributing it in discrete, smaller modules. While, from a logistical point of view, this has placed enormous strains on the staff involved, it does arguably mirror more closely the very integrated nature of engineering practice, which demands input from a range of design and analysis processes simultaneously. By so doing, it attempts to make study more closely aligned with practice and hence relevant, with the possible additional benefit of making the eventual graduate more employable. An additional benefit has been to improve retention and success in their course. Staff recognised the critical importance of a carefully graded approach to introducing students to project work. At school, projects might simply be about 'finding out' about a subject area. In engineering, a project involves creating an artefact or a process. In order to allow students the opportunity to begin to understand what an engineering project might entail they are invited to take part in four projects concentrated into 3-week periods spaced across the year, and which build on each other as follows:

Project 1: An investigation of an existing engineering artefact or process. The aim of the project is to enable students to understand the nature of an existing engineering artefact or process and to be able to describe and sketch it. Drawn from a wide range of disciplines, students were invited to investigate their locality (along the River Thames embankments) and local science and design museums to find a suitable subject matter for their project.

Project 2: Product improvement. The aim here is to enable students to investigate and critically assess an existing tool design or process and develop ways in which improvements could be made, or to develop a new tool or process. Suggestions to students included various mechanical processes and tools, hand tools, civil engineering plant and a variety of process engineering systems.

Project 3: International instructional video. The aim of this project is to enable students to gain an understanding of planning, designing and delivering a set of instructions about an engineering process through the medium of video. Using video gives students a respite from written work and allows them to develop new skills by employing hardware and software that are readily available on smartphones and computers. The basis of the project remains, however, at heart about communicating important engineering processes.

Project 4: Engineers without Borders. Having developed skills in the various previous projects, students encounter the final project which is integrative in nature. Here we have adopted the Engineers without Borders project which has the aim of providing students with the opportunity to learn about design, teamwork and communication through a sustainable development project. For 2011/12, the project considers problems faced in the remote community of Devikulam in the Pitchandikulam region of India. The background is more fully explained in www.ewb-uk.org/filestore/2011_EWB_Challenge_Design_Brief.pdf

Outline of student responses

The response to the learning environment offered to students through the medium of the projects has been an important concern of teaching staff. Students were asked what the module overall had been like for them, with the opportunity to rate on a ten point scale. 'Interest' was given the highest average score of 7.28, with other scores for difficulty (5.09), challenge (6.00) and excitement (6.45) all being lower. Specifically, so far as the project work was concerned, students provided ratings for how much it had taught them about the process of design (6.81), led them to be innovative (6.96), led them to learn how to derive information and data from the real world (6.56), and developed their skills in working in an engineering design team (6.87). These scores were greater than for other parts of the curriculum.

They were asked overall how much they had learnt in the different aspects of the module and in other modules in the first year. The score for the project work was 7.15 which is statistically significantly larger than for the other aspects of the learning they have undertaken.

Textual analysis of student responses always reveals useful insights. Of course, feedback is not universally consistent, and many students take a long while before they will understand the logic of what is being offered to them as a learning opportunity. A significant number of responses obtained from students about group work revolved around their developing understanding of teamwork (valuing the ideas of others, brainstorming, communication) and around the need for time management and project programming.

Fewer responses were of a meta-analytical nature, but it is gratifying to see that some students recognise that they have learnt about the 'generation of ideas', innovation, 'motivation' and 'systematic analytical thinking'. Here are some typical quotes.

'[The projects are] less theory-based and a more hands-on practical training, which makes it more interesting.' (HNC Civil Engineering student)

'The design and practice module has helped me to understand the design of a product or project in relation to its function and term of use.' (HNC Civil Engineering student)

'I really enjoyed doing the projects. They helped me to start to understand what I am studying. Also, I could improve my English a bit.' (BEng Civil Engineering student)

'Very much enjoyed doing [the] projects and found them challenging.' (BEng Building Services Engineering student)

'Design projects have been interesting and [I] have enjoyed the free-hand drawing.' (BEng Building Services Engineering student)

'I have enjoyed team work and [the] projects.' (BEng Building Services Engineering student)

'Interesting, especially the projects. [I] enjoyed the hand drawing, [I] haven't done as much since GCSE.' (BEng Building Services Engineering student)

'Overall it has been constructive, the projects being the most beneficial.' (BEng Building Services Engineering student)

'With project work, I would not waste as much time 'thinking' about it and get it done early.' (BEng Building Services Engineering student)

'Projects have been very eye-opening.' (BEng Electrical and Electronic Engineering student).

Outline of staff experiences

Course Directors were involved as tutors in the projects. This enabled them to get to know the students through conversation and interaction, rather than, as is often the case, as individuals with administrative issues to solve. It also allowed staff to help students to integrate the ideas they were learning in other Level 4 material. In this way we try to undo the assessment-driven approach of allowing students to pick, pass and forget isolated segments of the course, which has been the practical outcome of UK schools in the past fifteen years. The projects, particularly the final one, are 'real', not some arbitrary test of understanding and cognitive ability.

A prime purpose is to attempt to develop in students, from the earliest stages of their career with us, a professional engineering attitude, so all manner of topical issues can be introduced in discussion. A major difficulty has been staffing the projects, however, with the very small number of staff involved being significantly stretched in their ability to get to know, and work with, a large cohort of students, even though they were broken down into fourteen different occurrences and worked in groups of up to four. Getting the correct amount of staff input would make the students feel more valued, but it would be expensive to deliver. Within four weeks students had become self-motivated to the extent that they were arriving early to get to work on their projects. This was gratifying. This increased motivation, improved the pass rate on the module and hence retention of the students on their courses.

Assessment remains an area we intend to refine. Student reports can be voluminous, and there remain issues with students relying on (sometimes non-peer reviewed) references rather than their own observations, which we need to tackle in the future. The grading process needs to be streamlined without diminishing the student experience. There is promise for the quality of work we shall see in Levels 5 and 6 from some of the cohorts.

