Getting students to concentrate on writing about the things that really matter

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Abstract

A new course for 3rd Year students has been set up to allow them to learn about computer modelling and experiments. Students were expected to submit short assignments on-line each week. These assignments required them to think about what their work meant as opposed to reporting their actions.

Students generally managed to keep up with the work and got a lot out of the module. They also began to get a mental picture of how skills developed in one section could be applied to another. The on-line nature of the assessment meant that it was possible to monitor staff and student progress on the module.

1. Background

The third year of our MEng Mechanical Engineering degree has always contained some laboratory experience. Historically, there was one laboratory for each of the three main analytical subjects (Thermofluids, Solids and Control) and these were examined through the students writing full laboratory reports. With 60 students on the course, this resulted in a considerable amount of marking which was divided up between a number of staff and led to a large variation in the standard of marking.

The drawback of using laboratory reports to test the students' understanding of their work is that much of the effort involved is in description and word processing, which can lead the students to adapt lecture notes and Web documents as opposed to thinking in a reflective way about their work.

2. Methodology

To overcome these difficulties, labs were replaced by a new module called *Experiments and Modelling*. For this, every student does an exercise in each of the three subjects, each led by a single teaching group. Two of the exercises had already been developed: a fluids one (Bullough et al., 2003) which involved flow through a diffuser, and a control one which was concerned with a ball and beam and a liquid level system (TQ Education and Training, 2007). The students performed experiments and then modelled them using suitable computer packages. Using these as examples, the solids and materials group were encouraged to put on their own experiment and related model. The aim of this was to teach students the relative uses and values of each approach and to show them how doing both can be far more valuable than only doing one. It also increased their skills base by getting them to work with computer packages on their own.

This new course is supported by a set of 12 lectures, each given by a different member of staff. Some concentrate on what students do in the laboratories and computer sessions, others on research experiences. In both, staff are encouraged to inform the students about their own research and use of experiments and modelling. The lectures put the work into context and stimulate interest in practical engineering.

Instead of writing a complete laboratory report (1500-2000 words) on each topic, 2 quizzes and a series of 16 short (50-250 word) hand-ins were required from each student submitted on-line using WebCT. These were designed to test students understanding. There were also two unmarked submissions that allowed the entire class to pool their results for a given experiment and be able to plot and analyse a large amount of data. In two of the exercises students were encouraged to pull together the various strands and set the entire concept of experiments and modelling into context. In order to avoid micromanaging the project, each of the three subject groups had their own leader who was responsible for delivering their portion of the work.

3. Issues

Getting the staff to set and mark the exercises was an issue, but all the lectures were delivered and the laboratory and computing sessions were timetabled. However, many of the exercises were not marked for a long time, which led to the students questioning the validity of the module. This was not anticipated as staff have been reminded about the importance of providing timely feedback. For next year, students have been assured that all exercises will be marked within two weeks of submission and with the electronic submission systems it is easy to monitor the staff to see who is up to date! Certain members of staff did not want to mark the exercises online, so secretarial staff were required to input hand-marked submissions.

4. Benefits

The use of WebCT was a great boon, as it allowed monitoring of the course as it progressed. Another strong point was the devolving of the different exercises to each group, but within a common framework. This meant that there was a single point of contact between the course leader and each of the activities. Students were able to organise themselves and work on their own. When they logged into WebCT there was a list of activities and they were able to plan their work in conjunction with a timetable. Very few of the 1,200 assessments were missed and the students

obtained a high mark for this module (average 72%). The discussion board was also reasonably well used, though this had to be closely monitored. There is a tendency for students to concentrate on presentation rather than content, but by asking them to concentrate on results, discussions and conclusions, more effort was put into doing the thinking part of the exercise as opposed to the description of what was done. It encouraged students to think carefully about what the work actually meant and the short word count also help them focus.

Another advantage was quality assurance. Firstly, having one member of staff marking all of the students' work for a single exercise reduces the need for moderation of marks. Secondly, submitting and marking electronically means that both staff and students have a record of when work has been handed in and marked. It also allows the module leader to constantly monitor progress and pick up problems early.

5. Evidence of Success

The success of the module was assessed using the standard departmental survey, some of the results from which are shown below.

	Disagree strongly	Tend to disagree	Neutral	Tend to agree	Agree strongly
I understood the aims and objectives of the module.	3%	17%	17%	**47%**	17%
I was informed of the expected learning outcomes of this module	10%	23%	13%	**37%**	17%
I found this module interesting	10%	13%	3%	**47%**	27%
I found that the module content was appropriate for helping my learning and preparation for the assessment.	17%	10%	10%	**41%**	21%
I am satisfied with the quality of this module.	17%	20%	23%	**27%**	13%

Some student comments:

"Brilliant! Great to have lecturers talking about what they are interested in."

"It helps me to understand better in the particular subject. For example, the control part was a practical example of what we learnt in the mechatronics module."

"It's a good idea for a module and has the potential to be a very effective module, however further refinement and organisation is needed."

"The assessments took up a lot of time, so it was difficult to keep up with other projects and tutorial sheets at the same time."

"I have not enjoyed this module in the slightest. Get rid of it and go back to practicals and reports that are part of the teaching modules."

6. How Can Other Academics Reproduce This?

Two main themes set this apart from more conventional courses. These are the large number of short, directed exercises which test understanding, and the utilisation of several members of staff who each mark a single exercise. Until the advent of electronic teaching systems, the paperwork and organisation involved to implement this sort of exercise would have been prohibitive.

Staff have to be carefully informed about what is required and the group leaders have to be motivated. Also, the course needs to be monitored closely so that problems can be quickly sorted out. Devolving the work into groups can help, but its success depends on the action of each of the leaders.

7. Reflections

The fact that some of the exercises had already been delivered helped to reduce the chances of failure. There is generally a good sense of collegiality in the Mechanical Engineering Department and this meant that the team approach to working was generally successful. However, this did mean that best practise in this group could not easily be translated to others. It also provided an excellent opportunity to implement research-led teaching that helped the students put the work into context.

8. References

Bullough, WA, Hart, JH and Chin, SB. (2003) Comparative studies: CFD, experimental and analytical techniques in the fluids laboratory, *International Journal of Mechanical Engineering Education*. **31**, 150-9

TQ Education and Training http://www.tq.com/teachequip_products.asp?choice=1&menu=1&sid=10, Coupled Tanks Apparatus : CE105 and Ball and Beam Apparatus : CE106 (28/02/07)