

# **EFFECTIVENESS OF USING TECHNOLOGY FOR REFLECTIVE LEARNING IN ENGINEERING AND DESIGN COURSES**

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## **ABSTRACT (250 WORDS MAX)**

Whilst it is true that technology can be excellent as an enabling tool in promoting learning in design and engineering courses, it can also be very much a distraction to the learning process. A scheme was devised that identified clear pedagogic principles in the aims and objectives of the project.

The clear lesson from the experience was that student need to have more control over their own learning process, allowing them to employ their own learning techniques, even it meant that they did not always prepare before a session. It was important that the process would include a method where students who did not prepare for a session could still participate in the learning activities.

What is more important is to reel in the students on their own volition, and to allow them to make mistakes. More importantly allowing them to recognize a good way forward in their learning process allows them to feel more valued.

The final use of technology revolved around the use of the on-line journal using the resources provided by the VLE and the amount of staff time needed. A scheme was devised where the students would refer to their reflective posts on BLOGS in a series of reports, each report covering a short period of a few weeks. This shifted the responsibility for the monitoring of the reflections back to the student.

*Keywords: reflective learning, engineering, product design, on-line.*

## **1 INTRODUCTION**

This paper is a follow up to the paper presented at EPDE'09 on using on-line journals in engineering courses. It also reflects the work done as part of the fellowship awarded by the CETL-C project at the University of Brighton in 2008 for project that encourages reflective learning using online tools available at the University of Brighton. [1] [2]

Much of the teaching today in the engineering courses tend to be lecture based delivered to the whole class. This has its merits in delivering material quickly to a large cohort. It can be argued that a delivered module with some tutorials can encourage rote learning and could limit the creative development in some students.

The main focus of this project was to investigate the use of on-line facilities to encourage reflective practice amongst students. Students appear to learn more when they have more control over their own learning styles and patterns.

Whilst it is true that technology can be excellent as an enabling tool in promoting learning in design and engineering courses, it can also be very much a distraction to the learning process. A scheme was devised that identified clear pedagogic principles in the aims and objectives of the project.

## **2 PROPOSAL FOR THE WORK**

Much of the teaching today in the engineering courses tend to be lecture based delivered to the whole class. This has its merits in delivering material quickly to a large cohort. It can be argued that a delivered module with some tutorials can encourage rote learning and could limit the creative development in some students.

The main focus of this work was to investigate the use of on-line facilities to encourage reflective practice amongst students. Students appear to learn more when they have more control over their own learning styles and patterns. The main motivation was to devise a way for students to learn via a reflective process. This could be implemented using several different online tools, such as BLOGS, discussion board activity, personal journal entries and online tests.

The various implementations in different modules are detailed in the next section.

## **3 IMPLEMENTATION**

The above was implemented in several modules that are listed below. Details of the numbers of students are also given.

- XE121 Engineering Concepts, taught jointly to 115 students from the first year of the BEng (Hons) Mechanical and Electrical Engineering pathways courses.
- EO230 Radio and Navigation Systems – 28 students, second year BEng (Hons) Electrical Engineering pathways courses.
- EO328 Communications – 15 students, final year BEng (Hons) Electrical Engineering pathways courses.
- MSc course - DGM13 Data Communications – 4 students
- MSc course - DGM15 Digital Television – 5 students
- XE336 Final year project, 5 students, BEng (Hons) Electrical Engineering pathways courses
- XE337 Group project, 4 students BSc (Hons) Mechanical Engineering pathways courses.

In XE121, students were asked to give their reflections via BLOGS, Journals, Discussion board weekly. As this was a rather large cohort, students were split into five groups. Students were allowed to choose their groups by using the latest version of the sign-up groups made available by the Blackboard based VLE with the previously mentioned online tools made available for each group. Only students within a group can share their experiences using posts to the discussion board. However the entries for their own private reflections that were posted to the journals can only be seen by the instructors. Weekly activities ranged from reflections on what was done in the electronics laboratories to focused research in particular issues of engineering such as ethics and sustainability, where students were asked to find out more about the subject area within a given framework instead of being given a dedicated lecture on this. The final outcome of the latter was a presentation in the broadcast studio where their presentations were recorded and produced on DVD as well as streamed within the Virtual Learning Environment (VLE), thus allowing the students to reflect on both the content and the style of their presentations.

