CASE STUDY

Enhancing Undergraduate Teaching and Feedback using Social Media – an Engineering Case Study

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Abstract

For large modules taught within the College of Engineering at Swansea University such as the level 1 module *Scientific and Engineering Skills* (EG168) or the *Engineering Analysis* (EG189/190) mathematics courses, it is a considerable challenge for the lecturer(s) to develop a meaningful relationship with students. Lecture cohorts on these modules are large (250+ students) and examples are delivered through smaller classes (~50 students) and laboratory sessions delivered by supplementary lecturers and/or postdoctoral researchers. This inevitably leads to a lack of continuity and meaningful engagement with regards to students' contact with the lecturer. It also places a significant pressure on 'office hours' and email. It is common in student module feedback that the generic theory on these courses is not linked closely enough to discipline-specific engineering examples. Often this is due to wide range of disciplines studying the course (the EG168 module is taken by all level 1 engineering students and sports science students).

This paper details a project aimed at tackling these problems by establishing an online community, using the social networking facility *Twitter* to connect students to the lecturer, who was able to drip feed examples to students in the form of online video 'mini lectures' posted and discussed via Twitter. It will be argued that this not only allowed an enhanced sense of affinity and belonging within the module cohort, but also improved real time feedback for the lecturer who was able to adjust future lecture content based on the feedback being received via Twitter.

This technique was initially trialled on the EG168 *Scientific and Engineering Skills* module: a very large module (550 students) taken by students in the first term of their degree at Swansea University. It has more recently been adopted by other lecturers within the College on a range of modules. One of the aims within the EG168 module in recent deliveries has been to try and tailor examples to specific engineering disciplines whilst delivering generic content to the whole cohort through large lectures. It will be shown that delivery of online multimedia discipline-specific examples to students via the web (posted and discussed using Twitter) was a significant factor that helped achieve this.

Keywords: Feedback, social media, Twitter, YouTube

Engineering Education, Vol 8, Issue 2 (December 2013)
doi:10.11120/ened.2013.00015

Introduction

Background and motivation

For students to learn most effectively, they need to feel involved and engaged in the learning process. This is difficult to achieve whilst delivering generic lecture content to large cohorts. Large lecture groups inevitably leave students feeling like they are simply being thrown information and engagement with the lecturer or other students studying in the same group is limited. Also, large lecture groups often leave students without an opportunity to provide meaningful feedback for the lecturer. This often results in a teaching environment restricted to 'lecture and tutorial' in which, as Biggs (2003) points out, leads to lecture-expounding and packaging, and tutorial-clarifying and extending. In such a situation, students often get away with passive listening and selectively memorising. The teaching intervention detailed in this paper aimed to create an environment that moves its emphasis from teaching to learning (Barr & Tagg 1995). The underpinning pedagogical approach is based on cooperation, collaboration, diversity and sharing (Whipple 1987, Bruffee 1995, Matthews *et al.* 1995).

Within engineering departments, modules are often delivering generic content (such as mathematics) to a wide range of specific engineering disciplines (aerospace, civil, medical, etc.) and it is difficult, logistically, to provide discipline-specific examples and case studies within the traditional lecture setup. Also, crucially, real time feedback (i.e. students being able to give feedback to the lecturer throughout the term whilst the module is being delivered rather than just filling in the 'end of module feedback form') is very difficult with large cohorts. There tends to be a lack of engagement between the students and the lecturer, or at least this is restricted to precious 'office hours'.

This project aimed to go some way towards tackling each of these three issues, i.e.

1. Developing a sense of involvement in the learning process.
2. Creating and engaging with discipline-specific examples.
3. Enabling real time feedback.

This was to be achieved by developing a sense of online community which could extend beyond lecture slots and office hours. Note these three objectives are closely coupled to Chickering and Gamson's (1987) Seven Principles of Good Practise and their grand meta-principle of 'active learning'.

As an aside, it was hoped that this teaching approach would lead to a reduction in overloaded office hours and repetitive emails through the sharing of common questioning and responses as part of the online community. This online community would become what Wenger *et al*. (2002) refers to as a 'community of practice'.