Case Study: Learning Through Interdisciplinary Project and Coursework

Chris Short, Sheffield Hallam University

Project Background

This case study reviews two practice-based examples of learning designed to excite students through the use of interdisciplinary project and coursework with the aim of enhancing engagement and retention. Example 1 uses material derived from a project at Sheffield Hallam University (Bramhall et al, 2010) which discusses the use of interdisciplinary final year project work within a small group of final year students. The second example discusses and compares the use of interdisciplinary assignment work across a large group of first year students on 8 different courses, undertaking a joint module on underpinning physics/engineering mechanics.

Rationale

There are obviously many reasons for reductions in retention rates, but one in particular, which we all recognise, is the challenge (or lack of it) provided to students by the approach to developing the teaching of the curriculum.

The teaching of engineering graduates often involves the traditional lecture or tutorial. Combined with this approach, modules are often studied in isolation from each other, whereas, in the real world, placement students and graduates enter employment and are given very challenging work as part of a multidisciplinary team, tackling interdisciplinary projects. Students become bored with the traditional approach, often disengaging from modules, which results in the carrying forward of referrals at which point they may drop out or continue on the course and, if still not successful, drop out further down the line.

Example 1: The Student Perspective

Final year engineering students normally undertake an individual project, working on their own, drawing on self initiative and motivation, and undertaking relatively narrow fields of investigation. But this example illustrates the benefits of students undertaking an individual project as part of a much bigger and wider team-based initiative, with the opportunity for joint team support and direction.

Six final year students were presented with a number of aerospace 'Themes' to explore with the potential to provide interdisciplinary/multidisciplinary final year projects; The themes were made deliberately broad (ie, around simulation, testing, measurement and data logging) to encourage multidisciplinary thinking and aid engineering design students to 'think outside of the box' so far as the scope of their individual projects was concerned. This had the added component that students took on an autonomous role and ownership of the activity and were excited, motivated and challenged.

The projects were set up to allow students to take control of their learning and to improve their confidence in undertaking interdisciplinary project work via:

- a three week pre-study at the commencement of their project to define clear aims and activities and potential problems
- a weekly diary/log
- students' self-managed weekly reports on performance submitted to supervisor showing tasks completed and action points for the coming week

- organisation Blackboard site for the group of students to use for peer support
- student support group
- weekly supervisor meetings
- external mentor based in Sweden acting occasionally as a visiting lecturer and the remainder of the time contactable through e-mail and video conferencing (funded by an internal LTA award)
- expert input by other academic staff (when requested by the students) to represent the interdisciplinary knowledge that would normally be available within a multidisciplinary team

The approach led to a high level of autonomous working outside of agreed sessions and increased engagement. Barring the occasional sick day, the students attended every Friday session in the supervisor's office, which involved a 1 hour video conference with the mentor followed by individual progress updates. Student engagement far outweighed previous years and resulted in higher project grades. The final year projects ran from September to May the following year and, at the end of the study, students were indicating the following:

'It feels like we are so much further on than other students that we have contact with.'

'Even if you get stuck, you know you have support on hand.'

'Having a number of aerospace themed projects running concurrently has really helped us by allowing ability to share ideas and build on each others work.'

'The weekly progress meetings and update reports have helped us critically evaluate our own progress. We feel we are letting staff down if we don't deliver.'

Challenges and Reflection

This experience provided opportunities for students to broaden their learning and industrial experience, improve project management skills, and increase their confidence and ability in disciplinary areas outside their comfort zone. The projects undertaken were quite large, complicated problems which challenged the students and required expert knowledge that, in practice, could only be provided by a team. Consequently, interdisciplinary projects need to be integrated group activities. In particular, without the enthusiasm and motivation of particular staff who were prepared to champion the activity outside of the normal expectations and the funding resource to assist with this, such an activity would not be as successful.

However there was a clear distinction between previous years' normal, ad hoc attendances of students at weekly supervisor meetings and the full-on interaction gained by the approach taken.

Example 2: The Student Perspective

In June 2011 we planned and developed the introduction of the Engineers without Borders (EWB) challenge into a first year Technology Foundation module to replace an existing assignment. Again, the aim was to use multidisciplinary work and interdisciplinary teams to challenge and motivate students in order to enhance engagement and retention and to extract and compare common themes emerging from the two interdisciplinary projects.

The challenge uses real world problems experienced in Third World countries as a vehicle for students to explore suitable solutions. The 'hook' for motivating students was the opportunity for the best five student projects to be forwarded to the national competition, with an ultimate prize of travelling to India to see the project implemented. 143 students from eight different BSc engineering design technology courses worked in multidisciplinary teams on interdisciplinary problems. As well as 48 hours of traditional lectures, tutorials and laboratory sessions, the EWB challenge used on-line learning support material which was available from the EWB challenge.

Students were also required to compile an individual portfolio of progress on their projects and to interact with a reflective, on-line blog through the University's virtual learning environment, Blackboard. This resulted in students achieving over 500 hits on the blog during a 6-week period. This process was encouraged, monitored and analysed by employing an associate academic mentor to work with students for a further 30 hours above the module time quota, and thus there was an associated cost on top of normal teaching.

Each week of the project, students were primed by both the tutor and the academic mentor to consider and reflect upon various aspects of the project and its progress.

Week 1

- Ability of team to meet up
- Degree of multidisciplinarity in the team

Week 2

- Usefulness of EWB materials
- Areas of individual interest in the design brief
- Opportunities for solving more than 1 problem

Week 3
- Progression to date
- Team interaction and team dynamics

Week 4
- Actual/ required ranges of knowledge, abilities and skills in the team to complete the assignment

In weeks 5 and 8 teams were required to undertake an interim and final PowerPoint presentation of 3 to 4 slides to report on progress.