Students were told that their postings in the VLE would contribute towards their final mark. The tutor was able to sample some of the journals to view what the students have done. The final report would include students giving the URLs to particular journal entries in the VLE, citing them as evidence of

the work the students have done. Hence, at a stroke, the students have had to demonstrate that they have done regular work and reflections, and the tutor only needs to look at a sample of the evidence at the end of the process. It would of course be educationally more sound for feedback to be given at regular intervals, and this was done at least once in the semester. Anymore would be quite unrealistic indeed.

Another change this year was the use of the weekly on-line tests for XE121. This was inspired by the improvement in results for EO127 Analogue Electronics by Graeme Awcock as detailed in the International Conference on Engineering and Product Design Education September 2009 [3]. This time, students were given an online test which had to be completed a few days after each lecture. This has the effect of encouraging students to reflect on the learning immediately after the lecture. A great deal of feedback was also given for the test after they were submitted, both for right and wrong answers. Interestingly, students indicated that whilst the material taught during the lecture did not make sense, it all came together after the test (after they read the feedback for their wrong answers). Whilst they were disappointed with the low marks, they were also encouraged by the fact that there would be further weekly tests to cover those topic areas later in the semester, to allow them to improve their marks. This confirmed the value of the currency of marks is still an important issue for many students.

For EO230, students were given a framework of questions for a particular topic area at regular intervals, e.g. a focused topic area in Global Positioning Systems (GPS). At the first activity, students were asked to spend an hour researching the topic area, and then to post their findings in the discussion board. This was then discussed with the whole class. Students would now subsequently complete the research in that area for the next week, having had immediate feedback with regards to what was required. This had a marked effect of engaging the students, who surprisingly became competitive and wanted to know how the other students fared with their answers. This was quite unexpected, but pleasing to see that the students were showing that they were interested and learning. Previously, students were given a similar exercise to do in their own time, but the results were not as encouraging. The carrot this time was also that the work would be vital for an on-line test activity that took place a few weeks later.

A similar process was put in place for two MSc modules DGM13 Data Communications and DGM15 Digital Television. This time the reflection was in the form of postings to Community, which is the University of Brighton's implementation of the ELGG technology for BLOGS [9]. ELGG allows the students to post BLOGS that can be read by students within a module, or just by the tutor. As the BLOGS are time-stamped, the students know that the tutor will be aware if they have been giving regular feedback on the course. The content of the feedback is not that crucial – what is more important is that the student is actively participating with the course. Again the students are told that the tutor will be monitoring the postings both throughout the module and at the end when a mark will be constructed. The contents of the BLOGS were also discussed regularly during the laboratory sessions so that students actively share their experiences and be seen to be doing that the reflective process was included formally in the assessment process. Interestingly, this resulted in more engagement in the process of learning as well as encouraged more study regularly throughout the term.

The above in part describe part of the process to encourage students to build their own personal learning portfolio in the various module areas. This was in part inspired by work by Gill et al [1], [2], Johnson et al [6], Rees-Jones et al [7] and Gill [9].

In XE336 and XE337 podcasts were used to further encourage reflective practice. Weekly meetings with students were now recorded. They were then uploaded onto the Virtual Learning Environment (VLE) and posted in the group discussion area, where the only group members were the student and the tutor for XE336 and the four students and tutor for XE337. The podcast was posted with comments about the highlights of the meeting. The student is then encouraged to add their own reflections of the meeting. This has greatly aided the learning experience of the students, for the students have had to reflect on the meeting in more ways than normal, and have helped to increase the engagement of the students on their project.

Finally, using podcasts and videocasts of the lectures have also proved quite useful. These were first described in the Teaching and Learning Conference at the university of Brighton in July 2008 [4] [5]. Students can now be pointed to particular videocasts in answer to particular questions. This has freed up the time of the author so that more reflective sessions could be used with the students. This has also manifested itself in other ways too – students were encouraged to make videocasts of their applications, to support the reporting of their progress of their projects for XE336 (Final year project). This in part was inspired by Derek Covill’s work in the use of Camtasia for assignments [4], [5]. The net result in all of this was increasing the students’ reflective activity.