> Communities of practice are groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly. (Wenger *et al*. 2002)

It was also hoped that establishing the Twitter community associated with the module would allow the lecturer to better connect students to the research that they undertake. Taking EG168 *Scientific and Engineering Skills* as an example (which uses a series of case studies relating to the design of BLOODHOUND SSC, the Land Speed Record vehicle in its delivery, since this is a research project that one of its lecturers works on), via Twitter the lecturer was able to keep undergraduate students better informed about progress on this project, and therefore, enhance the relevance of what they were studying to 'real world' engineering. The EG168 module is a 100% continuous assessment module with eight short

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assignments spread over a 10 week term with topics covered ranging from experimental methods, entrepreneurship and communication skills to an introduction to programming.

This successful method of teaching enhancement could be easily transferred to other areas of teaching across the College and University, and adopted at other institutions to enhance the learning and teaching experience.

This paper sets out the methodology and technology employed in this teaching intervention experiment, some examples of the engagement that resulted, statistics and feedback from students followed by conclusions and recommendations.

Methodology and technology

Twitter

Twitter is a free online social networking and microblogging service, established in March 2006, and as of April 2012 had grown to include over 140 million users worldwide. Users are able to *tweet* short (140 character) messages (often using *apps* on smart phone devices), which might include links to websites, that can be seen by all of the users *followers* in a *timeline.* These microblogs may or may not spark online conversation and the content of conversations can be tracked, allowing global or local *trends* in Twitter conversations to be measured. *Hashtags* are often employed by Twitter users in order for topics of conversation to be tracked; this is done by including a short expression in the tweet proceeded by the # symbol. The Twitter website is, as of May 2013, in the top 10 most visited websites in the world.

For this case, the account name @DrBenEvans was established for the lecturer to be followed by students on the course (although in practise no restriction was placed on who could follow this Twitter account). Also, the hashtag #EG168 was established for all conversations relating to the EG168 module. From the beginning of the teaching blog, students on the EG168 module were encouraged to follow @DrBenEvans and use the #EG168 hashtag in all tweets relating directly to the module.

Finally, using the free SAP PowerPoint Twitter tool plugin (2013), live Twitter feedback was utilised within lectures at the end of each lecture slot. This plugin for PowerPoint allowed students to tweet thoughts and questions regarding the lecture content, using the EG168 hashtag, and these were displayed on the screen in the lecture in the format shown in Figure 1. This real time feedback from students allowed the lecturer to answer some of the common questions related to the lecture content in the lecture and was also used to guide the content of the following lecture if, for example, it was clear from the feedback that certain aspects of a particular lecture were not well understood by many students.

By the end of the teaching block in which EG168 was delivered there were over 400 followers of the @DrBenEvans account. This is over two-thirds of the cohort.

Camtasia Studio

Camtasia Studio (2013) is a powerful screen video capture and video editing software package that allows the user to create videos incorporating a mix of webcam footage, computer screen capture and audio (Figure 2). This was used in conjunction with a modest Tablet PC, the Fujitsu Stylistic Q550, to create short video lectures to compliment the material delivered in the actual 'physical' lectures. The software package was extremely straightforward to utilise with the aid of a stylus pen to write on the screen. Typically, a 10 minute video would take approximately 30 minutes of time to produce including sketching a plan for the lecture, set-up and recording. These short videos were then uploaded to a YouTube channel and the link tweeted from the @DrBenEvans Twitter

