The potential of in-class online quizzes to promote attendance and engagement by first year undergraduate students.

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Abstract

Recent trends in mobile computing (e.g. rapidly decreasing costs of wireless laptop computers), and improvements in college technology infrastructures (wireless networks) suggest that it only a matter of time before all students will have access to online computing devices during lecture sessions.

This paper outlines the results of an action research project aimed at assessing the merits of conducting *interactive online quizzes during theory based lecture sessions*, as a means of encouraging greater student attendance and engagement, and providing formative feedback on student progress. The project was undertaken in the course of completion by the author of a Post-Graduate Diploma in Higher Education in N.U.I., Maynooth in early 2008.

The research involved conducting a number of theory lectures in a computer lab environment to facilitate the completion by students of online multiple choice quizzes *during, or just after*, the lecture on the material just presented. Appropriate multiple choice questions, with relevant feedback, were created to match each theory topic to be presented.

The paper will present the findings of the research in relation to the impact on student engagement, attendance and results, both as perceived by the students themselves, and as concluded by the author.

Keywords

1. Introduction and Motivation

While lecturing in Information Systems and Technology to undergraduate Marketing students, at the Institute of Technology, Tallaght, Dublin (ITT Dublin), between 2003 and 2006, the author observed a poor level of attendance by students at theory lectures, compared to a relatively higher level of attendance at practical lab classes. Poor end of semester examination performance confirmed the tendency of undergraduate students to postpone engagement with the theory material until just before exams, effectively depending on "cramming" to attempt to pass the module.

An e-Learning Summer School at Dublin Institute of Technology (D.I.T.), in 2006, included the demonstration of an online multiple choice quiz (MCQ) tool that provided automated scoring of questions on a topic presented. For the author, this was a "Eureka moment" – presenting the possibility that MCQs, with assessment marks attached, could be a way to get first year students more engaged in the theory component of his modules.

The introduction of the Moodle virtual learning environment (VLE), in ITT Dublin in 2006/2007, presented the author the opportunity, through a college supported pilot project, to develop MCQs on a trial basis for incorporation into teaching sessions, and to assess the results in term of attendance and subsequent examination results.

During this initial exercise, a quiz was conducted each week in the computer lab class, based on the material covered in the previous theory lecture. While the students did appear to benefit from the quizzes (based on their feedback, and results), the impact on attendance was not convincing, with students admitting on survey that they felt they could score well by guessing.

In Semester 1 of the following year (2007/2008), only students who attended the theory session were permitted to attempt the theory quiz in the next lab class. Overall, this did create a good attendance routine for the theory classes, but in the subsequent exams there was little evidence of actual improved learning.

It had occurred to the author after the initial project that the ideally one would like to incorporate the quizzes into the actual class, so that the class could discuss a topic and the students could then attempt the quiz to test their own knowledge, and receive feedback on it immediately, while the topic was still in their minds. This was the primary motivating drive for the initiation of this research, which it was anticipated could cast some light on the potential benefit of students having access to computers, e.g. laptops, during lecture sessions, over and above simple recording of notes.

2. Literature Review

Reece and Walker, in Teaching, training and learning (Reece and Walker, 2006, p. 335) outline a number of advantages of multiple-choice questions as a means of assessment, including:

- " Good coverage of the syllabus,
- Tests at variety of levels, e.g. knowledge, understanding and higher,
- Questions can be used many times over the years,
- Easy to mark …………
- Cheap to mark ………..
- High reliability
- Short time to answer and mark – hence feedback can be given at the end of a lesson."

The feedback point is particularly relevant in the fully automated online environment, where automatic individual feedback can be provided immediately as each question is answered, as well as class level feedback at the end of the lesson.

They do also note some disadvantages:

- " Time-consuming to write,
- May lead to trivial questions based on recall,
- Students may guess."

Biggs, in Teaching for Quality Learning at University (Biggs, 1999) draws together a number of lessons particularly relevant to this action research.

He suggests (1999, p. 3) that there are three factors at play in achieving student learning – "the students' levels of engagement, the degree of learning-related activity that a teaching method is likely to stimulate, and the academic orientation of the students." i.e. academically strong students perform well even with low levels of activity, while academically weaker students engage very little until the level of

activity increases, at which point they begin to engage at close to the level of the strong student. He suggests (p. 100) that inn the context of lectures "the attention of students span under these conditions can be contained for 10 to 15 minutes and then drops off rapidly" and he proposes that "A short rest period, or simply a *change* in activity, after about 15 minutes, leads to a restoration of performance almost to the original level". He notes that the '20 minutes' could be "10, 30 or even longer", depending on "the students, the skill of the lecturer, the pace of the lecture, the difficulty of the material, the use of educational technology (which involves a change of activity), the time of the day and so on."