#### **4 WHAT WAS LEARNT?**

There were a number of lessons learnt from the range of activities described in the previous section. Students motivation was certainly influenced by summative marks, no matter what the activity was (BLOGS, online tests, discussion board postings, reviewing videocasts and podcasts, guided research and review). Student engagement and reflection can be improved using technology if used within a framework that also relates directly to the module content via a framework of activities.

An adaption of the model of using online tests would be to implement one of the recommendations Gill made in [1] in using the weekly online tests to target the lecture material that would be delivered at the next lecture, thus encouraging students to prepare for the lecture.

Giving students some control in their learning seems to improve their motivational level. This is not new and has been highlighted in previous publications such as the range of articles in Gibbs [8]. What is new is the specific targeting of particular new technologies to help the students help themselves in the learning process. As indicated in Gibbs [8], encouraging students to work with each other and to even talk to each other has positive effects on their final learning.

Regular feedback for large class sizes this can be practically impossible, even for classes in excess of 25 students. Tutors today have a far higher contact time which leaves less time for marking and research. However, if students are encouraged to engage in the process of reflections as described previously, they learn by going through the process. The tutor can give feedback less regularly, giving the students to also learn from each other via the discussion board traffic.

The clear lesson from the experience was that student need to have more control over their own learning process, allowing them to employ their own learning techniques, even it meant that they did not always prepare before a session. It was important that the process would include a method where students who did not prepare for a session could still participate in the learning activities.

What is more important is to reel in the students on their own volition, and to allow them to make mistakes. More importantly allowing them to recognise a good way forward in their learning process allows them to feel more valued. This method allows for students to be rewarded for good work, rather than be “punished” by name/shame for not doing the work. Students can build a resistance to this kind of scheme.

The implementation relies on a rich resource that has to be built up over time. For this exercise, this was done with a combination of lectures recorded in the previous year, combined with recordings made from lectures in the current academic year. Much use was made of resources such as the assessment tools in the virtual learning environment, where the focus was not to test the students memory, but instead, to encourage learning by reading through the materials and engaging with the resources provided. The assessment tool hence helped to create a framework for learning to take place.

The final use of technology revolved around the use of the on-line journal using the resources provided by the VLE and the amount of staff time needed. A scheme was devised where the students

would refer to their reflective posts on BLOGS in a series of reports, each report covering a short period of a few weeks. This shifted the responsibility for the monitoring of the reflections back to the student.

Much of the experience obtained was mixed and largely depended on how much the student wanted to engage in this new way of learning, which seems much more difficult than simply being a passive learner by simply attending lectures and completing assignments.

The outcomes of the work were varied and surprisingly interesting. It was found that students needed a reason to be convinced of the validity of using online techniques. Reflective practice still remains a difficult skill for many students to develop. It was found that this could be encouraged more, if there was more feedback from the tutor. This worked well in small groups, such as project-led modules. The student's experience was further enhanced by the publication of podcasts of the individual meetings in a discussion board that was only accessible by the student and tutor. This led to a more meaningful exchange of ideas between the student and tutor.

The use of podcasts and videocasts of lectures have also led to a different way of working for the student. Students were now encouraged to answer their own questions by reviewing the material published. There was now a cycle in which the lecture is first presented, followed by some reflection, and then some testing via online tests and then further reflection via the feedback from the tests. Interestingly, it appeared that the main motivator for the participation of these activities were twofold – competition between motivated students and the desire to get as many marks as possible.

In part, the work done was successful in showing a different way forward in encouraging learning amongst students. Students now had more resources available (in terms of their reflections, podcats and videocasts) when revising for the final examinations, and were more responsive when given a framework of questions to study and research.

## 5 CONCLUSIONS

This paper highlights the use of a process to allow students to reflect on their learning using technology. Students can be coerced into student-centered learning scenarios if they can see a value for it, and that it will lead to some reward in the long run. This is because the time available for study has to be shared with other tasks such as earning for a living and lifestyle choices.

The author has proposed a way forward to allow students to engage in the learning process, allowing the students the students to have some ownership of the way they learn, and to provide a means for them to motivate themselves to learn. This has the added benefit of encouraging them to acquire skills for life-long learning after graduation.

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