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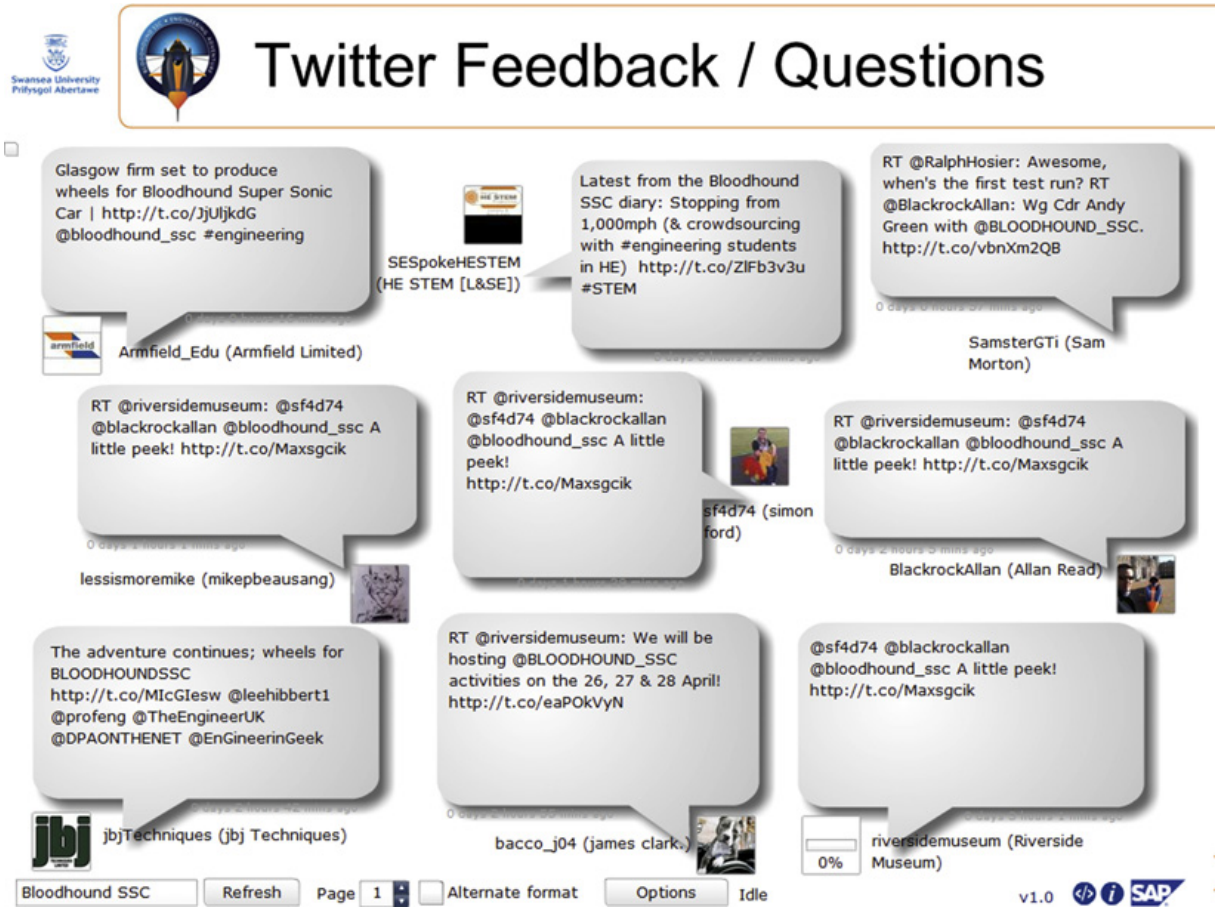

Figure 1 Example of SAP PowerPoint plugin searching on 'Bloodhound SSC'.

