Blending what? An approach to delivering earth science courses online

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Introduction

A major problem with online instruction in contemporary universities is securing cooperation of academics. Oslington (2005) argues that although the benefits are widely recognized, participation is inhibited by 'the unverifiability of expertise in online learning, the firm-specific nature of investments in online learning and the team nature of online learning.' The preparedness of science faculty staff to engage in online and distance learning is further discouraged by the difficulty in presenting the skills and knowledge involving particularly the practical and fieldwork aspects of science courses. Virtual field trips, interactive multimedia computer-aided learning (CAL) packages and practical kits have been used in the past to overcome these perceived difficulties and we have used a range of approaches in trying to deliver geoscience courses online (James, Clark, Hillis and Peterson 1995; James, Peterson and Clark 1996; James, Peterson, Roberts and Clark 1997). The introductory undergraduate geoscience course described here has thus evolved from a completely face-to-face delivered course to one which can be partly taken off-campus. We have experimented with CAL modules, just-in-time teaching (Novak, Gavrin, Christian and Patterson 1999), online readings, discussion forums, question and answer sessions, mail-out practical kits, interactive field simulations using a combination of digital images and real earth materials, and virtual field trips, in an approach that can be described as blended learning. Blended learning (Thorne 2003) is recognized as a way of meeting the challenges of tailoring learning and development to the needs of individuals by integrating the innovative and technological advances offered by online learning with the interaction and participation offered in the best of traditional learning. Fisher (2003, p11) describes it as 'the selection of an optimum mix of instructional delivery strategies that will enable a learner or learner group to achieve desired learning outcomes.' Blended learning provides all the benefits of online learning including cost reductions, time efficiencies and location convenience for the learner as well as the essential one-on-one personal understanding and motivation that face-to-face instruction provides (Brown 2003).

Purpose and research design

The ready availability of computer technologies in the classroom and the community have greatly expanded the educational options available to both learners and instructors in a way that has blurred the distinction between traditional face-to-face and distance learning. The recognition of the inherent strengths and weaknesses associated with both learning environments has enabled course designers to combine the two. Distance programs are attractive to working adults because they provide flexibility in time and place (Osguthorpe and Graham 2003) however they suffer from limited human interaction (Swan 2001). A weakness of traditional university courses is their lack of time flexibility, requiring learners to be present in class up to four times a week and often on more than one day. This disadvantages part-time students, adults returning to study after or during child rearing periods and traditional full-time students many of whom are now required to hold part-time jobs to survive.

The pedagogy of the blended approach that we have adopted is based on the assumption that there are inherent benefits in face-to-face interaction as well as the understanding that there are advantages to using online methods. The purpose of this project was to determine whether students perceived the benefits in the same way as we did. Specifically we wanted to find out from students: which of the online resources they used and how they used them; and whether they felt that they helped learning.

The principal methods of evaluation were the application of standard University of South Australia CEI (Course Evaluation Instrument), SET (student evaluation of teaching) surveys and a series of focus group interviews. The CEI and SET

evaluations are conducted online and are open for students to use from the middle of the second last week of teaching until after the exam period. 65 of 79 students in the course responded.

Focus groups of 6-8 students were convened during normal practical sessions in the final week of teaching. One of us (PJ) guided the discussion using a series of questions designed to elaborate on the class responses to the CEI and SET questions that related to the online components of the course. Each session was tape recorded and recorded by a note-taker. Adapting a method suggested by Kreuger (1994) the first part consisted of introductions and a brief overview of the background and purposes of the focus group. Students were encouraged to respond independently and to discuss their responses with each other before replying to the questions. About 20 of the 79 students in the course participated in the focus groups.

At the beginning of each focus group it was explained that we were interested in the use of online resources that were accessible through the course home page. We reminded the students that there were several components to the course online material: the course outline; *PowerPoint* slides for each lecture; online readings; questions based around the online readings; an online discussion page and the *AssignIT* online assignment submission tool. During each focus group interview, each of these components was explored separately and the students were asked about how they used them.

Course design

Introductory Soil Science is a core course in the first year of the undergraduate environmental management programs at the University of South Australia. It is a typical undergraduate science course consisting of two discreet but related components: a theory component in which new knowledge and concepts are introduced in lectures; and a practical component where manipulation and classification skills are introduced in the laboratory and then practised in the field. The lecture component has gradually evolved from a fairly traditional teacher-centred didactic style to a much more interactive student-centred style.

