

Research article

## Assessed Online Discussion Groups in Biology Education

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### Abstract

*Sophisticated software such as Virtual Learning Environments (VLEs) are rapidly being deployed by universities. Despite widespread use of such systems, experience shows that there is frequently poor pedagogic development, leading primarily to use of VLEs as electronic document repositories rather than as online learning systems in which the available suite of tools are used to their full potential. Online assessment is the major potential efficiency gain of such systems, but most staff do not scratch the surface of the full capabilities of the software. Based on our experience, we describe practical guidelines for a model of online assessment which promotes deep versus superficial learning, encourages higher level learning competencies and inclusivity.*

**Keywords:** assessment, discussion, virtual learning environments

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### Introduction

Virtual Learning Environments (VLEs) are now in widespread use in British universities (Browne and Jenkins, 2003; Ward *et al*, 2001). Evidence such as a recent audit of VLE use in the School of Biological Sciences at the University of Leicester (Badge *et al*, 2005) reveals that the majority of academic staff may use a VLE as an alternative or a supplement to printed handout materials. The overwhelming majority of staff fail to make use of the potential pedagogical advantages offered by the full functionality of VLE software. This pattern of usage is commonly seen at many universities.

These results indicate that when academic staff begin to use a VLE, they often do not consider how it can be used to improve the educational value of their teaching. Instead, it is seen as a quick way to deliver learning materials that would otherwise have been delivered by alternative means, e.g. printed handouts. In particular, time constraints and the naïve expectations that learning technology is either a bottomless pit or a quick technological fix for pedagogical problems, result in the use of sophisticated C&IT systems as mere filing systems - the lowest educational denominator.

Recent evidence has shown that simply putting notes on the web does not improve student learning (Evans *et al*, 2004). The same work also showed that material which is presented with sound pedagogical underpinning and which is easily navigable appears to enhance student learning. Many people have attempted to use C&IT to engage students in online academic

discussions to facilitate subject knowledge and reflection, either by email listservers or bulletin boards (e.g. see Cameron, 2002). These efforts were unsuccessful, and there is little published evidence concerning the outcomes of these approaches in bioscience teaching.

In discussions with colleagues, it became clear that many had tried to use C&IT to facilitate student attributes such as reflection (Kolb, 1984), and to assess skills beyond the basic “knowledge” competence in Bloom’s taxonomy of educational objectives (Bloom, 1956). As with our own previous experiences, most of these attempts had been unsuccessful for a variety of reasons. The predominant cause of failure was perceived to be the unwillingness of highly goal-directed bioscience students to engage with what was seen as a frivolous activity not directly related to assessment.

In January 2005, an initial study of a model for online assessment designed to overcome these limitations was tested on a group of 34 final year bioscience students at the University of Leicester. The software used was the Blackboard VLE. Students were subdivided into three random groups of 11 or 12, since prior discussions with colleagues indicated that 8–15 members appears to be the optimum size to facilitate online discussions. Smaller groups than this do not have the critical mass to sustain discussions and larger groups are difficult to administer and allow relative anonymity. Contributions to the discussion boards were explicitly linked to assessment, in this case contributing to 15% of the total module marks. Students were told that:

*Each week there will be a discussion board about the topics presented in lectures that week. Each discussion board will be open for contributions for two weeks, then close. To earn the marks, you are expected to make at least two contributions to each discussion board, i.e. two contributions per week. Of course, you can contribute as much as you want to each board, but you need to make a minimum of two contributions to earn the marks each week. An acceptable contribution is:*

- *Any original comment or discussion on the topics covered in the relevant lectures.*
- *A simple question in itself will not be regarded as an acceptable contribution, but a complete (and correct) answer to someone else's question is an acceptable contribution.*
- *Feel free to cite a relevant publication from WoK [Web of Knowledge] or PubMed, a book from the Library or a web page, but a citation or a url alone will not be regarded as an acceptable contribution unless you also describe in sufficient detail the content of the work and why it is relevant to this discussion.*
- *Any other original, non-plagiarised contribution relevant to the topics under discussion.*

Prior to the commencement of any discussions, the entire class engaged in an online E-tivity, an icebreaker to promote group cohesion, in this case, construction of a homepage on the VLE to introduce themselves to other module participants (Salmon, 2002). To accommodate the new form of assessment, the previous extended module essay was dropped in favour of

the assessed discussion boards and three one hour essays written under exam conditions and submitted electronically via the VLE.

