SUPPORTING COLLABORATIVE LEARNING IN SCIENCE WITH AN ONLINE TOOL

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ABSTRACT
This paper discusses a new approach trialled in a first year core science unit that aims to develop generic skills such as scientific writing, numeracy skills, computer literacy and communication skills. The trial involved integrating online assessable activities to the existing teaching and learning activities. The aim of the online activities was to help students to keep their pace throughout the semester and to facilitate students learning from each other. The online tool used was *InterLearn.* This is new web-based tool developed at Monash University to support collaborative learning. The tool was designed to simulate classroom interaction where students build knowledge together through discussion. It provides the facility to structure online activities, which students complete within their own workspace. Students can view each other's responses to the activities and can modify them as they learn from each other.

KEYWORDS
Online learning, collaborative learning, first year science teaching and learning

INTRODUCTION

In recent years there has been a visible change in the university students profile. Most notably, university studies are no longer the only and prominent focus of their lives, more and more students juggle their studies together with paid employment and other activities. This phenomenon has been reported in a recent Australian research (McInnis & James, 1995 and McInnis, James &Hartley, 2000) and some studies conducted in the US (Tinto, 1987).

Students have less time for their studies and are spending less time on campus to attend lectures and tutorials and to interact with their peers and teachers. This disengagement from university life usually has a detrimental effect on their performance and their satisfaction with the university experience. First year students are even more vulnerable as they have to face other challenges associated with the transition from the school environment, were their progress was monitored closely, to the university environment, where they are treated as responsible adults who take control of their own progress.

Online environments can play an important role in providing a framework to shape students' learning and in bringing students together even though they are in different locations. In this paper we describe the use of an online tool that facilitates a collaborative learning environment to assist students in keeping up with the pace and workload of a first year science core subject.

SCI1020: A CORE SUBJECT FOR THE DEVELOPMENT OF GENERIC SKILLS

SCI1020 *The design of science* is a first year core unit taken by all science students enrolled in the Bachelor of Science degree course, and who do not have the intention of majoring in mathematics (Varsavsky, 2001). Students are accepted to the degree with no prerequisites; in fact, the majority of them have not done mainstream mathematics at school. The aim of the unit is the development of

generic skills, with an emphasis on numeracy skills such as experimental design, collection and analysis of data, sample surveys, modelling of data and mathematical modelling. The teaching and learning activities revolve around project work carried out in weekly workshops, in which students conduct investigations following the scientific method and write a report including the methods they followed and their conclusions.

The skills-based nature of the unit requires from students a continuous engagement throughout the semester, unlike other science units which require a major effort put towards the preparation of the final exam. In addition, SCI1020 involves open-ended projects, where students have to decide how they will carry out their projects, rather than follow steps given by the instructor. This appears to be the most difficult hurdle to overcome for first year students, which combined with the students' growing isolation within the university system, leads to frustrating learning experiences.

Our major problem was to help students understand what was expected *of* them without doing the work *for* them, and to help students manage their workload and keep up with the deadlines. It was usually the case that the tutors had great difficulties in running a discussion necessary to start working on a new project, most students were always behind and could not prepare for the workshops. In this frustrating scenario, tutors usually ended up telling students what to do and how to do it, leaving little room for students to find out their own way and hence missing out on a valuable learning opportunity.

INTERLEARN: AN ONLINE TOOL TO SUPPORT COLLABORATIVE LEARNING

In order to address the problems of managing students' workload and helping them to get started on their open-ended projects, the teaching team applied for a grant to develop an online learning tool which would provide a framework for the SCI1020 teaching and learning activities and would facilitate collaboration between students. It turned out that academics from other Monash faculties applied for funding of projects with similar aims, so a university-wide collaborative effort was made to develop the online tool *InterLearn* to accommodate the needs of the different applicants (Varsavsky, McKenzie, Rome & Webster, 2002).

InterLearn is an online tool that aims at simulating the face-to-face tutorial environment, allowing for student interaction integrated with other teaching and learning activities. *InterLearn* is built on a database structure that allows students' individual text-based responses to online activities to be stored and viewed on demand. Students log on to an individualized worksite where they complete set activities mostly by entering responses into dialogue boxes. The activities can be shared, meaning that they are available for viewing by all course participants, or individual, meaning only the participant and the teaching team can access them. An important feature is that students' responses can be edited, to allow for the reviewing of their tasks after reading the submissions made by their fellow students, and so facilitate the collaborative construction of knowledge and understanding.