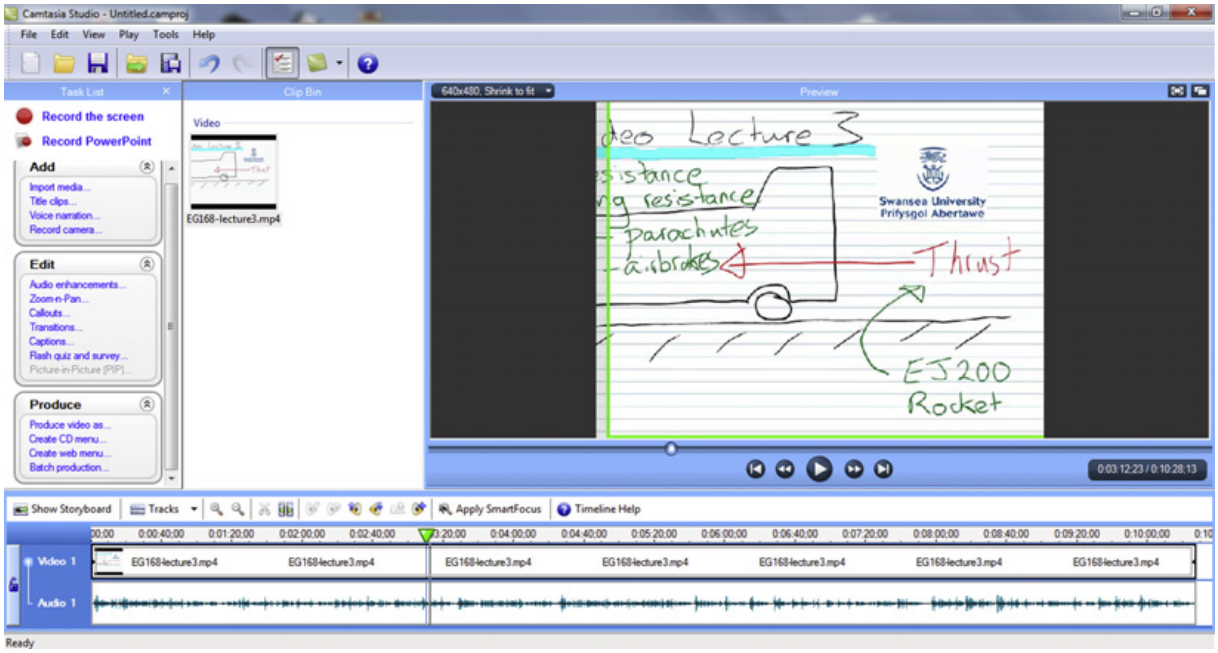

Figure 2 Screen-grab of the Camtasia Studio video editing software user interface.

account. This often generated discussion and feedback on Twitter which allowed students to compare reactions to the lecture content, tweet questions to the lecturer and gave the lecturer useful feedback on how well the students were understanding and processing the theory in the lecture content.

Note that this approach for creating the short video lectures is significantly simpler, more user-friendly and cost-effective than the more common approach of using a device such as a SmartPen.

YouTube

YouTube is a video-sharing website, created by three former PayPal employees in February 2005, on which users can upload, view and share videos. It is now a subsidiary of Google. There is, as of April 2012, a file size limit of 2GB and time limit of 15 minutes for video uploads in its most basic set up. It is the third most visited website on the Internet behind Facebook and Google with a reported four billion videos streamed per day. There are a wide range of smart phone applications specifically designed for streaming from YouTube.

Philosophy of implementation

The philosophy of utilising the technologies and social media tools detailed here was to establish a conversation between students and lecturer(s) that began in the lecture hall and was facilitated beyond the traditional lecture set up utilising YouTube and Twitter. This approach was deemed to work best when there was a strong interaction between the three components detailed in Figure 3. It was hoped that this would facilitate the establishment of Wenger's 'community of practice'.

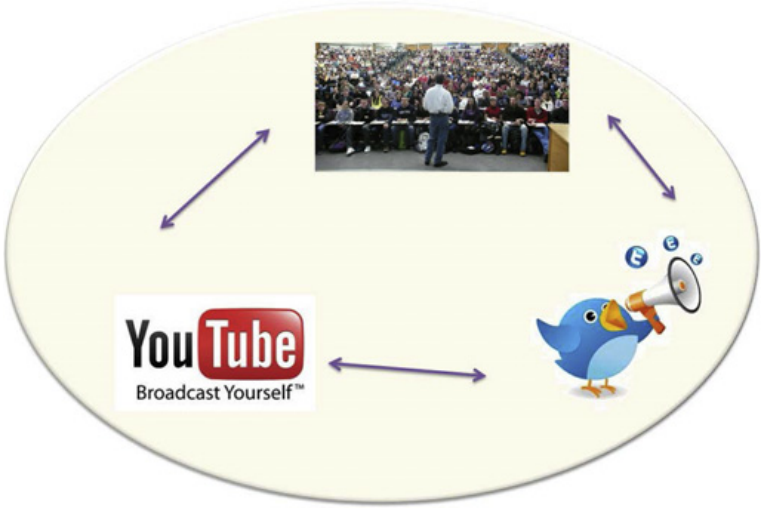

Figure 3 The interaction between traditional lecture hall environment, Twitter and YouTube.

Note that the earlier teaching tools supplemented traditional methods (e.g. lectures, laboratory sessions) and e-learning methods (e.g. Blackboard). It was not compulsory for students to engage with these technologies.