The way in which the course has been taught has evolved as new technologies and new (theoretical) conceptions of learning have been developed. The purpose has always been to provide an effective learning environment with the emphasis being on acquisition of knowledge and skills. At the same time the course is expected to begin to develop in students a set of generic skills (referred to as Graduate Qualities by the University of South Australia). These are the first two of three of what Goodyear (2002) describes as 'conceptions of the nature and purposes of higher education': academic; generic competence; and reflexive.

We feel that it is important to have a clear, coherent model of learning around which to design the curriculum and the learning system rather than to use the tools and technologies because they are available or trendy. Thus before the various face-to-face and online components were chosen we carefully considered how they would contribute to the model of learning that we felt would result in improving learning outcomes. The nature of the course, its place in the program, its relation to the University's goals, as well as more pragmatic considerations such as timing of the class, the time demands of both full-time and part-time students, class size, learning styles, etc. were considered. Biggs (1996) suggests that in designing the learning environment, close attention should be paid to what the learner is doing. Learning depends on both the physical and mental activity of the learner and while we cannot control these things directly we can create an environment that influences what the learner does. In what he calls 'constructive alignment', Biggs stresses the importance of aligning the curriculum, the teaching methods, the assessment procedures, the educational environment we create and the learning objectives we want our students to achieve.

Learning model – Guided Construction

There is a strong body of evidence suggesting that learners use their current knowledge to construct new knowledge and that what they know and believe at the moment affects how they interpret new information. Sometimes learners' current knowledge supports new learning, sometimes it hampers learning. Effective instruction begins with what learners bring to the setting. The guided construction model of learning is widely accepted as the one that best fits our understanding of how learning occurs (Fensham, Gunstone and White 1994; Tynjala 1999; Bransford, Brown and Cocking 2000). In this model learners have an active role in constructing their own knowledge. It differs from the 'Discovery Learning Model' in that there is an important place for external guidance, from the instructor, from on-line resources or from collaboration with other learners. Referring to this model, Goodyear (2002) suggests that learning outcomes are more likely to be improved if we use a model that emphasizes that learning is active, cumulative, individual, self-regulated, and goal-oriented. These were used as a form of checklist in the development of the learning environment that was created for this course.

It is not possible to describe all aspects of the learning environment here. In what follows we describe some of the online activities that have been 'blended' with the more traditional methods, the reason(s) that we chose to use them and a brief description of the results of their evaluation.

Aspects of the learning environment and its evaluation

Online readings and guiding questions
Each week during the course online readings and a set of related questions was posted. These were to form the focus of one of the one hour 'lecture' presentation sessions for the week. This style of reading and the Q/A sessions were designed to replace the use of a textbook for the course. There were several reasons for changing to this approach. It was possible to choose readings from a variety of sources that were most relevant to the lecture material. It was also possible to choose contrasting readings that caused students to think more deeply about the topic and recognise that there is sometimes more than one explanation or point of view. The readings were accompanied by a set of guiding

questions that were designed to link material presented in lectures with the readings and often required students to extend their knowledge. As the study period progressed the questions required more analysis and synthesis of information than straight recall or transcription from the text. This pedagogy was used because it fulfilled many aspects of Goodyear's (2002) learning model and because it creates an environment that influences what the learner does (Biggs 1996).

The readings and questions were posted immediately after the Friday morning lecture. Students emailed their answers to a special course email address by the following Tuesday. The elaboration of the answers was the topic for the Wednesday lecture. This process was chosen for a number of reasons, the most pragmatic of which was that the time of the Wednesday lecture (5-6 pm) was inconvenient to some students and it was thought that they would quite reasonably not be able to attend. The submission of answers prior to the lecture enabled us to identify and correct general misunderstandings, elaborate on concepts that needed more explanation and the nature of the guided questions helped the students focus on the main concepts. The thinking behind this was that student learning would be focused by providing targeted readings to support the main concepts delivered in the previous lecture. The following lecture was used to answer the questions and elaborate on those aspects that had been identified as needing attention. In most cases no new material was introduced. As well as submitting the answers the students were encouraged to use the online discussion page to collaborate in the development of their answers. This occurred to a limited extent and was used more by those who were unable to attend than those who were able to attend the lecture.

One question in the SET evaluation instrument addressed this. It was 'The online readings and associated questions helped my learning.' There were no strongly disagree or disagree responses and 2 neutral, 39 agree and 29 strongly agree. This was further investigated during the focus group evaluations; the students were asked whether the online readings were useful and if so in what ways? They were also asked whether the readings helped with their learning or would they rather have had a text book, instead of, or as well as, the readings?