ONLINE ACTIVITIES

The SCI1020 worksite was structured around a week-by-week schedule of activities. Figure 1 shows part of the screen students see when logging in to the site. The site shows week-by-week what students have to do prior to the weekly workshop, and during the workshop. On the last column they find a list of online assessable activities and a green tick or a red cross indicating whether that activity has been completed or not.

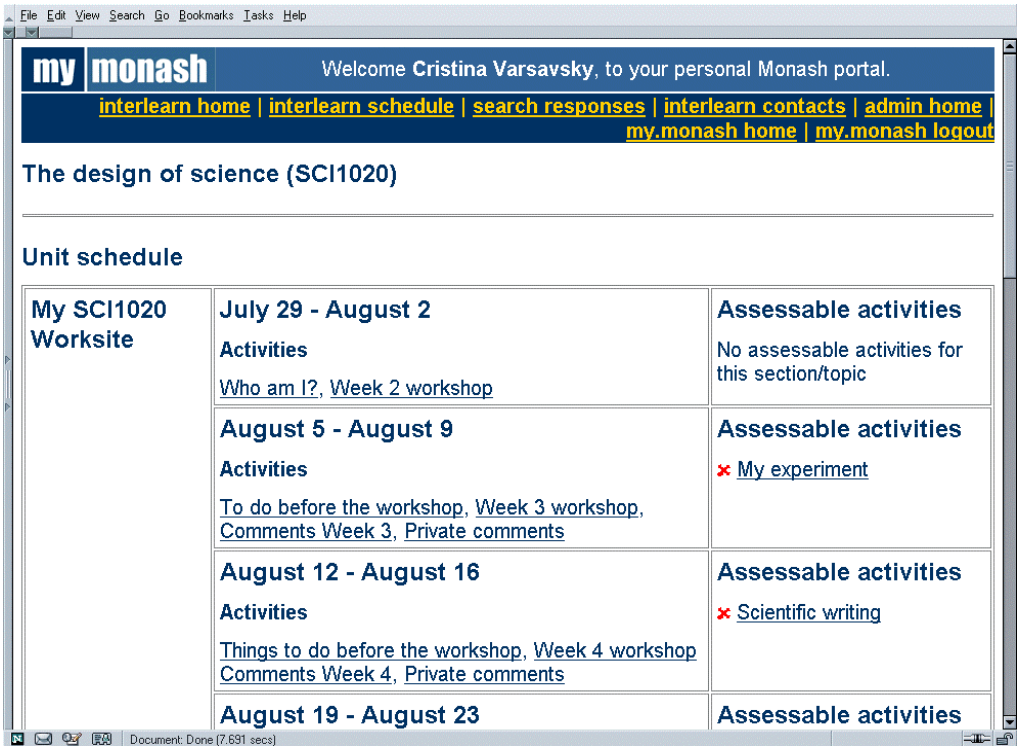


Figure 1. The SCI1020 worksite

Figure 2 illustrates the online activity *Scientific writing* (to be completed during the week August 12 – August 16, as indicated in Figure 1) which aims at introducing students to the structure, language and format used in a scientific report, and to provide models for their first report, due in the following week. Since this activity is labelled as shared, as soon as they enter their response, this will become available for viewing to the twenty or so students in their workshop group. At any time, students can view other students' responses by clicking on the link that shows under the input box.

Figure 3 shows some of the responses provided by students to the activity *Scientific writing* (student names have been removed). Students can edit their responses as many times as they wish within the timeframe set for this activity. This editing facility is a feature of *InterLearn* that distinguishes it from other online discussion or conferencing tools. It gives students the opportunity to learn from each other, and change their responses if they think of ways of improving it after reading the work of their peers. This is to simulate a face-to-face discussion, providing a framework for students to build an argument together. This online tool provides better opportunities for students to learn from each other because they now have access to everybody's responses, which is usually not the case in a traditional classroom setting. Even though students end up submitting individual responses, they are given the opportunity to make these collectively better.

