

Deployment of On-Line Quizzes to Maximize Learning

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Abstract: One of the Seven Principles of Effective Undergraduate Education is to emphasize time-on-task. However, annual studies by the National Survey of Student Engagement (NSSE) indicate that the number of hours that a college student actually spends studying is shrinking steadily with each passing year. This trend also agrees with common faculty observations about student study habits.

Over the last few years, On-Line Quizzes have proven to be an effective means of improving student pre-lecture preparation and thus increasing the "time-on-task" for the student. On-Line Quizzes can provide increased exposure to a subject to help students better understand terminology and basic concepts. This paper will explain six different places in the learning process where On-Line Quizzes can be used to support learning in higher education. This includes general background, pre-lecture preparation, post-lecture comprehension, practice problems, graded homework and pre-laboratory preparation.

For the instructor, On-Line Quizzes can help free class time for in-depth learning activities and for exploration of more advanced topics. Instructional software packages (i.e., Blackboard®, WebCT®, etc.) have been used at many educational institutions to deliver On-Line Quizzes.

In addition to the way that On-Line Quizzes are used in courses, there are seven different grading schemes that will be identified as well. These involve both supervised and unsupervised environments and different ways that success with the On-Line Quizzes can directly influence a student's grade. This paper will identify different ways to develop and present various question formats (i.e., Multiple Choice, Fill-in-the-Blank, etc.).

Introduction: The central idea behind this paper is that the On-Line Quiz capability, which is part of modern instructional software, can be effective in engaging students at several different points in the learning process. The technology would be recognized today as web-enhanced instruction (i.e., Blackboard®, WebCT®, etc.) used widely in traditional courses and in distant learning. This pedagogy can enable students toward gain a better grasp of course content and it can improve their motivation to learn.

One way of viewing the major learning activities designed into in a college course is by looking at the way in which both in-class and out-of-class activities work together to maximize learning.

Reading techniques that are effective in introducing students to new terminology outside of class would not be efficient for use in class. Likewise, certain discussion techniques that are used in class would not work well outside of class.

The traditional sequence of learning activities in higher education has been something like this: Students are generally asked to read their books, then attend class where they hear lectures and take notes. Next they complete homework. Finally, this process culminates with a measurement step in the form of an exam.

When introducing new terminology, the “first exposure” typically comes from reading assignments. Yet, the feedback on the quantity and quality of a student’s grasp of specific terminology may not occur until exam time. How much better would it be if students could receive feedback on their grasp of terminology and basic concepts earlier in the learning process? How much more can students learn in a class session where complicated problems are solved if they have completed the readings and understand terminology and basic concepts first?

Problem: One of the *Seven Principles for Good Practice in Effective Undergraduate Education* ^[1], is to “emphasize time-on-task”. However, annual studies by the National Survey of Student Engagement (NSSE) ^[2] indicate that the number of hours that the average student actually spends studying is dropping steadily. The 2006 NSSE survey showed that the national average for a full-time college student is at 13-14 hours per week of preparation for all classes. This trend is also confirmed by common observations about student study habits from faculty.

One tool that has been offered for about a decade is the On-Line Quiz capability available as part of Web-Based Instructional software packages (i.e., Blackboard®, WebCT®, etc.). Yet, there are a number of different ways to deploy an On-Line Quiz. The most effective method of deployment can depend on the nature of the course involved. The instructor should continually seek to find the point where On-Line Quizzes best support the learning process in each particular course.

As described in a paper by the author ^[3], On-Line Quizzes can improve student pre-lecture preparation. The increase in “time-on-task” gives students more opportunities to think about the subject and to become more aware of the topic at the beginning of class.

This paper draws from the experience of the author in teaching engineering courses where weekly On-Line Quizzes have been used. This includes *CAD/CAM Principles*, *Product & Process Planning* and *Creativity & Innovation*. The latter is a General Education course offered by the School of Engineering that is open to students of any major who have completed their eight General Education “Foundations” category courses. This paper also reports alternative strategies for deployment of On-Line Quizzes by faculty who teach courses in chemistry, computer science and engineering at Grand Valley State University.

When On-Line Quizzes are designed for pre-lecture or pre-lab preparation, they can be especially effective in introducing terminology and basic concepts to students. This means that students are more alert, informed listeners when they arrive at the classroom or the lab. Furthermore, On-Line Quizzes can help free class time for other activities including applications and exploration of more advanced topics.

backgrounder. Additionally, fundamental concepts like the relationship between temperature and heat is a concept that can be addressed very early in the semester to prevent misconceptions that could undermine grasp of more advanced principles. With today's technology, digital audio files can be readily produced by the instructor using just a computer with Windows XP and a microphone.

Pre-lecture preparation is one of the first areas that faculty should examine when looking to recapture some of the lost study time-on-task that NSSE has measured. In large numbers, students report that they only read the book after lecture and if they think that they must. As seen in Figure 1, On-Line quizzes are used for a course in CAD/CAM. Furthermore, in Introduction to Liberal Education and "Creativity & Innovation" (EGR 304), weekly On-Line Quizzes are provided as an incentive to read the book before coming to class. Engineering students at Grand Valley State University have reported that they like taking the On-Line Quizzes because they feel more motivated to complete readings before class time.