Responses to the use of the readings were very variable and marginally negative. Some students studied all of the readings in depth, but these were in the minority. Typical responses to the question about whether the readings were useful ranged from the observation that one student thought she could *'get away with not using the readings'* while another *'found out they were not compulsory hence didn't seem a priority'* and yet another agreed that he did *'not do the reading during semester, but read prior to exam'*.

Some students provided different slants on the value of the readings, questioning their content, size, importance and degree of difficulty. Other students did not read them because they were hard to read from a computer screen and not easily downloaded. The groups agreed however that they could be saved and then printed which would overcome these difficulties. A slightly more positive view was that using the readings did benefit learning, whilst

another indicated that she referred back to the readings quite a bit, and that if this had been assessed, students would prefer it to some other types and would probably do better in the final exam.

This approach of using online readings was generally favoured over a textbook. Some students said that they were not necessary, others commented that with a reader, they knew exactly what to read whereas the textbook contained information not required. The high cost of textbooks was also given as a reason for preferring this approach.

By comparison with other courses where the recommended texts and readings are often not available in the library or require photocopying of relevant pages, the ease of getting readings from the course home page was praised. Discussion suggested that all readings be put on the Web at the beginning of the course, allowing students to read them when they had time, rather that as wanted by the lecturer.

Overall these comments suggest that the use of the reader as a means to widen the knowledge base of the course was less successful than anticipated, but probably better than the setting of a textbook.

Questions associated with the readings
Accompanying the readings each week was a set of questions that were designed to focus the students' reading. The groups were asked about the value of these questions in relation to the readings and whether they found these helpful and if so in what ways? Most students in both the SET and the focus group evaluation found the questions related to the readings to be useful and helpful. Students had difficulty with a few of the questions, but appreciated the fact that these questions were revisited during the next lecture allowing full explanations and providing reinforcement of difficult areas leading to a better understanding of these concepts. *'If you did the study questions, this class provided immediate feedback to see if you are on the right track.'*, whereas they recognized that, *'If you didn't attend you did miss out on the finer details'*.

Students also mentioned that they used the questions for revision before the examination. The conclusion from the focus group was that some students did not attempt to answer the questions because they were not assessed although it was not clear what proportion of students this applied to. However it was clear that the readings and questions were low in some students' priorities. *'I looked at the questions and did think about them, but didn't actually complete them'*.

In answer to whether they found the lecture that concentrated on answering and discussing the questions helped their learning, or whether they would rather have had a more traditional lecture where more new knowledge could be presented two strong views were expressed. Some students saw the positive aspects of the Q/A sessions rather than having another lecture, in that they allowed reinforcement of material already presented, they were still able to get the information if they had not had a chance to do all the readings, and that they were just as informative as normal lectures. *'Wednesday lectures gave further*

explanations of the previous week's class and how to apply this information. Going over the material again, reinforced the learning…'.

The other strongly expressed view of this lecture was its unpopular 5.00 pm timeslot. All agreed that the timetable for this course was not ideal and that timetabling issues made it difficult for some students to attend the class with a six hour gap between classes. It proved difficult for students using public transport who did not live close to the campus. It was likely thus that these lectures were attended by only half of the class.

'The idea and style was good, but the timing bad.'
'The 6.05 bus was the last bus. If I missed it I couldn't get home so I chose not to go to Wednesday lectures'

Online discussion
The students were encouraged to post questions about anything that they were unclear about on the online course discussion page. There was no assessment for this component and the quantity or quality of contributions was not monitored or facilitated. It was thus in the form of an unstructured bulletin board and did not involve threaded discussions (Ferman and O'Brien, 2003) or oversight by a monitor although it was regularly visited by the instructor.

The groups were asked whether they used the discussion page, and if so in what ways? They were also asked if they found the page helpful and again, if so in what ways, and finally how it could have been made more helpful?

Responses varied and were about evenly balanced between those who found the discussion page to be excellent, to those who either did not use it or used it very infrequently. As the discussion page was set up largely for students to respond to each others' questions, some students commented favourably that the questions could be answered by other students or by the instructor and that if questions were raised when the instructor was away or not responding, they could expect at least to get help from other students, even with more technical issues. Others however were not sure about the authority of such answers. One student commented that sometimes if assignments were due and a student had a question, the responses were not quick enough to be useful before the due date.