This pilot study was highly successful as judged both by academic outcome and student feedback. The range of marks obtained was between 100% and 38% of those assigned for these exercises (mean=91%). It is clear from the following evidence that the online discussions engaged the students' attention. Of 87,000 hits on the module site over the 10 week teaching period (an average of 256 per student per week), 66% (57,000 hits) were on the discussion boards. In contrast, the online lecture notes, previously the most popular section of the module site, received only 15% of the total hits. 82% of hits occurred between the hours of 9 am and 6 pm and 88% of hits occurred from Monday to Friday, but a minority of these campus-based students consistently accessed the module site late at night and at the weekend. There was an average of 22 hits for each contribution on the discussion boards, clear evidence that students read what others wrote. Qualitative feedback from the module questionnaire include comments such as:

*"Discussion boards made you do outside reading which is helpful for the exam."*

*"Discussion boards were useful and I definitely preferred them to writing an essay. It also makes us learn more as opposed to writing an essay on one subject."*

*"Discussion boards were also good as you get the benefit of others knowledge too, and they help to clarify any points you are confused on."*

*"Discussion boards were much better than essays or presentations, and they encouraged further reading."*

*"The discussion boards were interesting to read as well as do research for - it helped improve my research skills and it also gave me an insight into how other people understood the course material."*

62% (n=21) of students on the module were female, and they accounted for 69% of the total number of hits and 68% of the contributions on the discussion boards. However, this difference in behaviour between genders is not statistically significant. There was some evidence of fatigue and loss of interest during eight weekly online assessments, the number of hits per week declining from 3700 to 1500 between weeks one and seven, the "low point" of the online discussions. In contrast, the number of contributions remained relatively constant from week to week, which could be interpreted either as cynicism or as increased efficiency on the part of the students. This observation also raised the possibility that a change in the online E-tivity midway through the module might inject new enthusiasm. Encouraged by these results, further studies were conducted to test the practicality of this model of online assessment, and in particular to address the following questions:

1. Is the model of online assessment described optimal, or can it be improved?
2. Is this model of online assessment applicable to other year groups?
3. Is this model of online assessment applicable to other VLE software and student cohorts?

### **Variations in the Model: (a) Leicester Trial 2**

In January 2006, a revised model of online assessment was tested on a group of 23 final year bioscience students at the University of Leicester. The revised scheme differed from the previous year in the following ways. After four overlapping weekly discussion boards, as per the previous year, assessments five to eight now consisted of a collaborative writing exercise requiring a specified minimum contribution to Wikipedia ([en.wikipedia.org](http://en.wikipedia.org)), an online encyclopaedia. The intention of this was to motivate students later in the module by providing them with an opportunity to display and test their knowledge in a public forum. Students were told that:

*An acceptable contribution to Wikipedia is:*

*A total of at least 100 words on any topic covered on this module with appropriate references which survives substantially unaltered (i.e. not including minor edits and vandalism) for at least one week after the original posting date. You can use the Blackboard discussion boards to discuss your contributions with others on the module, but everyone needs to make one unique Wikipedia contribution per week to qualify for the marks available for this exercise. You can make more than one contribution per week if you wish, but you won't get any more marks. When you have made your contribution, post the URL (address) of the Wikipedia page you have edited/created on the relevant discussion board for the week. I will use this information to mark your contribution once the period for contributions has closed, so if you don't post the link, you won't get any marks.*

This second cohort of students accessed the module site slightly less frequently than the previous year, but the discussion boards still accounted for 84% of the total hits on the site, and the range of marks obtained was between 100 and 50% of those assigned for these exercises (mean=78%). Although the weekly discussion boards were continued in order to support the wiki contributions, these later discussions themselves were not directly assessed. It is notable that the discussion boards in the second half of the module attracted only 20% of the hits and 27% of the posts which the assessed discussions attracted during the first half of the module. This observation is stark evidence of the significance of an explicit link to assessment in persuading students to engage in online discussions. The marks obtained for the wiki contributions ranged from 100% to 13% (mean=84%).

