2009-03-09

Harnessing Developments in Technology and Merging them with new Approaches to Teaching: a Practical Example of the Effective use of Wikis and Social Bookmarking Sites in 3rd Level Professional Education

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Recommended Citation

Behan, A., Boylan, F.: Harnessing Developments in Technology and Merging them with new Approaches to Teaching: a Practical Example of the Effective use of Wikis and Social Bookmarking Sites in 3rd Level Professional Education. INTED2009 International Technology, Education and Development Conference, Valencia, March 7th-9th 2009. INTED2009 Proceedings Pages: 2008-2016 Publication year: 2009 ISBN: 978-84-612-7578-6. http://library.iated.org/view/BEHAN2009HAR

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Harnessing developments in technology and merging them with new approaches to teaching: a practical example of the effective use of wikis and social bookmarking sites in 3rd level professional education

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HARNESSING DEVELOPMENTS IN TECHNOLOGY & MERGING THEM WITH NEW APPROACHES TO TEACHING: A PRACTICAL EXAMPLE OF THE EFFECTIVE USE OF WIKIS & SOCIAL BOOKMARKING SITES IN 3RD LEVEL PROFESSIONAL EDUCATION

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Abstract

While innovations such as Problem-Based Learning and elearning have informed pedagogical practice on the Geomatics honours Bachelor of Science degree programme at the Department of Spatial Information Sciences, Dublin Institute of Technology (DIT), Ireland, few attempts have been made to date to harness technological developments and merge them with new approaches to teaching. However, the recent conceptual change in authoring and usage of the World Wide Web from relatively static to fully interactive (Read-Write Web) provided an opportunity to embrace a change in technology as a means of modifying teaching practice to create a more student-centred environment.

This paper describes a project currently running at the DIT, with 2nd year students on the aforementioned four-year honours degree programme in Geomatics, where the students are required to use Web 2.0 sites for social bookmarking (www.delicious.com) and wiki creation (www.pbwiki.com) to enable collaborative research and writing, in the context of a module on introductory level remote sensing. No prior knowledge of wikis or social bookmarking sites is expected and instruction in the usage of these tools is an integral part of the task.

The students have been divided into small groups of four or five, given specific and independent tasks to accomplish, and given full autonomy in how elements of the task were subdivided. This particular arrangement has resulted in the emergence of a number of interesting organisational strategies within the groups, the practical details of which will be discussed during this paper.

Through appropriate weighting of this task within the overall module students have been given the opportunity to become accustomed to the new form of teaching and learning, with its potential for confusion or misinterpretation caused by unfamiliarity, without needing to worry about potentially significant assessment penalties. The usage of online sites, which are accessible to the students only through unique logins or identifiers, has made individual assessment within groups significantly easier and more successful than was previously possible.

Initial student feedback has been very positive, indicating that this method of learning is seen as interesting, challenging and effective, and that it is very fair in ensuring that non-contributing group members are not carried; a matter which is of significant concern to many hard-working students.

Keywords

Wiki, web 2.0, social bookmarking, active learning environment, collaborative work, student-centred approaches, learning styles

1. Introduction

The new approach to teaching reported in this paper relates to a Remote Sensing module undertaken during stage two of the Geomatics BSc. (Hons) programme at Dublin Institute of Technology (DIT), Ireland. The implementation examined the feasibility of using technological innovations in conjunction with pedagogical change to improve the learning of students on a professionally accredited programme. In the following, we will give some relevant background information related to the Geomatics programme and the specific module. This will be followed by a description of the technologies and the change in teaching method designed to accommodate their usage in a higher education setting. The following section covers the implementation and the strategies used by different student groups to complete their assigned tasks. The paper will conclude with an evaluation of the outcomes of the module from the perspectives of the teaching practitioner and the student.