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Examples

Tweets

The full list of tweets (timeline) from @DrBenEvans over the course of delivery of the EG168 module is available via the Twitter website and on-going Twitter conversations regarding EG168 can be tracked via the #EG168 hashtag. A random selection of tweets from the lecturer is provided later (many of these were the beginnings of, or part of, twitter conversations):

> *Dr Ben Evans @DrBenEvans Reply Delete Favorite · Open*
>
> *Those of you who have tried this week's #EG168 MATLAB assignment . . . how did you find it?*
>
> *Dr Ben Evans @DrBenEvans*
>
> *#EG168 anyone struggling with this week's assignment? Share your concerns here . . .*
>
> *Dr Ben Evans @DrBenEvans*
>
> *Will be doing a very short talk and Q&A in the Digital Technium at 3pm today about @BLOODHOUND_SSC. #EG168 students: get yourselves along*
>
> *Dr Ben Evans @DrBenEvans*
>
> *#EG168 Video lecture number 3: http://www.youtube.com/watch?v=s3uK9fqicko&feature=youtu.be*
>
> *View video*
>
> *Dr Ben Evans @DrBenEvans*
>
> *Check this out: RT @supersonick: @DrBenEvans Hi Ben – just put a newer report from SA up, including the shale picture http://www.bloodhoundssc.com/news/desert_updates.cfm*
>
> *Dr Ben Evans @DrBenEvans*
>
> *#EG168 MATLAB3 assignment deadline extension to Monday 12th December 8pm*

On average, original tweets were published from the @DrBenEvans account two or three times per day, the majority of which were either links to YouTube video lectures, general/topical comments or links to websites or tweets specifically designed to initiate discussion about lecture content. A relatively small proportion of original tweets were operational/transactional e.g. broadcasting information about coursework deadlines. On top of this there would be regular tweets in response to incoming questions typically clustered around the few hours after lectures or in the lead up to coursework deadlines. Students were encouraged to ask questions via Twitter in their timelines rather than as direct messages (hidden to other users) in order to develop the sense of online community. In the majority of cases this was adhered to. In a typical week, the lecturer would receive in the region of 10 to 20 Twitter questions from students on the course (and a number from members of the public). Often students would answer the questions of other students themselves without the need for any intervention from the lecturer.

The #EG168 hashtag was used in the majority of tweets (both by the lecturer and by students) but was not used enough to feature in any Twitter trending statistics.

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Camtasia online video lectures

The video lectures created to supplement the EG168 course are available to be streamed from YouTube (2013). The video lectures were typically 10 minutes long presenting example applications of the theory delivered in the main physical lectures. No new theory was presented via the video lectures, only application or consolidation. A screen-grab from a YouTube stream of one of the lectures is show in Figure 4.