Biggs (1999, p. 100) further identifies the benefit of end of lecture review, by students themselves, as a means of improving the degree of retention of material covered during a lecture, and presents a convincing illustration (from Bligh, 1971), showing significant increases in retention duration where student review has occurred. He makes the point that the students must be actively involved themselves in reviewing what they have been exposed to (not just a lecturer review). This point lends some weight to the merit of the end of session quiz, which can act as a self review tool.

3. The Research Activities

The action research involved theory lectures conducted in a computer laboratory environment, over two distinct cycles – one where a single MCQ was conducted at the end of the session (for four weeks), followed by a variation (two weeks) where one MCQ was held at an interim point during the session, and one was held at the end.

3.1. Cycle 1 - End of Session Quiz

The first cycle was conducted over four weeks in March/April, 2007.

The MCQs were set up to run in "adaptive mode" in Moodle - to encourage students to evaluate the feedback from incorrect answers - students were allowed two attempts at each question, the second attempt being worth a half mark. This approach necessitated (a) *avoiding giving the answer in the feedback*, which had previously been done with one-attempt questions, and (b) having *more than three options per question*, to avoid the second attempt becoming a fifty/fifty guess.

In Moodle's adaptive mode, the student has the option of submitting each question one at a time, getting immediate feedback, and making the second attempt before moving to the next question.

3.1. Cycle 2 – Mid-Point Quiz and End of Session Quiz

The second cycle was conducted for two weeks in April, 2007.

This approach necessitated breaking the lecture session down into a minimum of two clear sub-topics, so that an intermediate quiz could be held a suitable point in the class.

4. Findings, Results and Analysis

4.1. Attendance:

Attendance during the research period averaged about 52%, just marginally up on the previous semester average of 50% for theory sessions. It appears that the in-class quizzes did not have any significant impact on attendance by this group, *over and above the 'next class quizzes' already in use*.
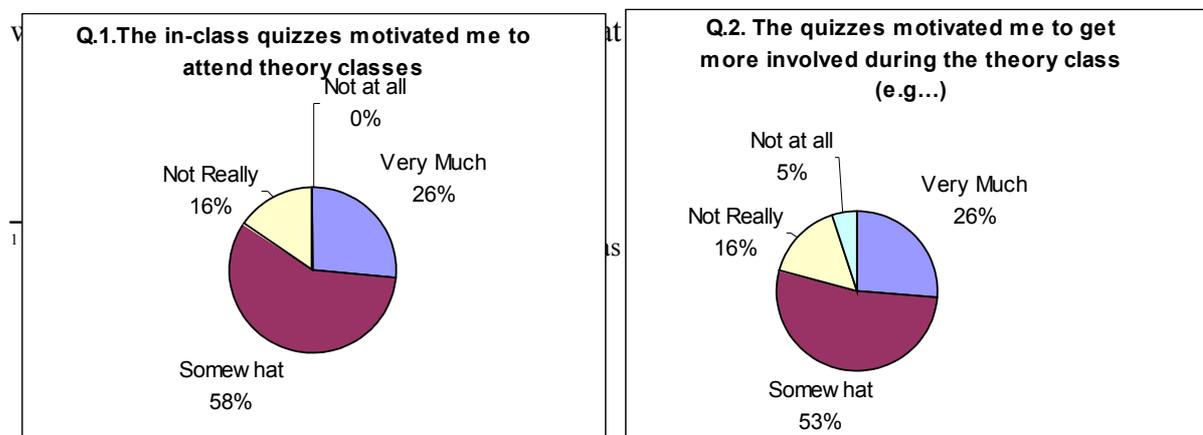
4.2. Examination Results

The class recorded a significant improvement (15.3% higher on average) in their theory examination results between semester one (post-class MCQs) and semester two (in-class MCQ for most of semester). While it is difficult to attribute the improvement purely to the change in approach to the quizzes, it is nevertheless a positive indicator, when considered in conjunction with the other feedback.

The average marks scored by students in the actual quizzes, also increased, from approx. 61% to 81%. This has to be seen in the context of the immediacy of the in-class quiz and the fact that they were effectively open-book.

