Introduction

Student engagement (or the ‘student voice’) is very much at the forefront of Higher Education at present. In 2009 it was identified by the Higher Education Academy as a priority area, though as noted by Duah & Croft [1] it is not always obvious what this means for Mathematics and Statistics. Student engagement is often taken to mean involving students more in their own learning, or in that of others. Students who are more engaged are generally more satisfied but are also more likely to fulfil their potential at university (see e.g. Trowler [2] for a review of the literature on student engagement and its benefits).

At the same time it is widely known that work placement schemes are extremely beneficial for the students undertaking them, no matter what degree programme they are following. Not only do they get to experience work directly related to their subject of study, but they are also able to develop a wide range of transferable skills beyond those taught in the classroom, and develop more academically (e.g. Gomez et al, [3]). Each of these aspects of industrial training lead to enhanced employability.

The natural way to bring together the benefits of student engagement in the curriculum with the benefits of work-based placement schemes is to create a teaching and learning (T+L) placement scheme. This is exactly what we have done at Reading in the Department of Mathematics and Statistics this past year, with much success. In this article we outline the scheme that we have developed, and highlight in detail the advantages for both staff and students.

Establishing the scheme

Over the last few years, staff in the Department of Mathematics and Statistics have had various small teaching and learning projects whereby students have undertaken paid work in the department, for example writing self-study guides for computing packages, compiling a list of online applets for demonstrating statistics topics and producing questions and answers for use in e-assessment. Funding has been ad hoc, coming from university e-learning grant schemes, the University of Reading Alumni Annual Fund or the department itself.

In 2010/11 the Department established a formal teaching and learning placement scheme, thereby committing itself to offering a number of projects each year ranging from a few days to a few weeks in the summer vacation. For each project, students will be paid to undertake the work alongside a member of staff. We have set aside funds for this purpose from a University Teaching Fellowship, and additional funds come
from applying for individual teaching and learning grants where opportunities arise.

The scheme is simple. The ‘unallocated’ funding that is not already attached to a specific component of a funded project is divided into a number of one-week placements, for which staff in the department are invited to bid. Applications are in the form of a paragraph outlining the T+L placement project. These can be focused on a variety of teaching-related things, with the proviso that they have to be feasible for an undergraduate to complete in one week, and have a clear teaching and learning link. Staff can request funding for more than one week, but the pot of money remains the same and longer placements can only be funded if others are not.

 Typically projects are focused on the development of new, or assessment of existing, teaching materials. This is interpreted loosely, and might include writing study guides or other documentation, creating feedback sheets or producing multimedia files.

The placements are usually advertised to students in the summer term, with the successful students undertaking the work in the summer vacation. Students are invited to submit a CV and covering letter explaining their interest in a project which we use to draw up a short list; short listed candidates are then invited to interview. We decided to offer a realistic interview process so that even unsuccessful candidates would take away some benefit from the application process.

The proposer of the project supervises the student(s) but the aim is very much that the student(s) can take control of the project and bring their expertise and insight when developing or assessing materials: this is an excellent opportunity to make use of the ‘student voice’ in developing materials for the curriculum.

Benefits to students

Benefits to students include, for the individuals undertaking the placements, enhanced employability and development of transferable skills, a greater insight into pedagogy, increased enthusiasm for a career in education, the opportunity to positively influence the learning of later cohorts, plus a better understanding of the subject matter or computing package that forms the basis of the work. By focusing these placements on the development or assessment of materials, there is also a clear benefit to students in the following year and beyond, who get to make use of these materials that might not have otherwise been developed. Such a scheme can also help increase the pool of students who are actively involved in the life of the department, and who can contribute in other capacities such as being Open Day ambassadors or teaching assistants in tutorials in later years. Quite simply, the effects of this scheme can be very wide reaching indeed.

Many work-based summer internships are only open to those who have completed their second year at university, meaning that first years have few opportunities for undertaking work placements. Crucially though, our T+L placements are open to all students who have not yet completed their degree, no matter how far along they are. This makes this scheme one of the few ways that students can enhance their CV early in their degree by undertaking subject-relevant work experience.

Student opinion is best summarised in the words of some of our students who have undertaken the placements this year: “I really enjoyed my experience, for a first job it was an amazing insight into the world of work.”; “Before the teaching and learning placement I felt near to the bottom of the class with regards to academic achievement, and now I feel I have boosted my position by a huge margin, so much so I hope to be within the top few in the class this coming year.”; “I think the placement scheme is a great idea as it gives students opportunities to work within their subject and also allows them to build relationships with people working in the department.”; “I have spent some of my time working alongside another student on my course; we were able to tackle the work together, which built on my team working skills.”

Students were unanimous in their support for the scheme, and said that they would recommend it to others. They also expressed their pride at being able to contribute in such a positive way to the learning experiences of others.