Quite a number of students indicated that they acted as 'lurkers' on the discussion page and that they checked into it, but did not submit any specific questions. They were happy to read what others had written, but did not necessarily participate themselves. *'Students can look at this page and get valuable information even if they don't have a question.'*

Students indicated that there was a significant advantage in that all responses could be accessed, and that this was good as they often had the same problems as others: *'I often had similar questions to those already submitted, hence could find the answer without actually having submitted a question'.*

Finally and somewhat surprisingly, students appeared to like getting responses from their peers about seemingly

basic questions such as layout requirements for assignments. The anonymity of responses was also regarded as a plus in that (the page) *'Could be used for questions you did not want to ask in lectures'.*

AssignIT
AssignIT is a UniSAnet propriety package for the online submission of student assignments. To submit an assignment, students log on, upload their document and provide any additional information required. The marker is then alerted via email and can then collect the assignment, mark and return it via *AssignIT*. *AssignIT* automatically tracks the assignment, recording this information in the University's corporate information systems and alerts students when their assignment has been returned. A copy of the assignment is stored centrally for three semesters. With *AssignIT*, staff can choose whether to:
- collect assignments online download, print and return them with feedback manually;
- collect assignments online, return them manually and provide feedback electronically; or
- collect assignments online, return them online and provide feedback online (the option chosen by these authors). Comments can be added to assignments using the 'track changes' or the 'insert comment' facility of *MS Word*.

Staff can also choose to mark assignments on-screen or print them first. The students were obliged to submit and received all assignments online using *AssignIT*. In the focus groups students were asked whether they had any problems with this compulsory online submission. They were also asked to indicate if the method of giving feedback using *'comments'* and *'track changes'* was satisfactory and what they liked about this process or conversely would they have preferred to submit their assignments in a more traditional manner.

With regard to the first question about the compulsory submission of assignments online, there was overwhelming agreement that this was an excellent method of transferring assignments and they were not sure why other courses were not using this process. They commented that it was a very simple, practical and seamless process and particularly liked the security of the fact that the assignments were automatically dated and a receipt sent.

This overcame an unfortunately common perception that students could previously not be sure that handed-in assignments actually arrived with the lecturer *'I felt safe that the assignment was actually received'.* Like wise one student commented that *'marks can be returned in a private manner (not for every one to access as happens with a display of marks on a spreadsheet on a notice board)'.*

Another commonly put view was the flexibility of this process.

'Good for students who do not live close to campus – can submit and have assignment returned without needing to visit the campus…'

Minor technical deficiencies were mentioned however in that there was a need for some basic instructions in the file

saving and transfer process– *'didn't accept rich text format – I wasn't told that I needed to save document in Word'*. Another student didn't realise she could get her work back.

With regard to the feedback using *'insert comments'* and *'track changes,'* students appeared to prefer this to normal methods of handwritten comments on paper assignments. They were happy that the feedback was in red text, so they could track their progress; they could easily read those comments, whereas some staff hand-writing previously was too difficult to read. One student mentioned that he could use the 'comments for the lecturer' box to explain the situation if assignment was late.

'In some courses only grades are given back without feedback and therefore you did not know what and where you went wrong, whereas AssignIT provided useful feedback-You saw on your report exactly what you needed to correct'

No-one expressed a desire to return to the old paper-based method of handing in assignments

Conclusion

The paper has described the evaluation by focus groups of the online components that have been blended with the more traditional face-to-face delivery methods in an introductory undergraduate soil science course. In summary the evaluation showed that the students:

- were positive about the use of *PowerPoint* slides to illustrate lectures and used the slides posted on the course home page in a variety of ways that aided their learning;
- appreciated the use of the whiteboard explanations and other student-centred classroom activities as a supplement to the *PowerPoint* slides;
- saw the benefit of attending class, rather than relying only on the online materials;
- were positive about the availability online of the course outline and liked being able to submit assignments online;
- were much less positive about the online readings and the associated guiding questions; and
- saw the benefit of the accompanying lecture but needed more guidance about the purpose of this aspect and the way it was intended to be used to support learning.

The balance between online and face-to-face components will vary from course to course depending on their instructional goals, student characteristics, instructor background and access to appropriate online resources. Despite that each of these was carefully considered when designing this course, some of the responses of the students during the evaluation of the online components were surprising and did not result in overwhelming acceptance.

From this we conclude that an additional important step towards acceptance by the learner is a careful and sufficiently detailed explanation of the pedagogy that is guiding the delivery mode. This involves explaining the purpose/reason(s) for incorporating each aspect and at the same time helping the learners to understand how it relates to their own metacognitive style.

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