Impact of Assessment Criteria on Students participation in Online Quizzes

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Introduction

Engineering Statics is offered in the first year of engineering course at CQ University similar to the most other universities that offer engineering degree. The subject is a prerequisite to many civil and mechanical engineering subjects that are offered in subsequent years. Hence, a deep understanding of the fundamental of the contents such as the resolution of forces, free body diagrams, application of equilibrium equations and calculating axial, shear force and bending moments needs to be mastered by the students to complete their degree successfully.

In principle, the content of the subject is slightly advanced than what students would have already learned in their high school physics. Newcomer (2006) states that teaching and learning of Statics should be simple because it is mainly the application of Newton's second law when there is no acceleration. However, the reality is a bit complex and generations of students have struggled to understand this simple theory. The subject has been one of the big hurdles for many first-year students at CQ University. The subject has been traditionally a difficult one as measured by student passing rate at other universities as well. For example, Hu et al. (2015) found that only less than 60% of students passed in the statics subject in the five years of study period at Western Michigan University in Kalamazoo, Michigan.

The fundamental reason behind the high failure rate in the subject has been identified as the inability of students to grasp concepts and master the necessary skills. Many students focus on plugging the numbers into equations rather than trying to reapply learnt knowledge and skills in different contexts (Danielson and Mehta, 2000). To improve students' understanding, Philpot et al. (2005) insist that the repetition of the application of the concepts in different contexts is essential.

To encourage students to repetitively apply the fundamental concepts in different contexts, aligning learning objectives with assessments is essential. We used unsupervised quizzes as an assessment tool which provides a learning environment. Use of unsupervised quizzes can be designed to create a wide variety of individualised problems which can be reused again and again. It has some other advantages such as reduced marking loads, immediate feedback to the students, and flexibility on test location and times.Proper design of the quizzes provides a perfect platform for students to repeatedly apply their knowledge of statics.

Effect of the quizzes on student learning, however, is not very clear yet because the current research is showing some conflicting results. Kibble (2007) concluded that the students who utilise the formative quizzes perform better in the subsequent assessment items; however, the participation rate in that type of quizzes was not very encouraging. To increase the participation rate, the authors offered 2% credit for the quizzes, but that created an environment for widespread inappropriate use of the quizzes . Angus and Watson (2009) reported that higher exposure to online quizzes leads to higher student learning. Smit (2007) also noted a higher correlation between the weekly online assessments and exam marks compared to group-work and the exam marks. In line with these findings, Dobson (2008) reported that the group of students who participated in a formative online quiz performed significantly better in the summative exam than others. However, Peat et al. (2003) did not find any clear impact of online formative or summative assessment on students' learning.

An extra effort needs to be made to encourage students to use this kind of formative assessment. Peat et al. (2005) suggested that encouraging students to use the available online resources need to be dynamic, interactive and fun, which would likely increase their enjoyment of and interest in the subject.

From the literature, we can reasonably argue that a) formative online quiz helps students to learn better and improve their performance in the subsequent summative assessments, b) students participation on formative only quizzes is usually low and c) the only way to increase students participation is to offer some marks to the online quizzes but d) it might encourage students to focus more on activities to earn marks rather than actual learning. In the context of this conflicting situation, we may seek an answer to how many students use the formative assessment opportunities and are they the students who need to practice the most? How does the assessment criteria change students behaviour towards online quizzes?

This paper focuses on the application of using online quizzes as an assessment tool in Engineering Statics unit to allow the repetitive practice of conceptual problems and to encourage the participation of students in the subject earlier in the term. The number of students ranged from 50 to 300 in different terms. Nearly 50% of the students were on campus, and the remaining half were distance students.

Method: Using Action Research to improve quiz participation and its effectiveness

In this project, I used an action research approach to understand the effectiveness of quizzes and use them to improve student learnings. Action research should be based on the reflection on the formulated plan and actions. It generally has five stages in a cycle 1) make a plan to intervene with a clear vision on the potential outcome, 2) implement the plan, 3) observe the reaction and process, 4) reflect on the entire process and outcomes and 5) revise the plan and go to the step 1.

Before the online quizzes were introduced, the subject had two assignments, end of the term final exam and workbook. The workbook was used as a formative assessment item, but the other assessment items were of summative type. The unit was initially offered to second-year students (Analysis structure) but later moved to the first year with some modification of its contents (Engineering Statistics). Because the assignment conditions and the contents in all the offerings were similar, we assumed that all the results discussed below are comparable. The first two results presented below are based on the second-year students and the last three from the first-year students.

Number, weight and criteria of the online quizzes were changed in each offering to encourage students' participation and make the students active early in the term based on reflection. Each cohort of students was given the same online quiz criteria, and changes were made for the following offerings only.