Benefits to staff

Benefits to staff of the development of these materials are multi-faceted, some of which have been alluded to already. Staff bring years of experience to their teaching, but they can always benefit from additional effort and experience being put into the development and subsequent delivery of their courses. It is through these placements that this enhancement can be accelerated, with the benefits of the ‘student voice’ permeating throughout. For example, this year two students worked on a project producing mathematics-specific study advice with the aim of bridging the gap between A-Level and university. While staff recognise the importance of and need for such materials, they are unable to reproduce the experiential filter of a first-year student or the authentic voice on which the success of the project depends.

The main contributions can be summarised as follows:

• time – the scale and scope of the materials simply could not have been achieved without the time the students are able to devote to this, thereby releasing staff time to devote to other aspects of the course;

• energy – students bring fresh energy and enthusiasm to the development of materials, allowing staff to concentrate their efforts in delivering the material and supporting students;
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4.2 Statistical computing screencasts

Higher Education has at its heart a commitment to develop life-long learners who are able to not only successfully push themselves beyond what they may initially perceive to be their limitations, but also to develop confidence in a wide range of skills that will help enhance their employability. Many disciplines generate data, and the requirement for students to develop expertise in the analysis of their data is ever increasing. The correct use of statistical computing software is vital, and yet learning a new statistical computing package can often be quite daunting. This is particularly so for students from other disciplines who are just taking a single statistics module as part of their degree course, or perhaps no statistics module at all, but who nevertheless need to use a computing package to analyse data as part of their final year project. With ever-increasing Web 2.0-literate students, an 'on-demand' and technology-focused solution to the issue

- relevance – providing material that is more likely to be pitched at the level of the students and is ‘on their wavelength’ makes the teacher’s job much easier;
- youth – young, fresh minds who can approach the material from different perspectives to staff, often based on their experiences which are naturally very different from some of the older ones among us;
- insight – seeing how students think nowadays helps inform subsequent teaching on the topics at hand, as well as teaching of later material;
- independence – the opportunity to study material beyond the classroom helps to create independent learners, which means that students become less reliant on staff input;
- confidence – students’ learning is strongly influenced by their levels of confidence, and any improvement in their learning through additional material in turn improves their confidence levels, making the job of the teacher far easier;
- understanding – anything that aids students’ initial understanding of material enables staff to move on to more advanced material safer in the knowledge that basic material has been fully understood;
- reinforcement – the opportunity for students to repeatedly reinforce their understanding of basic concepts also allows staff to move on rapidly to more interesting and in-depth topics;
- knowledge – we are all students of our discipline, and seeing different approaches to particular problems, or problem-solving in general, adds to knowledge for the benefits of staff and students alike;
- motivation – the role of a teacher is to facilitate learning, and in the main staff prefer willing participants, but since the primary focus of students is on achievement through assessment, their motivation to study often relies on this, and so any additional resources which improves grades will also improve motivation, which can only be of benefit to all;
- community - by involving students more in the working life of the Department we enhance the cohesion of our academic community and promote equality. In short, we become a better working environment for both staff and students.

The following summaries of some of our recent placements demonstrate the specific ways that the above can be achieved.

4.1 Geogebra self-study examples

There are a number of areas within the undergraduate mathematics curriculum that naturally lend themselves to problem solving, investigation and reinforcement of key mathematical skills. Prominent among these is plane coordinate geometry, and particularly a study of the conic sections. In 2011 a new module on this topic, entitled simply ‘geometry’, was commissioned. One of the authors set about the rather painstaking process of writing a course which would involve the creation of Geogebra files that would illustrate the theory and the results of the vast number of problems on loci that arise in such a study. But this was only the tip of the iceberg. The versatility of Geogebra and the nature of the subject does open up many more possibilities. As well as allowing students to investigate the theoretical results for themselves, and the wide range of problems, the interactivity of Geogebra aids students’ learning by allowing them to think about how to tackle the associated problems from a mathematical viewpoint, but also to explore new results. To achieve this many more Geogebra files were needed and this was an ideal opportunity for a student-led project to develop further resources. The benefits of employing students to do this are summarised above, and are acutely felt in this particular project. Beyond this the project included a detailed analysis of how to approach each problem, and techniques that could be used, or avenues explored. A student’s insight into this is very valuable for other students, mainly because they often have a better understanding of the pitfalls encountered by students, the misconceptions they have, the amount of detail and explanations they require, and approaches to the material or problems that students find most helpful. The project concluded with the generation of screencasts for a number of the Geogebra files, with a voice-over, and the animation and dialogue serve to take students through every aspect of the problem and its solution. This valuable resource also allows students to consolidate their learning after formal classes, at their leisure, and as often as they like. Above all the whole suite of resources produced in this project is particularly suited to self-study as part of a formal course, or as a standalone, off the shelf learning resource.
was timely: students can read tutorials on the package and attempt them in their own time, but when they are struggling the best way of solving their problem is for them to see on-screen what they need to do, so they can immediately recreate the steps successfully, and move on. This helps build confidence in their own ability and makes the whole process less daunting.

This project involved two students putting together a series of screencasts demonstrating each component of the tutorials that we already make available to staff and students at the University. Crucially, these screencasts now avoid the need for anyone to wait for assistance, and they have the benefit of being able to be viewed multiple times if necessary: they will help enhance transferable skills in computing as well as encourage independent learning. An added bonus is the greater familiarity with the packages that the two students who undertook the project now have, which has also enhanced their employability skills.