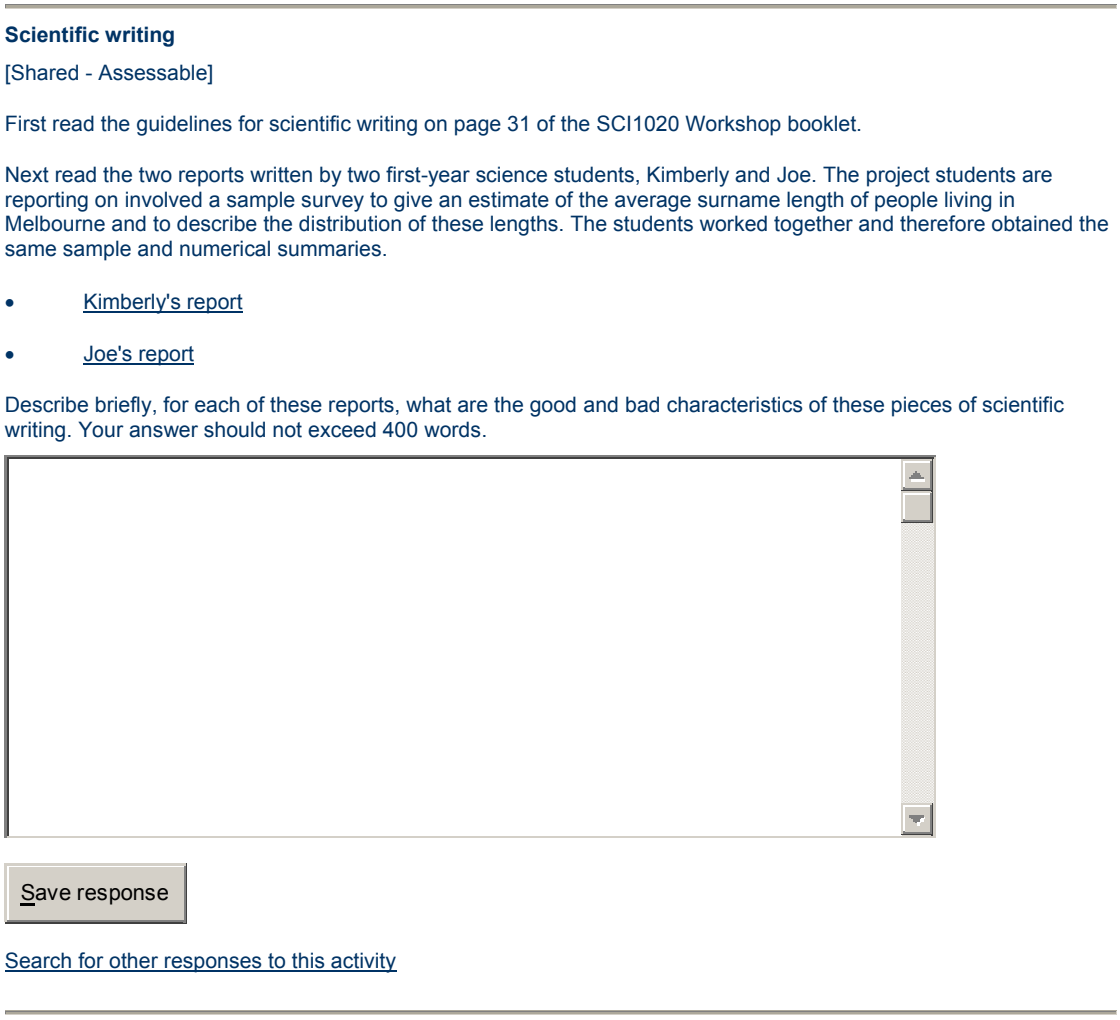