Challenges and Reflection

Student comments

'Enjoy working in a team because more ideas generated.'

'Having multidisciplinary group provides advantage of students contributing from their own specialist areas but not necessarily producing anything better.'

'Definitely useful to solve more than 1 problem.'

Student observations

'BB Blog used extensively for communication and project management – organising meetings – sharing ideas/work for development between groups.'

'Groups chose projects to match group strengths.'

'No problems being allocated to a team.'

Staff feedback suggests the activity has been a stimulating and rewarding experience, particularly in enhancing their rapport with students and improving engagement. The multidisciplinary nature of the work has provided the opportunity to cross boundaries that normally represent barriers to the application of fundamental engineering science when it is taught at first year level. The ability to have an impact on a real world situation and improve someone's quality of life has definitely had a major impact on students' experiences. From 2007, the module has always suffered from a drop off in attendance in semester 2, resulting in progression problems for a large number of students. However, this year, the students were more engaged. In previous years it was not unusual to have only two or three students attend, whereas this year every tutorial class had at least one member from each sub-group attend tutorials. As there were 3 to 5 sub-groups in each class, this represented an increase in attendance of at least double that of previous years. Overall, there were 32 project groups with between 3 and 5 members. There has been a level of non-engagement, but this is predominantly from a small number of students who are re-taking the module and experiencing difficulties fitting this into what should be their normal diet of modules.

The internet resources provided by EWB were particularly helpful for student research and were free for this year, but there may be a reasonably significant charge for this in future years.

From a staff perspective, the introduction of the activity has been demanding and time consuming, and only achievable because of individual motivation, well structured planning and the ability to engage with external EWB meetings to define the challenge in relation to the module requirements.

Summary

Both these examples of introducing interdisciplinary work show many more positives than negatives. Students gain opportunities for learning, experience outside of their discipline, confidence, a feeling of achievement, project management skills and, in particular, they really enjoy the activity.

In spite of the challenges and difficulties for staff, the implementation of the interdisciplinary EWB challenge has definitely been a huge success, with one of the teams of students being selected to present at the National Finals at Liverpool University in June 2012. The module was taken over by the current module leader three years ago when progression was around 40%. Statistics from the last 3 years are shown below:

Technology Foundation Module (First Year)	2011–12	2010–11	2009–10
Number of students on module	143	150	119
Percentage of module over 60%	57	37	48
Percentage first time pass rate	87	75	65
Overall average module mark	58	54	56

Last year, through curriculum development, progression had risen to 75% and this year, with the introduction of interdisciplinary work, progression has been almost 87%. The module may normally be seen as a very difficult by students and dubbed a 'killer module', but as a result of the increased engagement through the implementation of the interdisciplinary EWB challenge and the rise in overall progression, retention is expected to be improved significantly over the life of these cohorts.

Both examples discussed above show that interdisciplinary activities, either as individual project work or in class teaching of modules, benefit the learning experience of students significantly, and that progression and retention are influenced significantly by the delivery of the curriculum.

Case Study: Activity-Led Learning to Aid Student Engagement, Retention and Success

Sarah Wilson-Medhurst, Coventry University

Good practice project background

This practice is located within a large, multidisciplinary UK Faculty of Engineering and Computing in which there is a strong emphasis on employer- and profession- focussed education through activity-led learning (Wilson-Medhurst et al, 2008, Wilson-Medhurst and Glendinning, 2009). The Activity-led Learning (ALL) initiative was reported as an example of good practice in a recent Royal Academy of Engineering 'Engineering Graduates for Industry' report (Royal Academy of Engineering, 2010) and in a White Paper sponsored by the Bernard M. Gordon MIT Engineering Leadership Program report on 'UK Approaches to Engineering Project-Based Learning' (Graham, 2010). One of the pioneering departments for the ALL initiative at Coventry is the Department of Mechanical and Automotive Engineering (MAE) where, in 2008/9 session, 100 first year students took part in an initial 6-week Activity-led Learning experience. The evaluation of this pilot demonstrated reduced first term drop out rates and a 26% increase in satisfaction (Green and Wilson-Medhurst, 2009).

With the aid of illustrations and student feedback from this pioneering MAE programme, this case study highlights those features of the Activity-led Learning pedagogy at Coventry that support first year (and on-going) student engagement, standardise on retention and success.

Key features of the cross-faculty Activity-led Learning first year implementation

At the start of the course, an extended induction and orientation phase of 7 weeks in total (induction + 6 weeks) that engages students in meaningful activity-led learning challenges to engage, enthuse, and establish good working habits and relationships. The approach recognises the importance of the affective dimensions of learning (trust, safety, friendship, friendly competition) consistent with the aims of ALL pedagogy to support the development of communities of learners engaged in employer- and profession-focussed, activity-led education (Wilson-Medhurst et al, 2008). The approach adopted also recognises the need to develop core skills and knowledge including using early diagnostics eg in mathematics, to identify students at risk. Another key feature was early assessment and feedback (in the example below this was weekly from teaching week 1 for the first 6 weeks) and a recognition of the importance of the social experience for students, including the opportunity to mix with fellow students, make friends and build a strong course identity. The student and staff experience of the implementation was evaluated immediately after completion (Green and Wilson-Medhurst, 2009) and used to refine subsequent implementations.

The Mechanical and Automotive Engineering example

As outlined in Green and Wilson-Medhurst, 2009, in this first pilot implementation, following a departmental (but non-course specific) induction week, students embarked on the 6-week course orientation period, based on ALL. For this, 100 students were divided into six groups maintaining Mechanical, Automotive and Automotive Design group identities. In other words, rather than focussing on multidisciplinary working at this early stage of the course, the focus was on supporting the development of course identity and the social experience. However, the activities themselves did deliberately expose students to different facets of engineering practice and study.

