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REGULAR MOTION

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Abstract

Eight on-line quizzes were integrated into a first year physics unit at Edith Cowan University in semester 1, 2003. These quizzes were typically available for eight days after the content had been delivered in lectures and students were able to make a second attempt for each quiz using feedback from their first attempt. Students who attempted the quizzes overwhelmingly believed that they were easy to access and helped them learn physics. However, almost one quarter of all students did not attempt any quizzes and these students achieved poor overall grades.

Keywords

Quiz, Quizzes, On-line, WebCT, Physics, Motion, Mechanics.

Introduction

In learning physics, students need to attempt a variety of problems that target their understanding of concepts and develop their ability to apply physics knowledge. Given the limited contact time on campus, students are expected to gain most of their problem solving practice at home. However, few first year physics (in the author's experience) seriously attempt sufficient problems out of class time to gain mastery of the material. Indeed, McInnis, James & McNaught (1995, p. 3) noted that 53% of surveyed first year university students said they studied the minimum that was required by their teachers even though 83% (of all students) had a strong desire to do well in their subjects.

Publishers of university textbooks are increasingly offering on-line supplements to lecturers and students who adopt their textbooks. The current editions of two popular first year physics textbooks (Halliday, Resnick & Walker, 2001; Serway & Beichner, 2000) both offer WebCT resources that were not available with the previous editions (Halliday, Resnick & Walker, 1997; Serway, 1996). The publisher of the current textbook for first year physics students at ECU (Serway & Beichner, 2000) offered a WebCT test bank supplement with over 1000 questions. The prospect of adapting this test bank to create regular computer graded quizzes that might encourage improved learning (and study habits) was a significant factor in the decision to adopt this textbook at the beginning of 2001. In addition, the publisher agreed to provide free access to their WebCT server as the author did not have access to a WebCT server at ECU.

Unfortunately, the publisher promised resources were not in place for the beginning of the year, hence the first on-line quizzes were offered to students enrolled in the second semester unit SCP1112 Waves and Electricity. The introduction of these six quizzes was a success (Swan, 2002), and the author was keen to adapt the template to produce a superior product for use in the first semester unit SCP1111 Physics of Motion. The author believed that student outcomes might be improved by increasing the number of quizzes (from six to eight) to enable quizzing on a more regular basis, and to encourage a higher participation rate through greater publicity and an increased awareness of the assessment option. With the author being on leave in 2002, the quizzes were not introduced into Physics of Motion until 2003. This paper will describe and evaluate the quizzing experience for these students.

Creating Questions and Quizzes

The on-line quizzes were envisaged to be more than a series of multiple choice questions with the feedback consisting of a grade and correct answers. It was intended that students would receive detailed feedback after their first attempt which could be acted upon (and thus extend the learning process by enhancing knowledge and consolidating problem solving skills) in a second attempt at a similar quiz before recording the final outcome. WebCT (including version 3.8 used in semester 1, 2003) was flexible enough to allow this sort of learning process. In addition to a variety of allowed question types (including "calculated" type questions that allow different numbers for different attempts), WebCT allows for detailed feedback on individual questions and permits multiple attempts. Unfortunately, the test bank questions (provided by the publisher) were almost exclusively "multiple choice" type questions with answers but no solutions or detailed feedback. New "calculated" type questions were therefore created and all adapted test bank questions in the quizzes were edited to include detailed feedback

Similar but different individual quizzes for different students (and second attempts) were therefore created in WebCT to facilitate the desired learning goals and allow for a more authentic assessment of individual students. For "multiple choice" type questions, the "alternate" option was used so that students received a different question on the second attempt. For "calculated" question types, truth tables were constructed (with 20 sets of numbers for the physical quantities and numerical solution) so that individual students again received a different question on the second attempt. In addition, the probability of any two students receiving exactly the same question was only 5% which made it difficult for students to copy any answers from other students' quizzes.

Integrating Quizzes into Physics of Motion

Eight on-line quizzes were given to students to supplement (unassessed) selected problems from the textbook (Serway & Beichner, 2000) and student solution manual and study guide (Gordon, McGrew & Serway, 2000). Students were able to access the first quiz in the second week using their student number as their WebCT ID and password. Students were also encouraged to access a guest quiz (which carried no marks) in the first week to familiarise themselves with the quiz website and to identify any access problems (which were few, usually password related and quickly fixed). This quest quiz is available to conference delegates through the WebCT server login page (Thomson Learning, 2003) with a WebCT ID and password of "ecuguest".