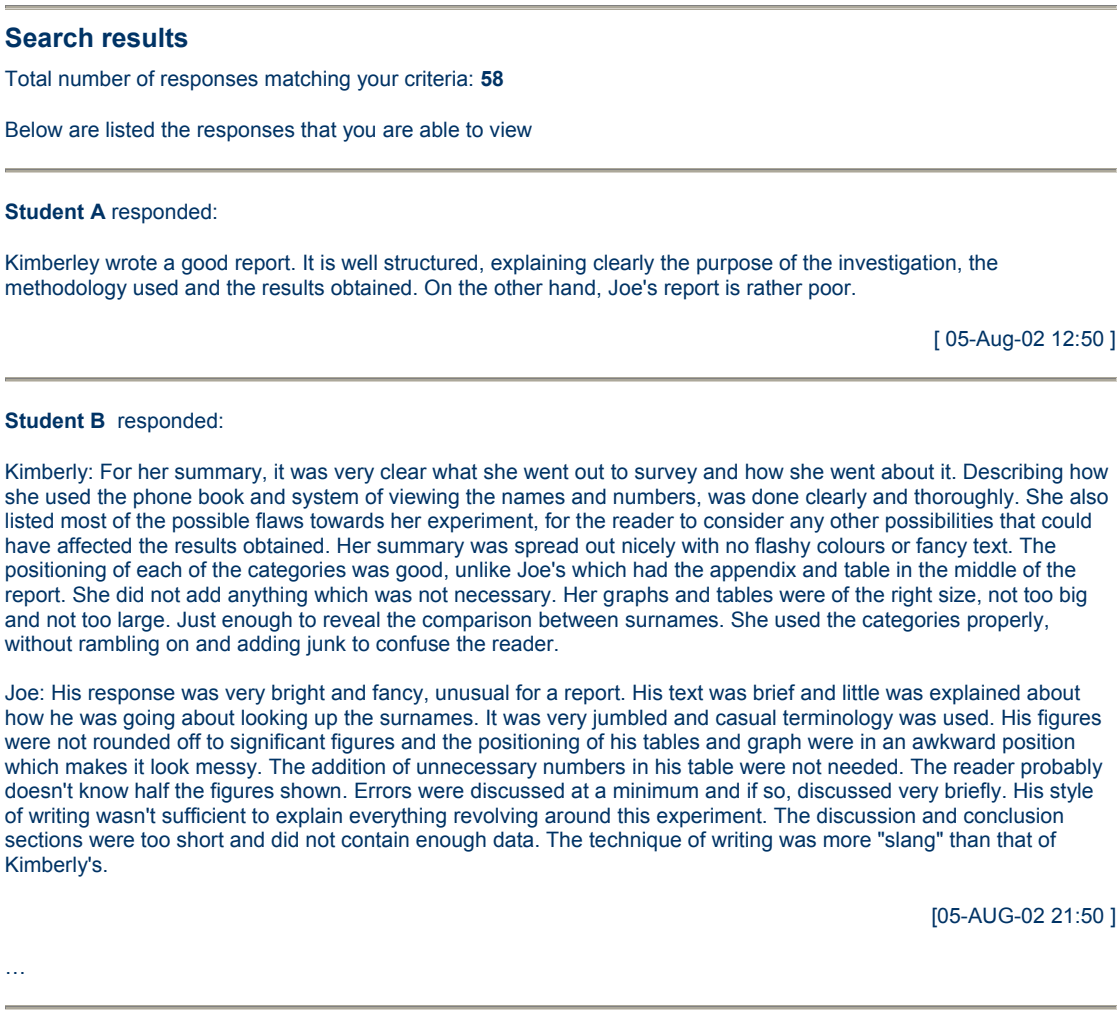