The Geomatics BSc. (Hons) programme at DIT is unique in an Irish context being the only native undergraduate programme to directly service the surveying and geographic information industries. This characteristic results in both advantages, such as support from and contacts with industry, and disadvantages, particularly the need to cover a very broad range of subjects within the arena of Geomatics. At present, during the four years of the programme, students study all 40 modules as mandatory elements with the only opportunity for selection and specialisation being offered with the Work Placement module at the beginning of stage three and the dissertation in the final year [1].

The programme prepares students for careers in the areas of geodetic surveying, remote sensing, land management, or geographic information science (GIS) or for a variety of cross-disciplinary occupations. The principal modules are supported through instruction in the areas of mathematical methods, information technology (including programming, Computer Aided Drafting and specialist computer applications) and professional development (including project management, law and communication skills).

With this very broad range of material to cover it is essential that modules are both distinctive and integrated within the programme, and that students can see their relevance, are interested in the content, are motivated to learn, and feel that they are properly rewarded for their efforts. This has lead to the implementation of a number of pedagogically-driven developments in teaching and assessment for a range of modules on the programme.

1.1 Changes in teaching practice – elearning, Problem-Based Learning & Work Placement

In 2004, faculty decided to roll out the usage of the WebCT virtual learning environment to all appropriate modules on the BSc. Geomatics programme. For most modules adoption of the new system simply meant the online provision of learning materials and the usage of the mail or calendar tools. However, teaching practices changed very little with standard lectures still dominating as the mode of delivery. For the students the main change was that many now considered it unnecessary to attend classes due to the easy accessibility of module notes. These problems are not unique to this programme as a DIT review of Information Services found the situation to be similar throughout the institute [2]. In subsequent years elearning tools such as assignments and self-tests have been utilised but on an ad-hoc basis and without any fundamental change in teaching or assessment practice.

In a change designed to better prepare final year students for careers that involve participation in cross-disciplinary teams and lifelong education Problem-Based Learning was also introduced in 2004. Initially the problems set for the students related only to geodetic surveying but in 2005 this was expanded to include the area of remote sensing. Further improvements in the design of problems and the structure of the assessments have been carried out in subsequent years as a result of student feedback and faculty reflection [3].

Another change made in response to an acknowledged shortage of practical exposure in the final two years of the programme, mainly due to the range of software and research requirements, was the introduction of a work placement module for the firth semester in 2008. A review of the issues affecting geomatics education in Ireland, and influencing this decision, is available in Prendergast et al. [4]. The introduction of this module required the remodelling of both prior and later modules in order to achieve sufficient levels of knowledge for the broad range of possible placements on offer. This change also acted as a catalyst for the developments detailed in this paper.

1.2 Module Details

The module of interest in this study is called Remote Sensing 1 and is delivered during the third semester of the eight semester programme. Two distinct components are included within the module; the first entitled Introduction to Remote Sensing and the second Close-Range Photogrammetry. This paper relates only to the former component where the Web 2.0 functionality is more fundamentally embedded. More details of the second component can be found in Behan (2008) [5].

Prior to undertaking this module students have received only a very brief introduction to the science of remote sensing as a component of a module called GeoSpatial Awareness which is delivered during semester one. This module covers, at a basic level, the generation and handling of geographically-referenced spatial data and is delivered to a joint cohort of students studying honours degree programmes in Geomatics, Spatial Planning and Environmental Management. The material is delivered as two two-hour lectures, giving an overview of typical sensors, platforms and applications, supplemented by six hours of computer-based practical sessions which focus on the manipulation of remote sensing imagery using a simple software application. Passing the assessment of the component is not mandatory and this has influenced a relatively high percentage of students to either ignore the assessment or perform very poorly. This implies that subsequent modules cannot assume prior knowledge and, because the Remote Sensing 1 module forms the platform for four further modules during stages two, three and four, all necessary fundamentals must be delivered.

On the BSc. Geomatics programme students undertake approximately 24 hours of contact teaching per week and this is designed to be supplemented by up to 15 hours of self-study. In reality few students will spend the required self-study hours during most of the semester due to the requirements of part-time work and their social lives. Therefore, best results are often achieved on modules where it is possible to ensure that the required learning is achieved during the contact hours. However, few lecturers would consider that the existing schedules provide sufficient time within which to achieve their module's learning outcomes and, therefore, must promote methods of encouraging students to undertake the necessary self-study time.