Six activity-led exercises, mainly extracted from the 'Engineering Application' requirements of the course and constituting 75% of a 20-credit core module, were set up and undertaken in rotation by the students over the six-week period. The six exercises focused on Design and Build, Metrology, CAD Modelling, Materials Testing, Reverse Engineering and Product Marketing. A 16-strong mixed discipline team of academics, development officers, technicians and interns facilitated and assessed the exercise. Each activity was timetabled for 18 hours across the 5-day week, the structure and timings are illustrated in the table below.

An important feature of this weekly implementation is that students were given their mark and feedback before departing for the weekend. As part

	0900–1100	1100–1300		1400–1600		1600–1800
Monday	Mathematics lecture	ALL Task Introduction		ALL		
Tuesday	ALL	ALL		Spreadsheet Exercises		
Wednesday	Engineering Skills					
Thursday	ALL	ALL	Tutorial	ALL		Option Module
Friday	ALL	ALL		ALL Assessment	Maths Diagnostic Assessment	

Table 1: Six-week intensive programme including Activity-led Learning (ALL) – the structure of each week (Source: Green, 2010)

of this ALL programme, each week students also engaged in a visit to an engineering skills training provider (3 hours). To support core skills and knowledge they also engaged with spreadsheet exercises (2 hours), a tutorial (1 hour), a mathematics module (2 hours), a mathematics diagnostic test re-assessment for those students requiring it (1 hour) and a free choice option module (2 hours). This also served the aim of providing a full timetable and 'working week' to help establish good study patterns, as well as the opportunity to establish and build friendships and a course identity.

In terms of achievement, progression rates on the module improved from 82% to 96%, while on the programme as a whole they improved from 72% to 76% at the end of first year (2008/9). These achievement figures plus student feedback (see below) gave the Engineering and Computing faculty at Coventry confidence to introduce a first 6 week activity-led learning implementation in all of its undergraduate programmes in engineering, computing and mathematics maintaining the key features and guiding principles outlined above.

The student perspective

At the end of the first year implementation 79% of the cohort completed a survey and 8% participated in focus groups (see Green and Wilson-Medhurst, 2009 and Green, 2010 for further details of the evaluation design). This initial evaluation indicated increased satisfaction aspects of the course such as 'how you are being taught' as well individual development in areas like 'self-confidence', 'time-management' and 'practical skills' (Green and Wilson-Medhurst, 2009). 74% of the survey respondents wanted to see 'more use' of Activity-led learning in their course. A survey of this cohort in 2010/11, combined with a focus group, indicated that looking back they appreciated the benefits of the first 6-week ALL activity in terms of supporting the development of professional skills and attitudes as well as for the social experience and personal development (the participants were those students graduating that year, although some of the cohort were on sandwich placement and therefore not able to take part). The table below highlights which activities students associated with the development of specific professional skills and attitudes.

Challenges and reflection

While the majority of students (74%) (and this went up to 92% for the 2009/10 starting cohort) wanted to see more use of activity-led learning for the benefits it provides, there are others for whom activity-led learning presents challenges they do not enjoy (or certainly do not want more of). We need to explore their experience to see why this is the case so they can reap the benefits of a pedagogy that develops professional skills and attitudes (amongst others) so effectively and, aligned with other appropriate retention enhancement strategies such as early diagnostic assessment, can be highly beneficial for students. It is important to explore such students' experiences in more detail so that they don't perpetuate within a course without getting the help they might need to support them in achieving their potential and benefiting from activity-led learning (or similar) challenges.

Skill / Activity	Professional outlook	Communication skills	Team-working capabilities	Exercise responsibility	Plan own work	Information retrieval and evaluation
Bridge Design			X	X	X	
Metrology						X
CAD Modelling				X	X	
Materials Testing				X	X	X
Marketing	X	X			X	X
[Reverse Engineering]			X	X		X

Table 2: showing the activity that most effectively supports the 6 professional skills and attitudes that were a key focus of the 6-week ALL (Source: Wilson-Medhurst and Green, 2012)

Supporting active learning in the curriculum

The previous case studies show that active learning in the curriculum not only challenges the students, but engages them in ways that are realistic and meaningful on their journey to be a professional engineer.

If they see a reason for engaging with the curriculum for example, it being part of a group design process on an 'Engineering without Borders' project, they feel part of a global community supporting the common good. It is important they are supported and encouraged to reflect on their learning. The following mini-case studies outline mentoring, peer support schemes and reflection that can be included in supporting their route through the curriculum. Loughborough University have significantly improved their retention by the incorporation of peer mentoring. At Sheffield Hallam the 'Venture Matrix' scheme describes how active learning on real projects, using staff and student mentors promotes confidence in first year students, develops social engagement and a sense of belonging within the curriculum. The use of on-line progress files, also described in the following section is a good example of how students at risk can be identified and supported. All these examples enhance student learning, their experience and their success.

Mini-Case Study: Using Mentors to Support Projects – Mutually Beneficial Peer Development

Ella-Mae Hubbard, Loughborough University

Background

Mentoring has been identified as a practice which has a positive effect on motivation, both for the mentors and mentees (especially in minority groups, eg, Felder et al.(1995) and Good et al.(2000)). Increased motivation within the student body helps retention, although it is hard to quantify (Moller-Wong and Eide, 1997). Motivation is especially important for retention in engineering (Baillie and Fitzgerald, 2000). Loughborough University has outstanding records for retention and employability (with retention of both young and mature entrants above the benchmark). During the 2010/2011 academic year, there were no withdrawals from the School of Electronic, Electrical and Systems Engineering. Student feedback has shown that mentoring within the School motivates the students, for example '… it was motivating to know that a student in their masters' year was helping us to achieve our goal.'

Mentoring and peer support schemes within the School of Electronic, Electrical and Systems Engineering

Within the School of Electronic, Electrical and Systems Engineering at Loughborough University, there are a number of mentoring and peer support schemes implemented.