Figure 2. The InterLearn activity *Scientific writing*

All SCI1020 online tasks were short, focussed and fully integrated to the project work. Although each of them had their own objectives, the common aim was to help students to get ready for the workshop or the new project they had to work on. There was one such online activity for each of the four projects, which had to be completed before the start of the workshop where the relevant project would be discussed. Students were asked to read the project requirements and think about how they were going to carry it out. For example, in the project that involved answering, following a scientific method, the question "How many traffic lights are there in Melbourne?" using the street directory as a sampling frame, students had to think of a proper stratified sampling technique they would use to produce an estimate before the next workshop. Through this online activity, students came up with different sampling designs and grappled with ideas such as "what are the boundaries for Melbourne?", "what would be the sampling units? the street directory pages or subdivisions of these?", "what if a sampled unit contained only water?", and so on, without the help of their tutor. The tutor would read these responses and use them as a starting point to their discussion in class.

In other online activities students were required to post numerical summaries of data collected in workshops, and interpret their meaning. For example, in the project that asked for an estimate for the average surname length of people living in Melbourne, after designing the sample survey, collecting the data and calculating the numerical summaries, students were required to post the mean and standard deviation and explain their meaning in the context of their investigation. Students then used the summaries posted by their peers to interpret them in the light of the Central Limit Theorem. This simple

exercise proved to be very useful for students to understand the difference between the standard deviation and the standard error.



Search results

Total number of responses matching your criteria: **58**

Below are listed the responses that you are able to view

Student A responded:

Kimberley wrote a good report. It is well structured, explaining clearly the purpose of the investigation, the methodology used and the results obtained. On the other hand, Joe's report is rather poor.

[05-Aug-02 12:50]

Student B responded:

Kimberly: For her summary, it was very clear what she went out to survey and how she went about it. Describing how she used the phone book and system of viewing the names and numbers, was done clearly and thoroughly. She also listed most of the possible flaws towards her experiment, for the reader to consider any other possibilities that could have affected the results obtained. Her summary was spread out nicely with no flashy colours or fancy text. The positioning of each of the categories was good, unlike Joe's which had the appendix and table in the middle of the report. She did not add anything which was not necessary. Her graphs and tables were of the right size, not too big and not too large. Just enough to reveal the comparison between surnames. She used the categories properly, without rambling on and adding junk to confuse the reader.

Joe: His response was very bright and fancy, unusual for a report. His text was brief and little was explained about how he was going about looking up the surnames. It was very jumbled and casual terminology was used. His figures were not rounded off to significant figures and the positioning of his tables and graph were in an awkward position which makes it look messy. The addition of unnecessary numbers in his table were not needed. The reader probably doesn't know half the figures shown. Errors were discussed at a minimum and if so, discussed very briefly. His style of writing wasn't sufficient to explain everything revolving around this experiment. The discussion and conclusion sections were too short and did not contain enough data. The technique of writing was more "slang" than that of Kimberly's.

[05-AUG-02 21:50]

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Figure 3. Two responses to the activity *Scientific writing*

The SCI1020 worksite also facilitated a continuous evaluation of the unit. Each week, students had the option to provide feedback on their personal development, on the unit as a whole, or on a particular aspect of it. The feedback given could be individual, either anonymous or signed, or shared with other students. A reflective online activity was also included at the end of the semester where students had to elaborate on what they learned in the unit, the progress they made towards the development of the intended generic skills, and where would they apply these skills.

STUDENTS AND TUTORS FEEDBACK

This new approach was first introduced in Semester 2, 2001. The implementation involved evaluation processes including the observation of the development of students' online responses, student online feedback (signed and anonymous), fortnightly interviews to the members of the teaching team, and a student focus group interview at the end of the semester.

Overall, the results of the trial were very positive and encouraging. The trial was conducted by tutors who already had the experience of running workshops for this unit for at least one semester, so they could compare the student engagement with the unit to their previous experience. Reports from tutors indicate that students kept a more consistent working pattern throughout the semester and that students'

understanding of what they were required to do improved. The rate of successful completion of project work also improved significantly. Some workshop groups were however, more successful than others in remaining engaged with the unit and in their performance; it was established that this was due primarily to the tutors failure in conveying to the students the role of online activities in the process of construction of knowledge, and could be prevented in the future with appropriate training.

The monitoring of the evolution of students' responses and the interviews with students also indicated that many students were using the sharable and editing facilities of the online tool: very often they modified their responses after reading the responses of their peers. This was particularly noticeable in the first half of the semester; "feeling confident about what was required to carry out the project" and "too many assignments for other subjects" were the main reasons given for it.

An interesting observation was that shy students, who would normally not participate in class discussion, were very active in the online environment; often they were the brave ones to publish first the response to an activity for their peers to see.

Through the online feedback, which was unsolicited and had an open format, the most frequent comment students made about the online tasks was that they helped them to keep the consistent pace required by the unit throughout the semester.

CONCLUSION

The traditional lecture-tutorial format seems to be no longer appropriate for teaching and learning at universities; it is too rigid to accommodate the changing life and learning styles of the students who are demanding flexible structures for their learning, and more personal attention when they need it. Online environments can be used effectively to address these changing students' needs. The approach used in SCI1020 to provide an online environment that helps students keep their pace and support collaborative learning, proved to be successful in addressing the current concern of student disengagement from university. It also proved that such online environments need not be sophisticated to be effective.

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