4.3. Student Feedback

The following shows the results of a survey, consisting of seven questions, used to gauge student opinions on which approach (in class quiz or post-class[1] quiz) they judged had best helped their learning.
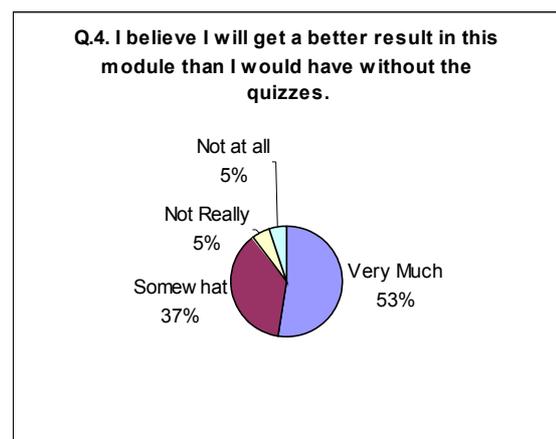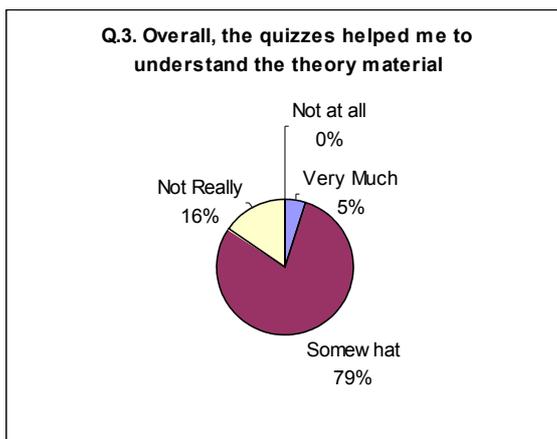
For the first two questions (see charts 1 and 2), relating to motivation to attend and motivation to be more involved during class, roughly one in four students agree *very much* that the quizzes have motivated them to attend and to be more involved in class,

Q.1.The in-class quizzes motivated me to attend theory classes
Not at all 0%
Very Much 26%
Not Really 16%
Somewhat 58%

Q.2. The quizzes motivated me to get more involved during the theory class (e.g...)
Not at all 5%
Very Much 26%
Not Really 16%
Somewhat 53%

Questions 3 and 4 relate to understanding of material, and anticipated improvement in overall module result. While responses to both are strongly positive overall, only 5% (one student) agreed *very much* that "the quizzes helped me to understand the theory material", while 53% (ten students) agreed *very much* that "I believe I will get a better result in this module than I would have without the quizzes". So there appears to be a strong belief in higher results, but a less convinced belief in actual learning.

Chart 3. Responses to Question 3   **Chart 4. Responses to Question 4**

Q.3. Overall, the quizzes helped me to understand the theory material

Not at all 0%
Very Much 5%
Not Really 16%
Somewhat 79%

Q.4. I believe I will get a better result in this module than I would have without the quizzes.

Not at all 5%
Not Really 5%
Somewhat 37%
Very Much 53%

Interestingly, the final statement (see Chart 5), "I found the quizzes interesting and enjoyable" elicited the second highest Very Much response of 37%, along with 42% agreeing somewhat.

Chart 5. Responses to Question 5

Q.5. I found the quizzes interesting and enjoyable.

Not at all
0%

Not Really
21%

Very Much
37%

Somew hat
42%
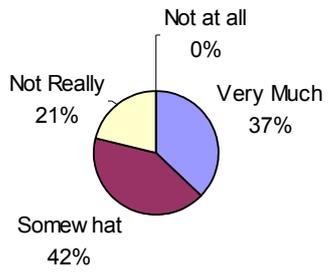
4.3.1. Interpretation of Responses – impact on motivation, engagement and learning

The quizzes do appear to have had a positive effect in motivating students to attend the theory lectures – they seem to have found the experience interesting, and more importantly, they have formed the view that by doing the quizzes they could pick up marks and get a better result in the module, than they would otherwise have. However, they were not as convinced that they understood the material any better as a result of the taking the quizzes. This lends weight to the argument that the quizzes may be resulting only in short-term or surface learning, even by the students' own assessment. It can, nevertheless, be argued that if students are attending *and engaging* to a greater extent than previously, then the quizzes are indeed achieving their primary objective – improving attendance and engagement, and thereby *providing a platform for increased learning, which will depend on the variety of complimentary teaching techniques employed*.

The comments given by the students under the open-ended 'Other Comments' heading can add something to our interpretation of these results:

Other Comments (sic)	
Motivational for learning & attendance & interactive	Good way to get a percentage. 'cause we are not studying computers, we are studying marketing.
Enjoyable	its good that they're short
V. good idea, easy marks towards end of year exam. Takes away the stress	Yes
Good to help get a better result in the exam, and helps understand theory a bit better	They are a good way to take off pressure from the Summer/ Christmas exams
It was good that you had 2 chances at the answers this time. You had 2 guesses which was better!	