- MEng 4th year students mentor BEng second year and third year students on group projects. Reflection on the process became a requirement in the submission from both mentors and mentees. This provides some encouragement to both parties to engage with the process.
- Peer support and peer assessment is used widely, especially where group work is prevalent in a module. It is found to be a positive way to increase feedback and motivation within the students. Students are asked to do a peer assessment within the groups that they work in and also carry out reviews of the presentations of other groups.
- Individuals are asked to answer two questions: 'What was the best thing about the presentation?' and 'What one thing could the group do to improve the presentation?' This helps to involve all the class in all the presentations, it also provides further feedback for all groups on the presentation they provide.
- Through this process, students are also encouraged to reflect on their own work throughout the group project and also specifically on their own presentation.
- One of the other schemes where mentoring and peer support is used is in the Departmental Buddies scheme. This is a departmental initiative where senior students volunteer to use their knowledge, experience and skills to support first year students and help provide a positive experience in their first year at University. A scheme such as this has many benefits, for the first year students (general support and encouragement, opportunities to meet others and to settle in at University), for the senior students (development of leadership qualities and interpersonal skills, useful experience and a certificate to add to a CV) and also for the School and the University (contribution to innovation in teaching and learning, supports widening participation and student retention).

Students on one of the modules which use this process commented:

'Overall, I found the course well organised, and what was going to happen next was well communicated in advance. Very interesting module and has enhanced my knowledge in the module.'

'the advice given throughout the project and questions answered both in person and via email were a fantastic help to the project and an invaluable learning experience to the group.'

Mentoring and peer support enriches the learning environment, it helps to support a deeper learning for both parties involved in the process. Mentoring provides a unique experience for the mentor, allowing them to view the learning process from a different perspective and hence providing further opportunity to develop critical enquiry skills. Reflection on personal experience and development, as well as on that of the mentee, is an important part of this process.

The majority of students find the process positive and understand the potential of the experience:

'overall the experience between group members and the mentor has been mutually positive and provided a good support system for various aspects of the project.'

With a recent focus on access linked to the increase in University fees, departmental mentoring schemes are a key measure in place for supporting retention and success for students across the University.

Mini-Case Study: The Venture Matrix

Charmaine Myers, Sheffield Hallam University

Sheffield Hallam's Venture Matrix (VM) is a University-wide, multi-disciplinary scheme, which allows students to develop their employability skills within the curriculum along with enhancing their enterprise and entrepreneurial capabilities. The modules involved in the VM can be either one semester long or run over a full academic year. Therefore, he VM real world activities that the students take part in are on-going activities, which give the students time to develop skills and build relationships. There are currently (2011–2012) just over 50 modules, which equates to approximately 1,600 students, involved in the VM scheme.

It allows students at all academic study levels to be engaged in real world activities such as:

- non-business critical projects from business/organisations in the South Yorkshire area,
- projects in Sheffield secondary schools with pupils involved in running their own businesses as part of an enterprise initiative
- projects put forward by our own University staff, which can be both academic and non-academic in nature.

The students form small groups within their module and use the VM framework to source a real-life project. The VM professional support staff team work in close partnership with academic colleagues in order to source projects that are relevant to their academic sphere.

In addition to collaborative peer group working, final year students are actively involved along with academic staff and the VM staff team in first year induction sessions, which assist with the transition to the University. These sessions provide an effective opportunity for the new students to assimilate and make sense of the VM scheme and to work with staff and the existing students. The induction sessions are then followed up by drop-in sessions, where the students receive formative feedback. This also provides a forum to identify students who may be experiencing difficulties. Once identified these students are then supported by staff and/or mentors in their studies to an extent that ensures that they are successful in their course, improving their confidence and hence their retention.

As first years, by entering into the Venture Matrix, we have gained so much more confidence and are able to advertise to other VM groups in order to find work. Plus it's a completely different experience to anything that we've done before. It is interesting and enjoyable! (First year student, 2009)

These early successes, often in the first semester of the student's university career, are showcased at a monthly on-campus VM Trade Fair. These Trade Fairs are attended, on average, by 20% of the students taking part in the VM (200 students). These are students from across disciplines and study levels. By showcasing the 'quick wins' of first years it is anticipated that it will engage and promote engagement to others, in particular, help support the inclusion of learners who might feel like outsiders (Bamber & Tett 2001).

The VM Trade Fairs make good use of the University's physical space. The Trade Fairs act not only as a formal gathering to promote the VM student activities, but it also gives students and staff an opportunity to come together in a semi-social environment nurturing a sense of belonging (Tinto, 1993).

A recent example shows a VM group consisting of Indian, post-graduate bioscience students, who were studying for only one semester at Sheffield Hallam. The Trade Fair gave them a chance to meet home students and promote their VM project, which led to improvement in their academic performance and social interaction.

Trade Fair – December, 2011

It has been observed that student engagement and motivation is strongly developed through ownership of VM projects giving them a sense of belonging. It also provides the students with useful professional networks outside the University.

We have loved working with the Inspiring Women's Board at the Chambers on this project. The Venture Matrix staff team have been a great support in giving us the opportunity to test our idea in a safe and supportive environment. (Final year student, 2012)

The first year Venture Matrix student groups are additionally supported by informal peer mentoring. The structure of the Venture Matrix allows for final year students to work together with first year students (and second year students). This group work and collaboration provide the opportunity for peer relationships to be built. This learning approach within the VM helps to promote peer interaction and the development of meaningful relationships (Yorke & Longden 2008).

The Venture Matrix scheme to-date has been mainly used in employability skills development of the different academic study levels of undergraduate students taking part. However, it has not gone unrecognised that the scheme plays an important role in supporting student retention.