Another difficulty with the programme delivery is that timetables are set per semester meaning that each module is delivered in a particular time-slot on a weekly basis. This produces severe problems in relation to continuity as students will have been exposed to a wide variety of other materials between sessions making it necessary to undertake significant recap at the start of each class. Depending on the duration of the class (typically one to three hours) this can mean that little new material is covered in some sessions, causing further issues related to a shortage of teaching time.

In the previous format of the Geomatics programme, mainly due to equipment and staffing constraints, the Remote Sensing 1 module was delivered via 12 theoretical taught sessions (once per week for two hours) with a limited number of hands-on practical classes delivered to pairs of students typically once per 4 or 6 weeks. Understandably, student feedback frequently reported problems of understanding and engagement with the subject matter due to this lack of hands-on experience and the theoretical nature of the subject, particularly relative to other modules. This had the added effect of causing both student attendance and grades in the module to be less than satisfactory. This situation was unsustainable, particularly in light of the possibility of introducing students to remote sensing companies or related public bodies for work placement during semester five. Without changes to the module there was a danger that both the students and the employers would experience an unsatisfactory placement semester, with a potential secondary effect of damaging the programme's reputation and the student's future employability.

It was therefore considered essential to change these modules in order to improve the student experience, attendance and grades, and to produce students who would be valued during placement and longer-term employment. This also implied that in conjunction with delivering the skills needed to underpin the technical requirements of the workplace students also needed improved preparation for the transferrable skills aspects of employment such as technical and collaborative writing, information researching and sharing, and oral communications in the form of one-to-one interaction and group presentations. The changes reported in this module aimed to try to address both the technical and some of the communications issues.

2. Relevant Developments in Technology

While a range of Web 2.0 developments were considered in redesigning the module the two which the authors selected were Wikis and Social Bookmarking.

2.1 Wikis

The decision to use Wikis was actually made by the students themselves because these sites afforded an opportunity to use some of the fundamental elements of Web 2.0 (information uploading, commenting, URL linking, online collaboration) which are integrated into most of the social networking sites which have become the usual forum within which teenagers and young adults make of friends and expand their social horizons. This phenomenon of increased usage of social networking sites could be observed on a daily basis in DIT computer laboratories and was supported by official statistics relating to the popularity of certain types of websites. In March 2008 in Ireland three social networking sites were listed within the top ten most trafficked internet sites (3. Bebo, 7. Orkut and 9. Facebook). The rest of the top ten places were occupied by a number of search engines and by You Tube and Wikipedia, both of which also allow user interaction [6].

Knowing that students were engaged in daily interaction via websites and that they were used to publically sharing material on the World Wide Web meant we could consider an initial hurdle to have been overcome prior to starting the module. However, the issue of enabling students to make the transition from social interaction to meaningful contribution and collaboration in an academic sense would still be a challenge. These problems were also reported by Wheeler et al. in a study from the University of Plymouth [7].

The wiki provider chosen was pbwiki, mainly because of the existing set of educational users, the quality of the tools (particularly the WYSIWYG editor), the ability to make sites private, and the provision of advertising-free work spaces.

2.2 Social Bookmarking

A fundamental problem for any teaching institute involves the difficulty of trying to ensure that students learn best practice with regards research methods. The dominance of Google and Wikipedia as primary sources of information makes it very difficult for lecturers to redirect students to use the more reliable, and costly, resources of institutional libraries. Students typically find the search engines of databases or publisher websites to be less readily accessible than their internet favourites, mainly because they are often required to search in more than one location. However, most of the database, library and journal searches create citeable URLs meaning that these can be shared between users, thus reducing the amount of search time required if collaboration could be encouraged. As a method of formalising this collaboration Social Bookmarks were chosen due to their reported usage as enablers of cooperation [8].