Qualitative feedback obtained via the module questionnaire, revealed that students' reactions to the discussion boards were similarly enthusiastic to the previous year (see above). Contributing to the wiki, however, was less popular, attracting comments such as:

*"I believe that the group discussions were helpful because we were supposed to answer different questions from other students and search to the internet for more information in order to complete our Wikipedia web pages."*

*"Wikipedia exercise - I didn't think there was much point in doing this. It didn't require a lot of thought and didn't really stimulate me to read anything more than what was covered in a previous exercise. The discussion boards were far better in generating my interest in outside reading. I didn't enjoy the wikipedia exercises."*

*“The Wikipedia assessment should be scrapped because the discussion board topics were more relevant to the lectures, and wikipedia articles could be about any topic.”*

### **Variations in the Model: (b) University of Newcastle**

At Newcastle, discussion boards were introduced into the second year of the degree in Biomedical Sciences, in a strand on the Immune System and Human Disease. Forty-six second year biomedical sciences students were divided up into three discussion groups on Blackboard and each student was asked to make a minimum of two contributions on each of three topics: Immunisation & Immunodeficiency; Hypersensitivity & Allergy; and Autoimmunity. All topics were ‘primed’ with questions from the lecturer, e.g.

- Can you find evidence in the literature that allergy might be on the increase?
- What evidence can you find in support of the 'hygiene hypothesis'?
- Can you find any articles in the literature relating to novel, immune-based approaches to therapy of autoimmune disease?
- I mentioned in the lecture on immunisation novel approaches that are being taken to develop more effective vaccines. What examples can you find in the literature?

The deadline for contributions was set for the end of the course. 5% of the total marks for this 30 credit module were allocated for the discussion contributions, and to obtain full marks students needed to make six valid contributions as specified. Of the 46 students in the study, three made no submission to the discussion board. Twenty six students (57%) achieved a mark of 100% for six valid contributions. The remaining students lost marks either due to making fewer than six submissions or making submissions that were viewed as less than satisfactory (e.g. some students simply copied from abstracts/papers, and were awarded partial marks for this).

The timing of submissions was bunched towards the end of the module when the deadline was set, which probably reduced the potential for discussion between students. The module questionnaire asked students whether they agreed with the statement "The discussion boards were useful" on a scale of 1-6, where 1 was disagree and 6 was agree. Disappointingly, only 44% of the students awarded a score of 4 or greater. Additionally, three of the students made reference to the discussion boards in the free comments, as follows:

*“Discussion boards were a good idea, it made you learn how to research things.”*

*“For the amount of effort and time the discussion boards took up, more than 5% of the in course assessment marks should have been allocated.”*

*“I feel that the discussion boards were of little value. I didn't get anything out of them and another form of assessment would be better.”*

Thus, the discussion board exercise did not appear to be well-received by these students. Several factors may have contributed to this. For this group of students the timetable was heavily loaded towards the second half of the semester when the discussion boards were scheduled. Next year this component will be taught at an earlier stage when the students are less

heavily committed, which may help. From the very limited number of comments about the discussion boards it appears that views may have been split. This will be explored further at a staff-student committee early next year. Academic staff were pleased with the way the discussion boards encouraged students to undertake additional reading and research beyond the lectures and would like to persevere with them on that basis. The discussion groups were used to replace a timed essay in the module. The time taken to mark the essays was about 10 hours, and around the same amount of staff time was spent on the discussion groups, although this was spread out and easier to timetable than one large block.

### ***Variations in the Model: (c) University of Warwick***

Assessed online discussions were trialled at Warwick in a large third year student cohort taking a course in animal developmental biology. The Development course is an unusually large module in terms of student numbers for the Biological/Biochemistry courses within the Biological Sciences at the University of Warwick. The course consists of 30 lectures, two tutorials, two assessed essays and a week long practical. It is assessed 40% by course work and 60% by examination and is core for the Biochemistry module and for those taking Biological Sciences with either Molecular Genetics or Cell Biology. Students traditionally consider this a tough course, particularly because of the assessed essays, each requiring the reading and interpreting of around 30 cutting-edge scientific papers. Additionally, the course runs October to December, somewhat distant from the examination period. Nevertheless, the numbers taking the course have grown from around 40 to 70. Staff concerns include that possibility that high student numbers could affect marks for assessed essays and examinations.

To this end, the introduction of the student led/staff moderated discussions were hoped to at least maintain levels of achievement. The 70 students were randomly organised into five discussion groups. They were given permissions to view all other groups, but to contribute only to their own discussion. The discussion groups were only assigned 3% of the total assessed marks for the course.