Mini-Case Study: Improving Student Achievement through the use of online Progress Files

Jeff Waldock, Sheffield Hallam University

Introduction

BSc Mathematics students at Sheffield Hallam University (SHU) are required to complete an electronic Progress File comprising a portfolio of work – in the form of a personal website – and a reflective logbook. In their logbook students provide regular entries for each module in which they reflect on their learning, identify what is going well and problems that need to be resolved. They are encouraged to develop an action plan to address the problems they have identified, and report progress made towards resolving them. They are also encouraged to raise issues in the logbook that staff can respond to quickly, thereby helping to develop an active, supportive, learning community. Student feedback indicates that they recognise the value of this activity in improving their levels of achievement.

There is a considerable body of research literature supporting the claim that both student achievement and the development of graduate employability skills are enhanced by the inclusion within the curriculum of structured processes that develop the ability for self-reflection. Students should be able to identify their strengths and weaknesses, formulate strategies for addressing the weaknesses and plan for their own personal, educational and career development. This applies to all academic disciplines, but perhaps has more impact in Mathematics, where students may have less well-developed skills of articulation. There is clearly a shared view amongst stakeholders that Progress Files – and the process of reflection and action planning – is of increasing importance in raising students' ability to recognise, develop and articulate their skills. In doing so their retention and success is increased.

Implementation

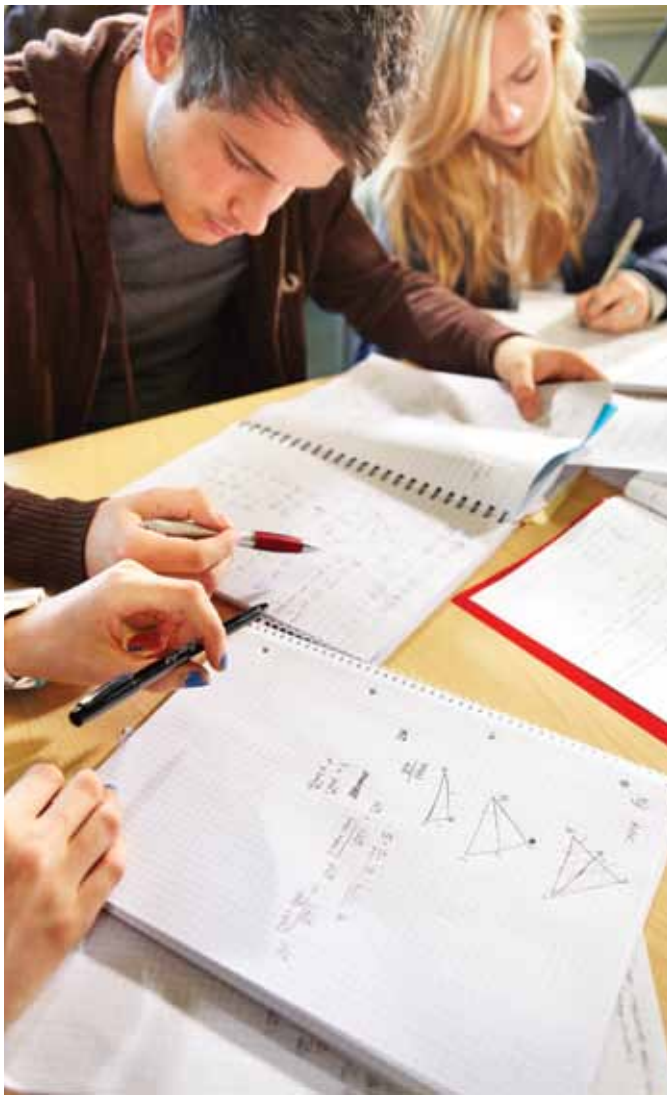
The Mathematics programme at Sheffield Hallam University has since 2001 incorporated a web-based Progress File system. Unlike some other e-PDP approaches, in which student reflection takes place only once or twice per semester, the SHUMaths system requires students to engage with the reflective progress on a continuous basis. Every student is expected to provide reflective entries in their Progress File for each module at least weekly – and they receive academic credit for doing so. The use of the on-line Progress File system has spread beyond the maths course itself – during the last complete session (2011–12) there were 590 students from 7 courses involved, contributing a total of over 36,000 entries and 3.1 million words.

In year one, students are expected to make entries for each module at least weekly. These entries are assessed, and provide 20% of the mark for one module. Each student receives simple weekly feedback, in the form of a mark awarded against published assessment criteria. At the end of the year students provide a longer reflective summary of their development over this time, for which they receive fuller email feedback. In year two students continue as above, but the entries are marked every other week with the marks again contributing towards a core module. The logbook marks comprise part of a general employability element of assessment in this module, as students prepare to apply for an industrial work placement.

In the final year, the logbook assessment is built into the Project module, comprising 5% of the 30 credits available. This keeps the Project work higher on students' list of priorities and helps tutors to track progress.

Evidence of Success (Impact)

The system has been running now for over ten years. At the end of each year, first year students are asked to provide a summative review and feedback of the system, for which they receive some logbook credit. Some selected students comments are shown below:



Student comments

'While I was writing something that I was afraid of, I was becoming stronger and with more courage to face all my problems.'

'I have found this progress file very useful throughout the year, in helping me to record my thoughts and feelings on all the modules, I have also found it useful in helping me to organise my time better by finding where my weaknesses and strengths are so I am able to see where I need to concentrate most on.'

'The progress file has helped me to develop my communication skills and to become more confident in talking about my own work and feelings on the course. It also allows you to see for yourself how you have progressed, or dealt with any personal problems.'

'The online progress file has been a huge help in making the jump from being in a 6th form to university. It forces you, once a week, to actually think about what you have done and what you still need to do.'

'From my comments that showed I was struggling, looking back made me realise what I needed to do to improve and also build on aspects where I had problems. I could do this by giving myself targets and this is a way of recording them.'

'The logbook, looking back now, has made me realise how much I have improved.'