The social bookmarking tool chosen was www.delicious.com, mainly because of its tagging capabilities and because it was found to be very user-friendly when tested by the authors.

3. New Approach to Teaching Remote Sensing I

In order to integrate the selected new technologies into the Remote Sensing 1 module the assessment method was changed from unseen, time-constrained, written examination to a variation on continuous assessment. While assessment is obviously necessary in the context of progression between modules, the focus was changed from end-of-module, summative processes to formative methods with emphasis on the provision of feedback as early as possible in the semester.

Cognisant of the potential confusion that could be caused by the introduction of new teaching and assessment methods during stage two of a programme, the authors considered it important to provide a relatively safe learning environment where students could become familiar with the new methods before its impact on their grades became significant. In an ideal situation the first part of the module would have been based on feedback only but due to the workload issues described previously students generally, and a large number of this group in particular, are known to focus only on coursework that contributes to end of semester grades. Therefore, the decision was made to create an initial task that contributed 30% to the overall module marks.

To provide the student group with a starting point for their collaborative tasks two, two-hour lectures were delivered using the standard transmission model. Furthermore, two two-hour tutorial classes were run in the computer laboratory introducing students to the Web 2.0 sites, pbwiki and delicious, as well as the library's online research resources of databases, electronic journals and meta find search tool.

The 22 students were then divided into six groups, ensuing that these groupings were aligned with other arrangements for practical classes to facilitate the possibility of working collaboratively outside the time-tabled Remote Sensing class. Due to significant issues of absenteeism with this particular cohort the group compositions were also informed by attendance records from a number of classes. Each group was provided with a list of three remote sensing sensors (two airborne and one spaceborne) for which the following information needed to be collected: technical description of the sensor; brief description of three applications of the sensor; and a review of a conference or journal paper describing the usage of the sensor for a specific application.

The students were given approximately 20 calendar days within which to complete the tasks. Within that period two scheduled remote sensing classes of four hours each occurred. The students were informed that attendance would not be monitored on these days but that these sessions would operate as tutorials where each group would have opportunities to engage with the lecturer. The authors envisaged that students might need further guidance on technical aspects of the sensors or their applications, or that clarification of aspects of the brief might be needed. These sessions also enabled the lecturer to engage with the students in small groups in order to gauge their understanding of fundamental technical issues.

The assessment of the component was divided between the following elements: group wiki produced (30), individual sources used (10), individual wiki contribution (20) and individual interview (40). Students were, however, informed that if no contribution was made to the wiki then the group marks for the final product would not be awarded. The group marks evaluated the achievements of the group in meeting the three specific tasks included in the brief based on technical accuracy and completeness. This mark also considered the continuity of each group's wiki section in terms of navigability and uniformity of appearance. These elements were considered essential in the context of preparing students for engagement in collaborative work environments. The marks given for the sources used were deemed essential as a way of forcibly encouraging students to engage with the library resources previously introduced. Due to the set up of the pbwiki site, it was very easy for the lecturer to ascertain the exact amount and nature of each individual's contribution to the final product. This functionality was demonstrated to the students during the tutorials to ensure that students understood the methods to be employed in assessing the module.

The individual interview was an essential component of the assessment strategy. Although one of the goals of the new teaching method was to encourage and facilitate group work, it was also essential to ensure that individuals could not hide behind the knowledge and produce of the group. The form of the interview was discussed at the first project briefing. Students were informed that in the interview questions would be asked about the materials included in the lecture classes, about the technical aspects of any of the different sensors and applications, and that students would be asked to recommend specific sensors for particular applications with reasons for their choice. The interviews were conducted for 20 minutes duration on a one-to-one basis with students randomly selecting one question from each of the three categories, lecture material, sensors, and recommendations. These methods ensured that students were required to study not only their individual or their group's contributions to the wiki but also that of the class members.