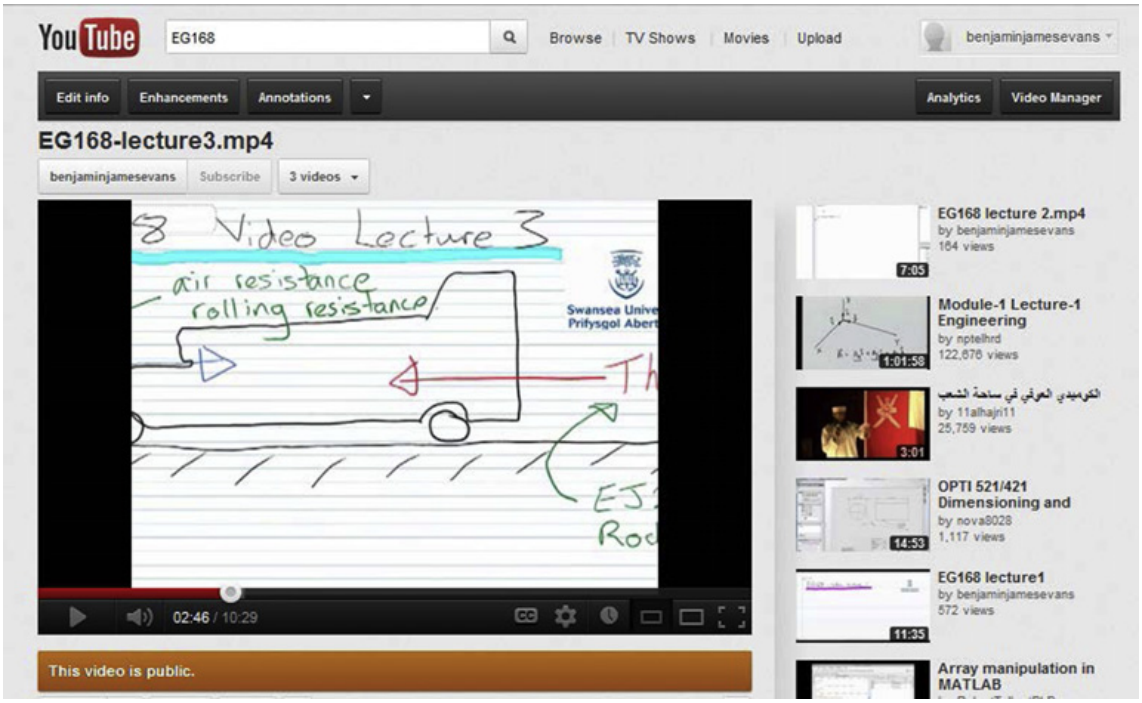

Figure 4 Screen-grab from a streaming of one of the EG168 video lectures on YouTube.

Statistics

Student engagement

Over two-thirds of the 650 strong cohort for this module were following @DrBenEvans via Twitter by the end of the module and the video lectures were streamed over 900 times in total. When questioned, the majority of students stated that they were engaging with this teaching method primarily using smart phones.

Despite initial concerns that a greater availability of material online and contact with the lecturer via social media would reduce attendance at lectures, it was found that lecture attendance actually increased. Before the introduction of this teaching intervention lecture attendance typically dropped to approximately 70% by the end of term. After the introduction of this approach lecture attendance was 83% at the end of the term. It is believed that this statistic is a result of students feeling more involved in the learning process and feeling a sense of belonging to a learning community and therefore were less likely to disengage. This finding is in agreement with Cross (1998) in her address to the National Conference on Higher Education and the findings of Pascarella and Terenzini

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(1991) in which she states that there is an inverse correlation between student–faculty contact and student drop-out rate.

Student performance and satisfaction

A snapshot of students' comments in the academic year pre- and post-intervention are included in Table 1.

Table 1 Snapshot of student comments pre- and post-intervention.

Pre-intervention	Post-intervention
not relevant for medical engineering	module was really stimulating
not enough feedback on assignments	lecturer did a good job of making boring topics not quite so boring
do not understand why this is relevant	lots of applications
unengaging tedious and boring	videos great for revision
not enough involvement	enjoyed following the lecturer on Twitter
lecturers needed to involve students instead of just standing at the front	great to find out about the BLOODHOUND project and follow the lecturer

Obviously these comments are only small and selected example of the change in attitudes of students but it is believed that these comments are representative. It was interesting to note that students did not necessarily find the module any easier as a result of this style of engagement. However, the keywords that regularly appeared in feedback from the cohort after this engagement was introduced gave a strong indication that students enjoyed studying this module more and felt that it was more relevant than students in previous cohorts.

Figure 5 shows the mean, standard deviation and relative frequency in student feedback responses to five simple post-module questions and Figure 6 shows how the mean of these responses, in red, compared with the College of Engineering average. As well as the analysis here taking into account attendance and engagement rates, and general student feedback, assignment submission rates improved as a result of this intervention.