'Talking about myself the first thing that I thought it was that it would be terrible due of my problem that I faced in English language. As the year passing, day by day I was feeling more confident to write everything that I wanted to ask or everything that I wanted just to say.'

'In quite a few instances I have wrote that I can't do or understand something and I have been given feedback which then enables me to do what I originally couldn't. Without this I maybe wouldn't have sought help and then not be able to complete certain assignments or work'

A further measure of success – albeit an indirect one – comes from the results of the National Student Survey. The last three of the 21 specific questions address students' personal development:

Q19: This course has helped me present myself with confidence
Q20: My Communication skills have improved
Q21: As a result of the course, I feel confident in tackling unfamiliar problems

Question	2009	2010	2011
19	95% (1st)	89% (4th)	93% (2nd)
20	95% (1st)	89% (4th)	93% (3rd)
21	97% (2nd)	93% (1st)	92% (4th)

The table above shows the NSS score for each question for Mathematics at SHU, together with the ranking position nationally (out of 63) for Mathematical Sciences.

Recommendations for others

From the experiences at SHU, there are a number of important features that an e-PDP system should have in order for it to work effectively:

- A key staff champion is needed to take responsibility for developing the system, and for selling it to all participants
- It needs to be very easy to use (both for staff and students)
- It also needs the active engagement of staff. Students clearly perceive the logbook as having more value if they receive prompt replies or feedback to their entries
- Although students understand the importance of developing employability skills, they prioritise their work according to credit received, so it is important that the logbook entries are assessed
- The system needs to be embedded into the curriculum, becoming an important element of normal academic activity on the course
- The process is more important than the tool used. Student engagement is the key and PDP should not become a tick box activity
- Students are active partners in learning, and the purpose of each activity should be explained and justified to them. Progress Files are no exception!

The strategic fit

Sheffield Hallam University's Corporate Plan 2008–13 was designed to deliver a positive student experience. The central theme of the Plan is to 'Improve the Student Experience', and one of its objectives is to support and enhance student transition, progression and achievement.

A group was formed to review 'Retention and student success' in the summer of 2009 with an objective to formulate and recommend a framework and to make recommendations in order for the university to enhance the retention and success of its students. The key features and guiding principles of the resulting Retention and Student Success Framework are:

- A supportive environment to help students succeed. All academic and professional support staff are responsible for supporting and helping students to achieve their full potential within the university
- Student engagement is a focus of what we are aiming to achieve and central to retaining students; their feedback is a key element of this and informs decisions
- Students should have a sense of belonging, build meaningful relationships pre- and post-entry with their peers, academic and professional support staff
- Students should know what is expected of them eg, study hours, attendance, taking personal responsibility for attending, engaging and managing their learning
- Retention and student success issues should be regularly reviewed and embedded within university enhancement processes, such as module quality review
- We need to be consistent across the university in utilising data and measures that highlight student success, and data that gives early warning signs of potential student failure, such as identifying those students at risk and acting on modules with persistently poor pass rates
- There should be ongoing evaluation, sharing, dissemination and identification of practices that help to improve student retention and success
- Retention and student success should be incorporated into the course planning process

The framework was developed from principles outlined at the time by the Paul Hamlyn Foundation and Higher Education Funding Council for England Retention Grants Programme, co-ordinated by the Higher Education Academy and Action on Access (2010), and What works? Student Retention and Success Programme (Thomas and May, 2011).

The framework consists of several sections:

a) Preparation and transition
b) Student skills and knowledge development
c) Academic experience
d) Social experience
e) Professional services support
f) Monitoring and evaluation
g) Sharing and dissemination of effective practice

Curriculum development is covered in section c) of this framework, and the use of active learning, peer mentoring and student support is clearly identified in its core requirements and recommendations. This framework is therefore a useful tool for institutions to use when looking strategically at the issues that enhance student retention and success.

Provision of a variety of opportunities to aid student motivation and improve retention is a key element of the vision and strategic aims of Loughborough University. For example, the Loughborough University vision states:

We will:

- Provide diverse opportunities for all students to develop qualities of critical enquiry and independent learning within a supportive and intellectually stimulating learning environment.
- Expand our portfolio of activities in order to equip Loughborough graduates for the challenging opportunities of a rapidly changing global environment.

This is echoed in the strategic aims, one of which states an aim 'to enrich the learning environment in order that all students have the support to succeed in their studies.'

The Case Studies presented in this booklet can be utilised to embed these ideas into the curriculum, through activity led learning, peer mentoring and interdisciplinary learning.

Challenges and reflections

The challenge to changing the curriculum to improve student retention and success is one of staff motivation. It is not easy to change learning and teaching methods to those described in this booklet without taking some risk, and by attaining all staff buy-in from those who teach on the modules and courses concerned.

Improved pass rates and progression should be the main drivers. However, there can also be improvements in the National Student Survey results and in employability of graduates as an additional benefit of making some of these changes to incorporate active learning, inter-disciplinary learning and student mentoring etc.

To achieve these changes it is recommended that:

- Curriculum developments are strategically aligned across all years of a course
- There is staff buy in at all levels to these changes, from heads of department and all teaching and support staff, with at least more than one 'champion' for change at a module level
- Developments are carefully planned and changes made based on evidence of success in other areas
- Students are involved in the developments as co-developers and that their feedback is regularly sought
- Monitoring and evaluation of developments are used to continuously enhance the student experience

Mini action plan

Action	Guidance in the booklet
Consider the use of Activity led learning, based on real life scenarios to be used to motivate students to reach their full potential.	Case studies on the use of activity led learning
Consider the use of Interdisciplinary team work to give students opportunities for active group learning, and help them to develop confidence in working across subject boundaries	Case Study on learning through inter-disciplinary project work
Consider the use of Peer mentoring to enrich the student learning environment and support deeper learning, with individual reflection being an important part of the process	Mini-Case Study on peer mentoring and mini-case study on use of progress files
Undertake well structured and detailed planning of these types of developments, with utilisation of external, university, faculty or departmental resources, which is critical to their success	Case studies in this booklet

References

Action on Access, www.actiononaccess.org/index.php?p=11_3 [Last accessed 4 April 2012]

Baillie, C. and Fitzgerald, G. (2000) 'Motivation and attrition in engineering students', European Journal of Engineering Education, 25(2), pp.145–155

Bamber, J. and Tett, L., (2001), 'Ensuring integrative learning experiences for non-traditional students in higher education', Widening Participation and Lifelong Learning, 3(1), pp.8–16

Bramhall, M., O'Leary, C., and Corker, C., (2010) CPLA Case Studies Volume 2, Sheffield: Sheffield Hallam University.