3.1 Group Strategies

Of the six groups created for the project three availed of all opportunities to engage in small group teaching, two groups were present for one week each, and one group did not take part in either of the feedback sessions. The groups which engaged in the tutorial sessions completed the tasks to the best standard, partly because the opportunity for questions ensured that the students comprehension of the brief was satisfactory but mainly because ongoing student work could be evaluated and feedback given. This afforded the attending students the opportunity to improve their work and their understanding without incurring penalties, as frequently happens with summative assessment strategies.

It is also important to state that in recognition of the condition that students were not required to attend the tutorials any student who contributed to the wiki up to five days before the due date received written feedback and guidance on how to improve their content. In this way the potential of an online collaborative environment was examined although, on reflection, these attendance arrangements were considered too flexible. Each student group was also provided with a private discussion board on the DIT's Webcourses VLE but no usage was made of this application. For some groups it was not necessary because they worked together in the real environment – laboratories during tutorial times – and for other groups because, in general, there was little collaborative work.

As was previously explained, students were clearly informed both in the written brief and in the discussions accompanying the start of the project that it would not be sufficient to only pay attention to their own section of the wiki. It was also not sufficient to only regard the work of their own group as questions could be asked on any sensor. However, in order to focus on the required learning outcomes and recognising that some groups would carry out better research than others the set of sensors provided to each group, although different, covered the three relevant parts of the electro-magnetic spectrum (visible, infer-red and microwave) as well as the major types of acquisition technology (frame, pushbroom and scanning) from sensors that were airborne or spacebourne. The design of the interviews attempted to keep the questions as general as possible so that each group could align their answers to their own research. In a sector where technology changes so rapidly it is essential that students can demonstrate understanding of fundamental concepts but it would make little sense to waste energy remembering the details of systems which may only operate for a short number of years.

With the broad-ranging learning outcomes in mind students were encouraged not to carry out unimaginative task division where each student took one sensor and investigated its technical description, its applications and a paper where it was specifically used unless the group then engaged in some form of discussion session where peer-assisted learning was utilised. The three groups who attended both tutorial sessions used various arrangements for sharing the work on different sensors between members with the outcome that each student carried out some research on each type of remote sensing technology. These groups also benefited most from the use of the social bookmarking sites as research started by one individual could be continued by others in a seamless and efficient fashion. Both of the groups who attended only one tutorial had already carried out an amount of work via the one student per system model of task sub-division before engaging in discussion with the lecturer. At this point advice was given on the need for group interaction and sharing of information through discussion rather than only through the wiki. One group considered fully the recommendations, engaged in quality information sharing and, therefore, performed well at interview. The second group continued to operate as separate individuals and performed only marginally better than the final, non-attending group both in the group wiki product and the individual interviews part of the assessment. The final three groups also made little or no use of the social bookmarking site.

The final difference to be noted in terms of group strategy related to the design of the wiki and its navigation. Each group were given full control of the layout of their section of the site, within the possibilities of the tools offered by pbwiki, with the only requirement being that a link had to be provided to a group table of contents on the side bar (the main form of ever-present navigation links on pbwiki) and that all content had to be fully referenced without any cut-and-paste where quotation marks were not used. Again these requirements were clearly identified in the brief, during tutorials and in written feedback given on the wiki. As before the groups who engaged in the tutorial sessions and the individuals who posted content at least five days before the deadline received guidance towards improvement and, in general, made the necessary corrections before incurring assessment penalties.

4. Evaluation

Evaluation of the results of the change in teaching was made in two ways, from student feedback and following staff reflection.

4.1 Student Feedback

A formal questionnaire was developed for the end-of-module quality assurance procedure and the results of that evaluation will be discussed in a forthcoming publication by the same authors. However, in order to gauge the requirement for immediate change or improvement before commencement of the second component of the module, students were asked, at the end of the individual interview, to give their opinions on the new method of teaching and learning. The following is a summary of the main issues identified:

The content of some sections of the wiki was problematic because it was poor both in terms of quality and the inclusion of appropriate referencing to support extra background research. This issue was also recognised by the lecturer when assessing the wiki and allowance was made for this problem when preparing questions for the interviews, as was noted in section 3.1. However, due to the very short time between the deadline for completion of the wiki and the start of the interviews it was not possible to convey this information with sufficient clarity to the student group in time to make studying for the interviews any easier.