The discussion groups were set up using Warwick Forums. This is a centrally-supported system to deliver discussion tools on the web from Warwick e-lab. Many systems have been used at Warwick (webBBS, WebBoard and Ultimate Bulletin Board), and tools such as those produced by the Technology Enhanced Learning for Research-led Institutions project ([www.warwick.ac.uk/ETS/TELRI](http://www.warwick.ac.uk/ETS/TELRI)) have been prototyped. Continual problems integrating them with other central services led to the development of Warwick Forums (details can be found at [forums.warwick.ac.uk](http://forums.warwick.ac.uk)). Initial information on group structure was accessed from the Departmental Teaching Intranet. Each group was given a total of four discussions over a period of two months. The topics were: Stem Cells or Teratology; Genetic Model Organisms in Developmental Biology; Evolution and Development; and The Basics. The discussions were initiated by staff, who also provided starter references.

The requirements, in terms of the information to be posted and the number of contributions, were specified at the beginning of each thread. General feedback was posted by staff after the closure of each discussion. Students were also allowed to ask for specific personal feedback. After the completion of the course a questionnaire was circulated, and the responses were posted on the Departmental Teaching intranet. The discussion threads remained available and advice was also posted on using them for revision purposes.

Nearly all students completed the discussion tasks, despite the low credit value assigned to them (3%). It became obvious very quickly that early responders to the threads were writing too much detail, covering many of the discussion points but not covering basic information. At several points staff would moderate the discussions by asking for clarification of basic issues. Additionally, it was stipulated that each statement had to be ended with a question, and this appeared to greatly facilitate the flow of discussions. An example of this general feedback is shown:

*Group 2 Discussion 3: In comparison to others your group is faltering a little, 7 members have gained full marks, 2 members 66% of marks, 1 member 33% of marks but 5 members have gained no marks. Can I suggest that you try to shorten your answers a little. This breaks up the volume in one post, requires you to give less time for researching and allows others to add points rather than feel that its all been covered. Good luck with the next one.*

Group dynamics were interesting to analyse. Of the five groups, one group performed perfectly, all members obtaining full marks. Analysis shows that two further groups had a lower number of maximum marks and an increased number of fails. It seems likely that a number of students considered that the credit level (3%) was inadequate to justify a lot of effort. In addition, the outcomes of the discussion groups was judged by questionnaire analysis. Of the 70 students on the course, feedback was received from 37 (53%, see Table 1). Clearly the discussion groups were not popular with the responders, as can be seen in the following table.

**Table 1** Student questionnaire responses to "favourite" and "least liked" course components

Component	Favourite	Least Liked
Laboratory	23	1
Lectures	9	0
Tutorials	5	9
Discussion Groups	0	26

In contrast however, the students agreed that it made them aware of the examination "General Section" and did increase their awareness of the subject area. In response to the statement "The discussion groups have increased my awareness of developmental biology", students responded as follows: Strongly Agree (0%); Agree (62%); Neutral (34%); Disagree (0%); Strongly Disagree (4%).

An important criterion for our analysis was to know how long the students spent finding discussion information. The results were somewhat surprising;

with several students claiming they spent more than three hours investigation for a single posting. The students estimated their time commitment per post as: less than 10 minutes (1 student); 10-30 minutes (6); 31-60 minutes (18); and more than 60 minutes (9). This may indicate a need to educate students in the methodology of finding information, in prioritising and in reporting the information they find.

It is interesting to consider several reasons why the group achieving maximum marks outperformed their peers. They were the smallest group ( $n=8$ ), they were the most mature (Year 4 students, returning after a year in industry), and they were already known to each other. In the student responses made by the wider cohort, criticism of peers was the most frequent comment. Students criticised their colleagues for posting overly long responses and for the technical nature of the content. A simple solution would clearly have been for an aggrieved student to post a question asking for clarification of the content, but some seemed reticent to do this. Therefore, a useful addition to the exercise may also be to mark student's responses to questions raised from points posted. The possibility of plagiarism was also an issue.

Overall the initial cohort of Warwick students disliked the discussion groups. This did not, however, detract from a relatively large class performing as well as previous cohorts. The approach appears to have raised the students' awareness of the course structure and the breadth of the research area covered. We will definitely be running these online discussion groups again in future years. Credit will be raised to 10% of the course (having been initially restricted to 3% by the course convenor). Staff time in total was around 30 hours; the alternative of marking 70 final year assessed essays would easily take double this time.