Felder, R.M., Felder, G.N., Hamrin Jr., C.E. and Dietz, E.J. (1995) 'A longitudinal study of engineering student performance and retention. III. Gender differences in student performance and attitudes', Journal of Engineering Education, 84(2), pp.51–163

Graham, R. (2010) UK Approaches to Engineering Project-Based Learning, White Paper sponsored by the Bernard M. Gordon MIT Engineering Leadership Program, Available [online] web.mit.edu/gordonelp/ukpjblwhitepaper.pdf [Last accessed 4 April 2012]

Green, P. (2010) 'Six-week introductory programme of Activity Led learning to improve student engagement and retention,' Proceedings of Engineering Education 2010 Conference 'EE2010'. Aston University, UK, July 6–8.

Green, P. and Wilson-Medhurst, S. (2009), Activity led learning to improve student engagement and retention in a first year undergraduate programme. A paper presented at 38th IGIP Symposium – Q2 of E2 Quality and Quantity of Engineering Education, Graz, Austria, September 6–9.

Godfrey, E., Aubrey, T. and King, R. (2010) 'Who leaves and who stays? Retention and attrition in engineering education', Engineering Education, 5(2), pp.26–40.

Good, J.M., Halpin, G. and Halpin, G. (2000) 'A promising prospect for minority retention: students becoming peer mentors', Journal of Negro Education, 69(4), pp.373–383.

House of Commons Committee of Public Accounts (2008), 'Staying the course: the retention of students on higher education courses – tenth report of session 2007–08', www.publications.parliament.uk/pa/cm200708/cmselect/cmpubacc/322/322.pdf [Last accessed 4 April 2012]

Moller-Wong, C. and Eide, A. (1997) 'An engineering student retention study', Journal of Engineering Education, 86(1), pp.7–15.

National Audit Office (2007), 'Staying the course: the retention of students in higher education', www.nao.org.uk/publications/0607/retention_of_students_in_he.aspx?alreadysearchfor=yes [Last accessed 4 April 2012]

Royal Academy of Engineering (2010), Engineering graduates for industry, February, Available [online] www.raeng.org.uk/news/publications/list/reports/Engineering_graduates_for_industry_report.pdf [Last accessed 4 April 2012]

Russell, M., (2008), Leveraging student engagement with assessments: Collecting intelligence to support teaching, student progress and retention in Crosling, G. et al (Eds.) Improving student retention in higher education: the role of teaching and learning. London: Routledge

Tinto, V., (1993), Leaving College: rethinking the causes and cures of student attrition, Second Edition, Chicago: University of Chicago Press

Thomas, L. and May, H., (2011), What works? Student retention and success programme in Thomas, L. and Jamieson-Ball, C., (Eds.) Engaging students to improve student retention and success in higher education in Wales, The Higher Education Academy

Tudor, J., Penlington, R. and McDowell, L., (2010) 'Perceptions and their influences on approaches to learning', Engineering Education, 5(2), pp.69–79.

Wilson-Medhurst, S., Dunn, I., White, P., Farmer, R. and Lawson, D. (2008), Developing Activity Led Learning in the Faculty of Engineering and computing at Coventry University through a continuous improvement change process, Proceedings of Research Symposium on Problem Based Learning in Engineering and Science Education, Aalborg University, Denmark, June 30 – July 1.

Wilson-Medhurst, S. and Green, P. (2012) Researching the effectiveness of Activity Led learning as a pedagogy for engagement with professional development in engineering. Case study. Available [online]: www.hestem.ac.uk/sites/default/files/case_study_-_researching_the_effectiveness_of_activity_led_learning_0.pdf [Last accessed 4 April 2012]

Wilson-Medhurst, S., and Glendinning, I. (2009) Winning Hearts and Minds: Implementing Activity Led Learning (ALL). Learning by developing new ways to learn 2009 conference proceedings, Laurea Publications, Helsinki. Available [online] markkinointi.laurea.fi/julkaisut/d/d07.pdf [Last accessed 4 April 2012]

Yorke, M. (1999) Leaving Early: undergraduate non-completion in higher education. London: Falmer.

Yorke, M. and Longden, B. (2008) The first year experience of higher education in the UK. Final report. York: Higher Education Academy, www.heacademy.ac.uk/assets/York/documents/resources/publications/FYEFinalReport.pdf [Last accessed 4 April 2012]

Contacts

Sheffield Hallam University

- Mike Bramhall
  M.D.Bramhall@shu.ac.uk
- Chris Corker
  Chris.Corker@shu.ac.uk
- Chris Short
  C.Short@shu.ac.uk
- Charmaine Myers
  C.E.Myers@shu.ac.uk
- Jeff Waldock
  J.A.Waldock@shu.ac.uk

London South Bank University

- John Parkin
  J.Parkin@lsbu.ac.uk

Loughborough University

- Ella-Mae Hubbard
  E.Hubbard@lboro.ac.uk

Coventry University

- Sarah Wilson-Medhurst
  aa3881@coventry.ac.uk

UNIVERSITY OF BIRMINGHAM