4.3 Other projects

‘Bridging the gap’ preparatory materials

Students start university with very varied experiences; either because of the way they have been taught, what emphasis has been placed on certain topics, the specification they have followed, the strengths of the teacher, which modules they have studied, in particular whether they have studied Further Mathematics, and of course how conscientious they have been! There is no better way to prepare incoming students for university study and bridge the gap between school or college and university (which may be large in terms of time for mature students) than getting existing students to compile a set of resources which addresses this. Having experienced a further one or two years study beyond school or college they are ideally placed to advise on and prepare materials that support incoming students generally, but also to make the transition as smooth as possible. The set of resources that two students helped produce this year are now made available to Freshers, and can be added to in the future.

Creating multimedia files highlighting facts about mathematicians

Beyond offering a module on the History of Mathematics, opening students’ eyes to the development of the subject, and the characters who have contributed to this, brings the subject more alive, and makes it an even more interesting discipline. By researching particular themes, or individuals, students can gain a valuable insight into the history of the subject they are studying. Sharing their findings with other students will have greater benefit than staff input on this because they will be able to see that their peers are also enthusiastic about the origins of the subject. This year one student undertook a placement to produce audio files describing a number of ‘fun facts’ about different mathematicians.

Developing feedback cover sheets for Data Analysis reports

Coming out of a desire of both staff and students to have a mechanism for providing more in-depth, timely and tailored feedback on student summative reports for a module involving data analysis, this project focused on constructing a feedback cover sheet. The student who undertook the project gained pedagogical research experience through first studying examples of feedback sheets from other departments, and was also able to design the sheet from a student perspective, focusing on partitioning feedback into sections that she felt would be most beneficial for a student to receive.

5. Discussion

We have highlighted above, both in generic terms and also with reference to specific examples, the clear contributions that a T+L placement scheme can bring. All these show that benefits to staff and students are inextricably linked, making for a more conducive working environment for all which allows staff to achieve their aims and students to fulfil their potential.

Since this is the first year that a formal scheme like this has been run in the Department of Mathematics and Statistics, it is difficult to assess its long-term success. So far it has tended to be the staff who are already heavily involved in teaching and learning who submit projects for the scheme, but it is not exclusively so. In fact, for research active staff who also have an interest in teaching, as noted above it can be very beneficial to have a student working on developing new teaching materials when it would otherwise be difficult to find the time to do this.

In summary, our experience this year of the scheme has been positive from the perspective of both the staff and students who have engaged with it, and the effect on future cohorts who will benefit from the outputs is expected to be similarly so. The benefit of having a formal scheme in operation that is advertised to run each year, rather than ad hoc tasks occasionally available, is that we can encourage those who have successfully completed placements to feed-forward their views on the scheme to students in the year below. This endorsement will help to create and increase interest and enthusiasm in this and other types of student engagement. Indeed, current students can be encouraged to make suggestions for how their placement could be continued the following year, either by them or by another student if they have graduated by then. Furthermore, students will be encouraged more generally to submit their own suggestions for projects, strengthening even further the ‘student voice’ aspect of this scheme.

For various reasons described above, we see such a placement scheme as an excellent example of student engagement in the curriculum, and as a scheme whose scope could be even broader than we have experienced so far. For example, if several universities eventually
have similar schemes in operation then it may even be possible for students to carry out such a placement in another university, giving them the additional benefit of experiencing a whole new working environment.

We therefore strongly encourage other universities to consider establishing an undergraduate teaching and learning placement scheme in mathematics and statistics. The benefits to both staff and students make this an excellent venture, well worth the investment of time, effort and resources.

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References


HEA Funding Opportunities

Workshop and Seminar Series

– Discipline call for proposals

The HEA is offering a grant of up to £1000 to institutions to host and deliver a workshop or seminar on teaching and learning in a discipline context. An additional fund of up to £500 is available for speaker expenses.

Through the discipline series, institutions are invited to host and deliver a workshop or seminar on teaching and learning in a discipline context. Workshops and seminars will be held throughout the 2011-12 academic year.

For further information and a proposal form please go to www.heacademy.ac.uk/funding#seminars

Teaching Development Grants

– Collaborative Grant Scheme

As part of the Teaching Development Grant Scheme the HEA will shortly be requesting submissions to its collaborative grant scheme which has the themes of internationalisation or employability. Collaboration may be cross institution and/or interdisciplinary. The project lead must be a Fellow of the Academy.

A total of £570,000 will be available with a maximum of £60,000 per project. Project duration will be 18 months. Successful bids will demonstrate longitudinal impact and will include evaluation and dissemination criteria. Matching support should be sought from the participating higher education institutions.

• Call opens - Monday February 27th 2012

• Submission deadline - Midnight Sunday April 22nd 2012

• Projects to commence - July 2nd 2012

For more information go to www.heacademy.ac.uk/funding#tdg