4.3.2. Analysis of student responses – type of quiz:

In response to the question "Which type of quiz do you think best supported your learning?" (Post class or In-Class), 18 of the 19 students indicated a preference for the in-class quizzes. The following are the reasons they gave for this answer (sic):

Reasons given for preference for in-class over post-class(later) MCQs	
Because the theory (is) in our head(s) - easier to remember	It is easier to understand. The topics are very heavy to learn and it makes it easier in class
Made you listen and take note and the quiz help you to learn & understand	I could remember some of the stuff & they made me listen more
More comfortable	I pay more attention
You remembered it , (because) you did quiz at end of class	(I) just think that was the case
In class because we have just done the theory and understand better	Because it was easier to remember the answer
It was easier to remember what you just learned doing the class quizzes	Yes, they are good.
Because the information was fresher in your head	You are just after learning the information so its fresh in your head
Because it showed what I learnt in that session	Because the material is fresh in your head
	You learn and take in more information due to the in-class sessions

The student preference for the in-class quizzes is clear, at least in terms of the students' perception of likely success at the quiz.

In response to the question "Which type of quiz do you think best supported your learning?" as applied to the categories In Class (End-of Class) versus In-Class (Middle and End of Class), 15 students gave a preference for the intermediate quiz (middle and end), i.e. a 79% preference rate. The following reasons were given by students who preferred the intermediate quiz approach:

Reasons given for preference for Intermediate MCQ	
Your mind is being kept occupied by the material being covered	Because it kept your attention for the class
Divided up the topic for easier understanding	I remembered the stuff better
More exciting	Keeps your interest
Remembered more	V. good
In class because you've just done it and can remember better	Breaks the two up, so its easier to score well in the quiz
Breaks ups the class and keeps you more interested	Because your mind is constantly alert during the lecture

The preference for intermediate quizzes comes across quite strongly in the comments, and seems to centre on the class being more active and interesting as a result.

5. Concerns and Issues

Prior to starting the research, the author had some concerns about the manageability of running MCQs during the lecture session, and in an environment where students had to have access to computers during the class (possible distraction). In the event, this risk was minimised by insisting that computer monitors were turned on only for the duration of the MCQ, both for end-session and intermediate MCQs.

While there was no problem getting the class attention back after the intermediate quiz the first week it was used, the class appeared to be somewhat more distracted during the second session, with the author noting some difficultly getting the class attention back after the intermediate quiz. This aspect to running an in-class activity has to be balanced against the apparent benefits of the activity to the students' engagement and learning.

It should be noted that the development of an effective set of MCQ questions, with meaningful feedback, for any particular topic, can be a time consuming process. As noted by Brady (2005) "… significant commitment is required in preparation (of MCQs) to provide reliable and valid examination tools". As a guideline, it is estimated that, for this research, it took approximately two hours per each one hour lecture session to develop a meaningful set of questions in Moodle. Once created, however, these questions can be re-used with ease, so the once-off effort can pay dividends in the following academic years.

6. Conclusions and Future Work

This study has shown that online MCQs with associated assessment marks increase student motivation to attend and engage in theory classes. It has also shown that *in-class* MCQs can result in greater student *engagement* by providing a change of activity at suitable interval(s) during the lecture, along with immediacy of assessment and formative review and feedback to consolidate and improve student learning. While *in-class* MCQs did not seem to have any significant attendance advantage over post-class (later) MCQs, the in-class MCQ was perceived by almost all students as more beneficial to their learning, with the immediacy of the quiz a frequently quoted reason. Furthermore, a significant majority (79%) preferred the use an intermediate MCQ at intervals *during* the class, referring to increased interest in, and attention to, the material due to the topics being broken up into smaller parts.

Recent trends in prices for mobile computing devices, e.g. laptop computers, net books and even mobile phones, with wireless connectivity, have brought the cost of these devices to a level where it becomes more likely that all students could acquire or be provided with one of these devices in the near future, opening up the potential for in-class online activities during all lectures, where wireless networks have been installed.

This study was carried in a computer lab environment. The next step in researching this topic will be to trial the process in a standard (wireless enabled) lecture theatre. This will require all students in a selected class having access to a suitable computing device – a wireless enabled laptop, net book or mobile phone with adequate features to provide access to the online MCQ environment (e.g. Moodle). It is proposed that further research should now be carried out into the feasibility of this exercise, where

the practical aspects of achieving this level of technology compliance by a selection of undergraduate students can be assessed (including access to the required computing devices), along with the capability of the latest generation of (lower-cost) mobile phones to access online MCQs through a college (wireless) network. The practical aspects of managing this process (technology and human issues) in a standard lecture theatre will also need to be assessed. The potential for a more active and rewarding learning experience, for undergraduate students, is significant.

7. References

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