## **Discussion**

The concept of online discussion groups is not novel. For example, Hartford (2005) used online discussion groups to facilitate group work and group assessment. This paper combines the issue of assessing online discussions with the problems associated with group assessment. Other authors have proposed complex marking schemes for online discussions, e.g. Kay (2006). Based on our prior experience with online discussions, we deliberately chose a simple, criterion completion-based marking scheme for these trials. This has proved to be robust and simple to administer, not requiring large inputs of staff time to generate continuous assessment marks, which can be fed back to students quickly via the VLE.

Unlike simple learning outcomes, higher level learning competencies are difficult to measure by quantitative metrics. We have not attempted to analyse the impact of online discussion boards on overall learning outcomes as these are highly multi-factorial and usually depend more on examination performance than on in-course assessments. Certainly there is no evidence in our investigations that assessed discussion groups are harmful to overall learning outcomes, and staff perceptions are that online discussions are very helpful. Qualitative feedback from module questionnaires shows that the assessed online discussions were not universally popular with students. This

disparity in responses may depend both on student expectations and on how the groups are integrated into the overall structure of academic courses. In contrast, academic staff generally find online discussions to be a valuable tool in motivating students to read and reflect on information presented in other formats.

***Are the models of online assessment described here optimal, or can they be improved?***

Further planned studies will be conducted to provide a final answer to this question. Aspects of implementation such as an initial E-tivity and staff moderation skills are important in achieving student acceptability, although academic staff clearly feel the online discussions are valuable. The evidence presented here suggests that the model described (and the recommendations below) provide a useful strategy for implementing this form of assessment.

***Are these models of online assessment applicable to all year groups?***

Successful use of assessed online discussions with second years at Newcastle shows that the approach is not only suitable for final year students. However, we have not yet had the opportunity to test the model on first year undergraduates.

***Are these models of online assessment applicable to other VLE software?***

A range of VLE software packages have already been used in the deployment of online assessments across the three institutions.

Based on our two year trials of assessed online discussion groups involving several student cohorts, we propose the following recommendations for successful deployment of this valuable tool (see Box 1).

Advantages of such discussion boards include encouraging contributions from all the students in a group, many of whom might be reluctant to contribute to oral discussions in a seminar or other formats. This could be particularly beneficial for students working in a second language or who otherwise lack confidence. Our studies have led us to believe that assessed online discussion groups of the type we describe here can have a positive yet challenging role for students and academic staff alike in promoting deep versus superficial learning and encouraging higher level learning competencies.

**Box 1** *The use of online discussion groups – recommendations*

**Recommendations for the Use of Online Discussion Groups in  
Biology Education**

1. It is important to integrate this form of assessment into the overall module/course structure so that it does not appear to students to be a last minute afterthought. This can be done by face to face explanation of what is required and reference back to the content of the discussions throughout the course, e.g. at relevant points in lectures.
2. An initial icebreaker "E-tivity" such as the creation of module homepages by the students is helpful to promote group cohesiveness and awareness and improves motivation and the quality of subsequent academic discussions.
3. Perhaps the most important factor is to assign a reasonable proportion of marks for the student input expected (research and reading takes time). The proportion of marks assigned to these exercise should be made clear to students at the outset of the course. In our experience, 10-15% of module mark works well as a motivating factor for students.
4. It is necessary to balance the students assessment load with their other commitments, and to drop older forms of assessment if necessary rather than simply adding one more thing students have to do to complete a module.
5. Group size and dynamics have an impact on academic outcomes of online discussions. Eight to fifteen appears to be the optimum size for successful sustained online discussions. Random assignment of students to discussion groups may help to mix up pre-existing in-groups and promote better discussions.
6. Online discussions should utilise the more sophisticated interactivity and communications features of available software to promote student engagement. Use the VLE to its full capacity and beyond a mere document store. Feedback and marks for completed discussions should be given to students rapidly, and via the VLE wherever possible. For example, week by week progression should be reported rather than retaining traditional end of module deadlines.
7. Staff e-moderating skills are important for optimum online discussions and may require some training, either from more experienced colleagues or from institutional Staff Development resources.
8. Like many other types of work, online discussions are subject to the problem of plagiarism and staff need to be aware of this issue where discussion boards are contributing to assessment. Possible solutions to this include staff awareness and moderation, backed up by electronic solutions such as TurnitinUK ([www.submit.ac.uk](http://www.submit.ac.uk)).

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