The quiz questions were of a numerical type (students need to enter numerical values as answers), and the number of values on each question were randomised. The students were also allowed to take the test as many times as they like within a given time frame. The set of questions also changes in every attempt. About 5% of the total marks were allocated per quiz. Following assumptions were made when designing the quiz:

a. Marks attached to the quizzes act as an incentive for the students to take quizzes.
b. Students do not feel the fear of failing because they can take the test multiple times.
c. Variables of questions and the set of questions, both were randomised. This condition requires the students to work the problems repetitively if they make mistakes. It is expected that they will learn from previous mistakes, and successive attempts will be better.

d. Automation of feedback for online tests means the students receive instant feedback. It will help them to identify their mistakes and use the feedback to improve their subsequent attempts.
e. For students who have already mastered the concept and got good marks, do not need to spend more time in the same area. Hence, this assessment is suitable to support all level of students.
f. The answers are to be numerically entered so that the students cannot guess the answers as in multiple quizzes.
g. Because the quizzes were open for a limited time (generally one week) and there were four quizzes in the unit, the student needs to make themselves up-to-date with the unit at all times.

Data Analysis and Discussion

Several models of the quizzes were planned and implemented. Some of the conditions were retained throughout all quizzes, and some were changed based on the effectiveness of the approach. The effectiveness of a particular approach is measured through the instructor's observations and reflections, as reported below. All the quizzes were made time-bound for 1 hour to make students focus on the task. At least 1 hour of a time gap was also required between two successive attempts in order to encourage students to reflect on their mistakes. Students were allowed to take the test as many times as they want but within the designated time windows of one week only. The quiz conditions that were changed and their effects are described below.

Model 1: In this model, the original end of the term Workbook submission was replaced by regular online submission of the quizzes. There were no marks from the quizzes towards the course grade however it was required to pass any four quizzes out of.

Participation on the first quiz was 100% then it slowly decreases in each quiz until the fourth quiz, which had a participation rate of 85%. The average score in these four quizzes was 77%. However, the last three quizzes were participated by only 40% of students, and the average score was also 40%.

It can be concluded that the students took the quizzes seriously and participated actively in the first four quizzes. After the four quizzes, most of the students passed the assessment, so they were only a little incentive for them to be active and invest their time on a quiz.

Records show that only the students who still had not passed the first four quizzes or the students who were highly motivated continued to participate in the remaining three quizzes. Brown (2004) rightfully mentioned that "We may not like it, but students can and do ignore our teaching; however, if they want to get a qualification, they have to participate in the assessment processes we design and implement". Once the students crossed the hurdle, the majority of the students stopped using the quizzes to practice and test their learnings. Even though students were frequently told that regular engagement with the unit is important, it was evident that students neglected such advice.

Group of the students who got 0-50 marks in the final exam attempted the quizzes 4.8 times but students who got 80-100 attempted them for 5.4 times. This shows that there is some correlation between the test attempts and their final score. Students who received 0-50 marks could have done better in the final exam, had they attempted used the quiz to practice more. Unfortunately, the students who need more practice are not using the opportunity.

Model 2: In order to improve the participation of the lower band of the students, in the next offering (model 2), only four quizzes were offered in the place of seven. 20% of marks were also allocated to the quizzes. The students were required to submit all the quizzes but were need to score only 50% in total from four quizzes. This time, students participation started at 97% in the first quiz and reached 87% on the last quiz. The figure demonstrates that the participation rate can be increased by making the quiz compulsory. However, this increases

stress and workload to the students early in the term. Two groups of students a) who are not interested in scoring high marks and b) who already know the stuff disliked this model the most.

Model 3: In model 3, the minimum criteria to pass was set to 75%, but the students were not required to submit all four quizzes. Students who have already secured to minimum marks are not required to complete the remaining quiz, if they choose not to. The result shows a similar result as in model 2 with 97% of students attempting the first quiz and 88% attempting the last one. The average score by all the students was 90.

Model 4: In model 4, the minimum criteria to pass was further relaxed and was set to 50%, and they can complete any number of students. Student participation started at 91% and reached 83% in the second quiz. We saw a larger decrease in student participation from the beginning towards the end compared to model 3. The average score was also reduced from 90 in model 3 to only 76 in this model. This decrease in average score can be attributed to the students' reluctance to work more once they crossed the minimum pass mark of 50.

Model 5: Over-assessment generally causes students to seek mastery of exams rather than being motivated towards genuine learning (Abramovich, 2013). In order to reduce overassessment, the number of quizzes was further reduced by three quizzes during the term. The minimum marks to pass the assessment was also removed, but 20% weight marks from the quiz were retained as in the previous models. This model has maximum freedom to the students and onus is given back to the student for their learning.

The new conditions were supposed to give students more control over their tasks and provide them with more freedom to decide on their learning. Interestingly, it did not reduce the participation in the quizzes, which was 97% in the first and 88% in the last. The average score, however, has been reduced to 70. The reduction in score was probably due to students giving less importance in multiple practices even though the opportunity exists.

This result indicates that most of the students attempted the quiz with their own choice rather than compulsory submission requirements. Because there were no minimum mark requirements, all the students decide how much score they want to get from the quiz. Students who were happy with the lower marks did not attempt multiple times, but students who want to get higher score took the opportunity and did so. The students in the course feedback highly appreciated this personal freedom.