Post-lecture comprehension In addition to traditional paper-based quizzes and tests, On-Line Quizzes offer a method for assessment of student progress which can be graded quickly and efficiently. The computer can grade Multiple Choice and Multiple Answer questions where students are asked to generalize from given facts, verify the value of evidence or solve numerical problems. For the instructor, the upfront work is significant but the payback for large classes can make it worthwhile. Tests for post-lecture comprehension are generally given in a supervised setting where all students begin and end at prescribed times and each individual has exclusive use of a computer. If the class has no regular meeting in a computer lab, scheduling a lab session on quiz days is necessary. Even in this setting students may have to be given explicit instructions barring them from electronic communication in all forms during the testing period.

Practice Problems are commonly used in an unmonitored setting. Practice can be an effective way to achieve mastery content in mathematics, science and engineering. In addition to testing for recall and calculation skills the Ordering question type can be used to assess student ability to recognize patterns. The Multiple Choice format can be used to help students track the progress of their own skills in inferring causes and generalizing from a given set of facts. On-Line Quizzes offer the advantage of repetition and 24 hours a day and 7 days a week access. When Practice Problems are delivered using On-Line Quizzes, the instructor can let the computer automatically score each problem so students can monitor progress. However, the instructor can still block the resulting score so it does not affect the final grade in the course. Thus, the Practice Problems serve a purpose of valuable feedback to students. The instructor can set any given On-Line Quiz for "Multiple Attempts" so that students can retake quizzes as many times as they want without waiting on an instructor reset.

Graded Homework would be deployed in a setting where the quiz grade is intended to have a direct influence on a student's final grade in the course. Commonly the setting will be unsupervised, however if staff is available, this need not be so. An unsupervised setting, as was the case with Pre-Lecture Preparation, means that the instructor must make use of a number of safeguards to discourage "osmosis". Most of the items described above for Pre-Lecture Preparation would apply. Specific questions in On-Line Quizzes used for Graded Homework can assess simple recall while other questions can be used to measure success in completing a specific set of calculations. At Grand Valley State University, a popular use of On-Line Quizzes is to assess student skill involving

the solution of numerical problems. After a specific problem is solved, the computer can also score questions requiring higher level thinking skills (i.e., application, synthesis, inference, etc.) using a Fill-in-the-Blank, Multiple Question or Multiple Answer format.

Pre-laboratory Preparation formats can be used to introduce procedures and equipment in one or more lab experiments during a semester. The On-Line Quiz approach gives students a chance to submit and receive feedback prior to the lab session. If desired, the instructor can turn on the function that allows students to repeat the quiz an unlimited number of times. With today's technology it is now easier to provide video clips that students can view prior to beginning a lab session. Although there are practical reasons why students at Grand Valley are directed to university computer labs for viewing, students with properly configured computers and high speed internet connections have been able to view these video clips 24/7 from their personal computer desktops.

Quiz Formats and Practical Tips: A popular format for On-Line Quiz Questions is the Multiple Choice format. To a lesser extent Fill-in-the-Blank, Multiple Answer and Matching have been used. The Ordering format question is a little more difficult for the instructor to design. Although the Ordering format can be used to ask students to put events in chronological order, they are also effective in ordering by weight, dimension, physical properties, and other measures. Since On-Line Quizzes can be deployed in unsupervised settings, two critical implementation challenges should be addressed. First, it is the rare learning environment where students take quizzes without having an avenue for asking clarification questions in case a specific question is found to be poorly worded or impossible to answer. For this reason, faculty should consider this potential problem when constructing questions and addressing student re-grade requests. Secondly, the "osmosis problem" must not be ignored. Since the setting may be unsupervised, a small group of students may decide to shortchange their education by sharing answers with each other against the guidelines that were announced. Fortunately, Question Pools can be used to render those efforts nearly harmless. Effective use of question pools, in the simplest case, means taking a question and making a minor variation by changing the wording so that the answers to each version are distinctly different. The On-Line Quiz can then pull only one of the questions at random from a pool. The result is that any two students taking the same On-Line Quizzes may have some identical questions but will have mostly questions that are different. Another capability of the instructional software that will reduce the osmosis problem is the feature that scrambles the order of questions and answers. This makes it more difficult for any kind of student generated answer key to be distributed to classmates. The scrambling process also reduces the problem of students trying to work together on an individual's On-Line Quiz when they have been instructed not to do so. Naturally, osmosis is not really a problem if the instructor has decided that the quiz scores are not to directly flow through to the final course grade.

Summary: On-Line Quizzes represent a significant tool for the faculty toolbox. Like any technology it can be overused and there are always start-up challenges. This paper gives some guidance on where and how they can be used. As a practical matter there are limitations on the number of different points where On-Line Quizzes can be used with the same set of students in a particular course. Although this paper identifies seven places where On-Line Quizzes can be used, the author believes that there is generally one especially effective point of deployment for each type of course. There are also limitations, although currently undefined, on the percentage of a student's grade which should be directly influenced by unsupervised On-Line Quizzes. Effective ways to

reduce the osmosis problem include deployment of question pools and the scrambling of questions and answers. The author has found that student anxiety can be substantially reduced by allowing all students to repeat one quiz at the end of the semester.

Since life offers no “free lunch”, even question pools supplied by publishers may need additional work before the instructor wants to consider them as ready for student use in an environment where the instructor is not present. A change of textbook can create a significant amount of work for the instructor when the new textbook does not have the same topics or if readings are presented in a substantially different sequence. Nonetheless, when combined with out-of-class reading and/or audio video learning, On-Line Quizzes have become an excellent way for faculty and students to re-capture some of the educational time-on-task that has been lost over the years.

Bibliography

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