Although students were not obliged to complete the on-line quizzes they were repeatedly encouraged to do so. Firstly, it was articulated that the selected problems and on-line quizzes would be most relevant to the sorts of problems likely to be encountered in the exam at the end of the semester. Secondly, they were informed that the total mark gained over the semester for the on-line quizzes would replace the mid-semester 20% component of the formal assessment for the unit if it was to their advantage. There were 13 weeks of Physics of Motion lectures, with a mid-semester test at the beginning of week 6 and a two week break between weeks 7 and 8.

Quiz No.	Topic(s) Set	Week Set	Type of Assessment
1	Motion in one dimension, Vectors	2	Best
2	Motion in two dimensions	3	Average
3	Newton's Laws	4	Average
4	Circular motion dynamics, Work & Kinetic Energy	6	Average
5	Conservation of Energy, Momentum	7	Average
6	Rotational Motion	9	Average
7	Static Equilibrium, Elasticity, Oscillatory Motion	11	Average
8	Gravitation, Fluids	12	Average

Table 1. On-line quizzes for SCP1111 Physics of Motion (semester 1, 2003)

Summary information for the individual quizzes is given in Table 1. The quizzes were accessible immediately after the relevant material had been covered in lectures and normally available for a period of 8 days. Students were allowed two attempts of up to 70 minutes each with each attempt at least 30 minutes apart. After the first attempt, they could immediately see their score and access the detailed feedback (ranging from hints to a step by step approach) on how to successfully answer individual questions. Students could then use this feedback to score better on their second attempt.

Although the best mark was used for the assessment of the first quiz as an incentive for students to begin accessing the quiz site, the average mark was taken for subsequent quizzes to encourage a serious first attempt. Students who chose not to attempt a particular quiz during the accessible period subsequently had neither the quiz nor associated feedback to use in their revision programs.

Evaluation and discussion

Physics of Motion students were given a written evaluation instrument to complete (anonymously) in class during the last teaching week of semester. The results were very positive with at least 85% of the respondents (who had indicated that they had submitted at least 1 quiz) agreeing or strongly agreeing that the quizzes:

- Were easy to access
- Were relevant to the unit content (100% of students agreed or strongly agreed with this statement)
- Improved my understanding of physics
- Provided me with necessary practice in solving physics problems
- Helped me develop problem solving skills

Students normally accessed the quizzes from home. More than three quarters of students thought that the number of quizzes (eight) was about right, and that overall the quizzes helped them learn physics.

Over three quarters of students believed that the amount of feedback provided to assist them in solving the problem for themselves (on the second attempt) was about right. This was particularly critical if the learning processed envisaged (ie first attempt, feedback, second attempt, outcome) was to be effective. Students were also happy with the number of quizzes (eight) and thought that the current 20% voluntary assessment (ie take best result of quizzes and mid-semester test) should continue.

The student participation rates for the on-line quizzes were disappointingly low considering the incentive of voluntary assessment. Of the 63 students who completed this unit, 30% attempted zero or just one of the eight assessed quizzes. This low use group of students faired badly and were over four times more likely to score a fail or borderline pass for the unit. In addition, only 17% of all students completed at least six of the eight quizzes which was surprising given that 100% of students found the questions relevant to the unit content. Over half of these students received an improved overall result because of their quiz grade being better than their mid-semester test grade. It should be noted that this group did not include any high distinction students who by virtue of good mid-semester test scores were unlikely to significantly improve their overall unit result through doing the quizzes. However the author is not very concerned by this statistic as the quizzes have always been mainly intended to benefit the struggling student.

Of particular concern was why almost a quarter of students chose not to attempt a single quiz. The poor participation rate was almost identical to that seen with the introduction of quizzes in Waves and Electricity in semester 2, 2001 (Swan, 2002). The author incorrectly believed that the participation rate would be improved by continually reminding students in the first few weeks that grades in the quizzes could count for their assessment and that the questions provided good practice for the exam. These students were asked in the written evaluation instrument for factors motivating them not to attempt quizzes, and although individual reasons varied, the common theme was a lack of time. The author does not at present have a solution to this dilemma and would be most appreciative of any suggestions from delegates at this conference.

Conclusion

Students were overwhelmingly positive with the introduction of on-line quizzes in this first year first semester unit. They found the quizzes easy to access and the amount of feedback about right. Students also thought that the quizzes should continue as a voluntary assessment component in the future. A significant minority of students did not attempt quizzes and their overall results were correspondingly poor. The participation rates of these students need to be improved.

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