Although the formation of the groups had been designed to try to account for the issues of attendance within the cohort one or two conscientious individuals were placed in groups where they received little help. In commenting on this result the affected students did acknowledge that group formation was, in general, fair and that they realised that the structure of the marking scheme ensured that they as individuals had received full credit for their work without carrying anyone who did not contribute.

The general reaction of all of the students was that this mode of teaching and learning was interesting and worth continuing. Most students highlighted the extra nerves caused by having to undertake a one-to-one interview which was generally a new experience. However, upon completion of the interview most students realised that this method of assessment worked to their benefit as it offered a greater opportunity to demonstrate knowledge. Also, the possibility that the lecturer could both deliver prompts and ensure that the student did not give an incorrect or misunderstood answer was an extra bonus that they had not anticipated and which was not available in a written examination. Furthermore, the provision of immediate feedback was considered a significant positive.

4.2 Staff Reflection

In reflection on this module the main response is that, notwithstanding the issues mentioned in section 4.1 and in the following, the student learning experience was improved when compared with a standard transmission model of teaching with assessment via unseen, time-constrained, written examination. From the perspective of a lecturer significant improvement can be achieved in the quality of delivery when more opportunity exists for interaction with the students. With written exams it is frequently frustrating to find that many students in a group have misunderstood a particular topic or concept and that the first idea you have of the problem is at the end of the semester when there is no further opportunity to provide feedback. Since the pass marks at DIT is only 40% it is often possible for students to progress within programmes while only achieving a subset of the intended learning outcomes. Therefore, this method of teaching provides a mechanism by which better alignment between assessment and learning outcomes is achieved.

Another major benefit is the improved engagement in the module material from the majority of students. By placing the responsibility for learning into the control of the student and their peers, and by creating a challenging environment the results achieved can be very successful. To know that students are actively engaged in problem-solving and supporting the learning of their peers is of great benefit to the lecturer as this enables more time to be spent on providing other forms of support.

It should also be noted that a significant change in teaching and assessment methodology does result in increased time requirements during the teaching part of the semester. However, the return from the extra time spent significantly exceeds the extra effort required and is more than comparable with the benefit felt when there is no requirement to correct a bundle of written scripts at the end of the semester.

Finally a comment must be made on the general applicability of this technique to higher level teaching. Our experiences have shown that this method is successful in small group teaching, with up to 30 students, but we acknowledge that the overhead may be too much with larger groups. However, if it was possible to engage the help of teaching assistants, perhaps from the 3rd or 4th years of the programme, then the monitoring of group activities, particularly the guiding of discussion and research activities, could still be successfully achieved despite the larger numbers. The main problem would then be created by the individual interviews but creative solutions using the assessment tools in Webcourses could be used to reduce the length of interview required while ensuring that personal learning was assessed.

5. Conclusions

By undertaking an evaluation of the module through the use of student feedback and staff reflection the authors have identified a number of key areas where improvements can be made and better alignment with learning outcomes achieved. These include the addition of an oral presentation; the reorganisation of small-group discussions into opportunities for peer-assisted learning based on reviews of journal and conference materials; better enforcement of participation requirements and the weighing of the assignment of all group marks based on that participation. A number of changes related to the technical content of the module may also be made for the next delivery in September 2009.

In conclusion, in this paper we have reported on the successful combination of developments in teaching methods with advances in Web 2.0 technologies for delivery of one module on a professional higher education programme at the Dublin Institute of Technology.

6. Acknowledgements

The authors would like to acknowledge the support given by the Dublin Institute of Technology's Learning & Teaching Awards, by Department Heads Frank Prendergast and Kevin O'Rourke, and by the 2nd year students of the BSc. Geomatics in 2007 and 2008. Thanks also to pbwiki for provision of the premium educational wiki sites: http://remotesensing1.pbwiki.com/ and http://remotesensing2.pbwiki.com/.

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