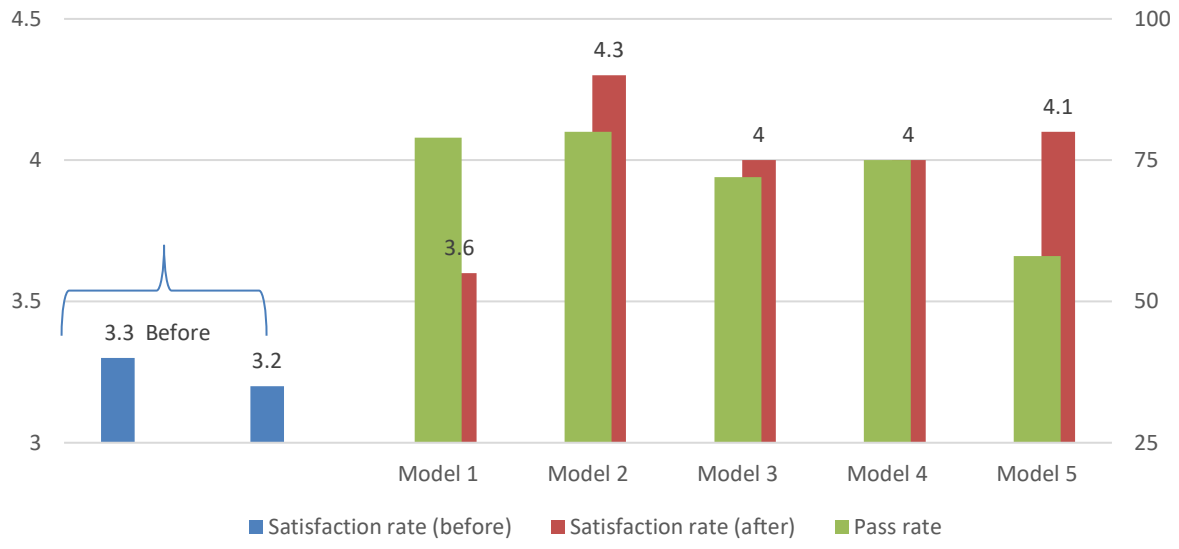

Figure 1 Overall student evaluation score from Moodle survey and the overall result

Figure 1 shows the effect of an online quiz on students pass rate and course satisfaction rate. The satisfaction rate, which was around 3.3 before the online quiz was implemented, increased significantly and sustained for many years around the value of 4.0. Based on the qualitative feedback given by the students (end of the term survey), it was found that distance students who work full time found it a way to keep up-to-date with the unit and maintain the study throughout the term. Students who want to cement the learned concept also found it helpful as it provides an option to review and learn from the mistakes.

The pass rate, however, remains the same except in the last model. This shows that the criteria of online quizzes significantly changes the behaviour of the students, but the quizzes alone do not change the overall pass rate. There is a reduced pass rate in the last model (model 5) which could be because of different reason such as a) the characteristic of that particular cohort or b) more freedom does not encourage the students who need more engagement c) or some other reasons which were not identified. Further investigation could help to further our understanding. Even though the pass rate did not increase has not increased significantly, the student feedback on the quizzes has been very positive in all offerings.

References

Journal article

Abramovich, S., Schunn, C., & Higashi, R. M. (2013). Are badges useful in education?: It depends upon the type of badge and expertise of learner. Educational Technology Research and Development, 61(2), 217-232.

Angus, S. D., & Watson, J. (2009). Does regular online testing enhance student learning in the numerical sciences? Robust evidence from a large data set. British Journal of Educational Technology, 40(2), 255-272.

Danielson, S. and Mehta, S., (2000). Statics concept questions for enhancing learning. Age, 5, p.1.

Dobson, J. L. (2008). The use of formative online quizzes to enhance class preparation and scores on summative exams. Advances in Physiology Education, 32(4), 297-302

Hu, Y., Montefort, J. M. & Tsang, E. (2015). ASEE Annual Conference and Exposition: Making Value for Society. American Society for Engineering Education

Kibble, J. (2007). Use of unsupervised online quizzes as formative assessment in a medical physiology course: effects of incentives on student participation and performance. Advances in Physiology Education, 31(3), 253-260.

Peat, M., & Franklin, S. (2003). Has student learning been improved by the use of online and offline formative assessment opportunities?. Australasian Journal of Educational Technology, 19(1).

Philpot, T.A., Hall, R.H., Hubing, N. and Flori, R.E., 2005. Using games to teach statics calculation procedures: Application and assessment. Computer Applications in Engineering Education, 13(3), pp.222-232.

Smith, G. (2007). How does student performance on formative assessments relate to learning assessed by exams?. Journal of College Science Teaching, 36(7), 28.

Conference proceedings

Newcomer, Jeffrey L. "Many Problems, One Solution Method: Teaching Statics without Special Cases'." Frontiers in Education Conference, 36th Annual. IEEE, 2006.

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