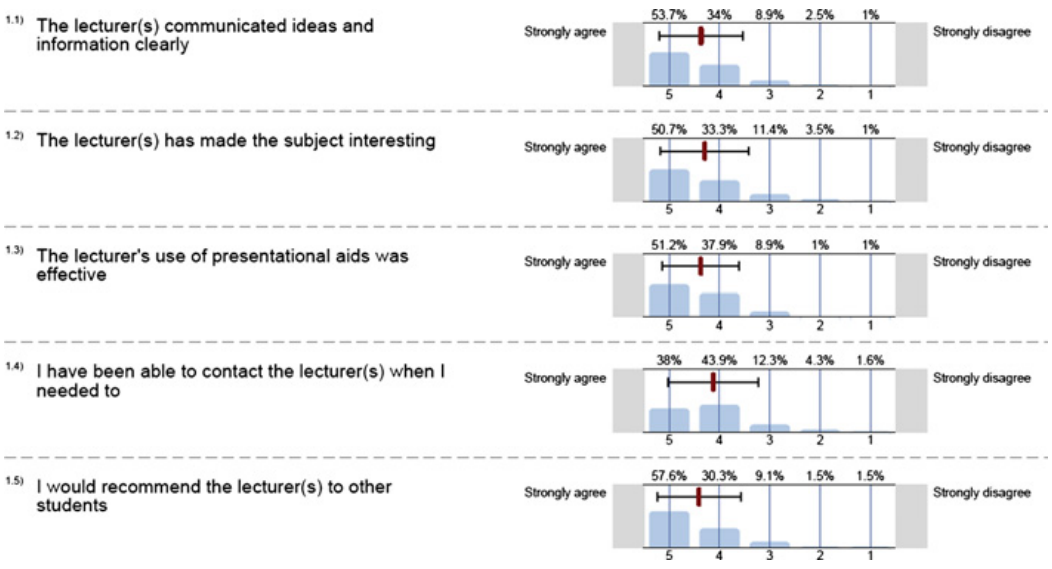

Figure 5 Mean, standard deviation and relative frequency responses in student feedback.

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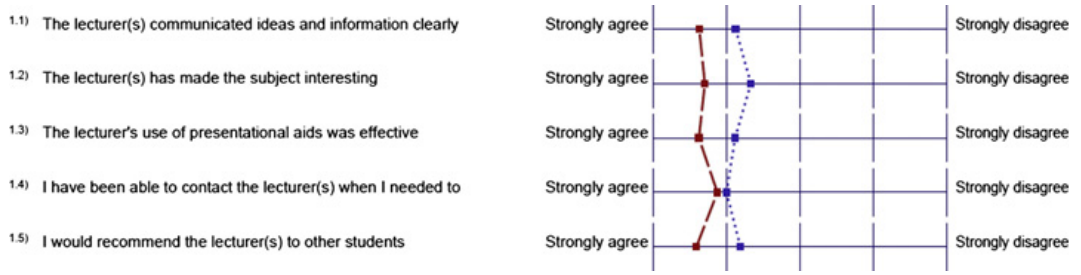

Figure 6 Comparison of EG168 mean student responses with the College of Engineering average.

However, average marks did not vary significantly as a result of introducing this approach, and there were some complaints from students who did not wish to sign up to Twitter that it was an unfair advantage to students who were engaging with the 'Teach by Twitter' strategy (despite ensuring students that all content was also available via the more traditional routes).

Conclusions and recommendations

Overall, the analysis of the 'Teach by Twitter' strategy indicated that it achieved its objective of better engaging a large cohort of students in the learning process. An online community was established that not only improved student–lecturer interaction but also interaction amongst the students themselves. Absolute measurable positive outcomes included better lecture attendance, increased assignment submission rate, improved student feedback and reduction in module-related email traffic and student office visits. At a subjective level, the lecturer felt that he got to know his students better as a result of this approach.

There was no significant increase or decrease in student performance in terms of grades and there were some student complaints that this strategy unfairly biased students who were already engaged with Twitter.

It is deemed that this teaching strategy successfully addresses the three specific problem areas identified in the introduction of this paper:

1. Creating a sense of involvement and engagement in the learning process.
2. Delivering discipline specific examples within large multi-discipline cohorts.
3. Allowing real time feedback in both directions between students and lecturers.

Referring back to the *raison d'etre* for this project, it is believed that the philosophy outlined in this article is a significant improvement to the traditional Higher Education teaching approach in that it takes steps towards a deeper involvement of students in the learning process by creating a sense of community through better student–lecturer interaction and better student–student interaction. It is planned to continue with this teaching strategy and share it more widely within the College of Engineering and more widely within Swansea University. As this approach is adopted in other modules, an analysis of whether this style of teaching can also improve student performance (i.e. grades) when implemented across a wider range of modules and degree subjects.

From a philosophical and specifically pedagogical perspective it would appear that this project has proved Chickering and Gamson (1987) to be correct in their assertion that the meta-principle that all educators should be trying to achieve is 'active learning'. Modern

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technology, in particular social media, is just one method that is successful in engaging students and staff in the learning process with many positive outcomes.

Acknowledgements

The author wishes to acknowledge the support of the Swansea Academy of Learning and Teaching (SALT) in providing a teaching grant to support this project.

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