

2006-1646: FIVE SURPRISES: THE KEY TO RE-ENGINEERING THE TRADITIONAL QUIZZES

Brian Houston, University of Pittsburgh-Johnstown

BRIAN L. HOUSTON is an Assistant Professor of Civil Engineering Technology at the University of Pittsburgh at Johnstown and Managing Partner of Roundtable Engineering Solutions, LLC. Prior to academia, he worked as a Senior Design Engineer in the petrochemical industry and is licensed in several states. He received a B.A. from Northwestern University in 1986, and a B.S./M.S. in Civil Engineering from Oklahoma State University in 1997/99.

Robert Martinazzi, University of Pittsburgh-Johnstown

Robert Martinazzi, P.E. is a Professor of Mechanical Engineering Technology at the University of Pittsburgh at Johnstown. He received his B.S. degree in Aerospace Engineering from the University of Pittsburgh, and an M.S. in Mechanical Engineering from Carnegie Mellon University. His interests include engineering economics, management and leadership development. He has worked as project engineer for Armstrong World Industries, does engineering management and leadership consulting work and presents seminars on effectiveness and leadership at both the individual and corporate levels. He is Colonel (Ret) in United States Marine Corps Reserves.

Five Surprises – The Key to Reengineering The Traditional Quiz

Abstract

Most professors use quizzes as a method of keeping students focused on their responsibility to learn the course content. With the potential of a quiz looming, the consequences of coming to class unprepared serves as motivation to students to do their homework and the assigned readings. This method is negative rather than positive reinforcement, and is not as effective as it could possibly be for student learning. In previous research, working alone and quizzing were ranked lowest in terms of preferred classroom learning.¹

Part of the problem lies in the fact that traditional quizzing methods are neither collaborative nor active in nature. Students literally have no input into when quizzes are administered or to the actual content of the quiz. For classes in which teamwork and active learning techniques are stressed, alternative quizzing methods are more consistent with the instruction and potentially more beneficial to the students in developing team skills and working under pressure.

Students are more interested and engaged when a variety of techniques are used to test their knowledge and analytical abilities, just as active learning techniques are more effective when a diverse sampling of methods are employed. When given a voice into the quizzing process, the students invest more in their own learning. This serves as positive reinforcement and truly motivates the students to become active learners.

This paper examines a wide variety of alternative quizzing techniques. The title of the paper, “Five Surprises” reflects the quantity of quizzes given per semester and the unannounced nature of the quizzes. Some are formulated by faculty and others recommended by students. Some have been employed in the classroom; others are being evaluated by faculty for possible implementation in the current and future semesters. This paper will highlight some of the best ideas which have been given specific names suggestive of the type of quiz. Overall, nine alternative quiz types have been identified and include names such as “Dante’s Quiz”, “Jumping Beans”, “Who Wants to be an Engine-aire”, and “The Relay”.

Introduction

Assessing student learning remains a principal requirement for faculty wanting to increase their teaching effectiveness. Faculty members develop a wide repertoire of methods to evaluate student’s knowledge of the material presented in lectures. Some type of “testing” needs to occur in order to accomplish this evaluative task. Many faculty members choose tired, proven, and traditional means of keeping students engaged in the learning process. The traditional quiz, especially unannounced ones, appears to work, but possesses a “carrot and stick” mentality which may not serve to motivate and encourage the student to take ownership of the course material. While these traditional methods may produce short-term results, they create student anxiety and produce an adversarial relationship between the student and instructor.²

From a modern day electronics' perspective, today's students seem very interested and accustomed to interfacing and interacting with a variety of exciting games and challenges presented to them on their computers. Attempting to take advantage of their interactive desire and transfer it to the student's learning process seems very appropriate. The question becomes one of how can this be done in an academic and classroom environment.

One potential solution, as presented in this paper, focuses on student interaction in the form of a collaborative learning model utilizing teams. If students are given significant input into how they will be assessed from a quiz perspective, they become important stakeholders in the learning process. Working as a member of a team naturally affords each student an intercommunicative opportunity to demonstrate their newly acquired knowledge, and to experience team dynamics as they work together on a common assessment method.

Establishing an interactive means for evaluating student learning required presenting the students with the concept of reengineering the traditional quizzes and the rationale behind modifying the way they take quizzes. The hope was that a positive response to the idea would open the door for students themselves to provide a variety of ways the instructors could engage them in the learning process.

Concept Development

Last year, throughout the Spring Term of the 2004/05 school year, the authors discussed various ways of developing new methods to "quiz" students for learning throughout the semester. As the discussion progressed, it became evident that any change must be grounded in an interactive model requiring students work together as a team to solve the challenge or problem presented by the instructor.

Initially the authors toyed with their own ideas on what could be done to meet the objective of reengineering the traditional quiz. Since it was near the end of the semester, any new approach could not be implemented immediately. Alternatively, the instructors chose to solicit input from the current students even though they would not be affected by the outcome of a new quiz model.

Seeking student input was based on the premise that "two heads are better than one." Most assuredly then "eighty-four students heads would definitely be better and two old faculty ones" for coming up with novel ideas. Future students would be the direct beneficiaries of having a reengineered quiz format, and faculty could tell the students their peers had a major input into these new types of quizzes. This would hopefully make the concept more palatable to the students. Current students were encouraged to participate in the quiz formulation project by implementing the ideas in the next term, thus insulating them from the impact of their ideas. An additional incentive to foster cooperation in this effort was offered by allowing up to an additional two (2) percentage points on to the student's final class average if they offered a reasonable and viable option for a reengineered quiz. Armed with this information, the concept was then presented to each class.

After explaining the reengineering quiz idea to the students, their feedback and input was encouraged and sought. Since all three classes were taught utilizing student learning teams, the students reinforced the team quiz concept as a natural extension of what they were doing throughout the semester. The opportunity to have additional points added to their final course percentage was welcomed by the students and did serve to motivate them to assist the authors in coming up with some novel ideas. Any student team who did not choose to participate was not penalized in any manner, but very few teams chose this latter option.

The students were given a week to develop their ideas. They were required to present their suggestions in a formal written format to be evaluated by the instructors. After all of the proposed reengineered quiz ideas were evaluated, 33% of the students earned 2% points to be added to their final grade, 54% earned 1% point, and 13% of the students did not receive any bonus points for their efforts.

Names were chosen by the instructors to best illustrate the “spirit” or “intent” of the reengineered quizzes which in itself took on a whole new name of “Five Surprises”. This new nomenclature was in keeping with the intent of totally revising the traditional quiz.

Table 1 presents the results of the students and authors efforts to provide options to the traditional quiz.

Table 1 – Quiz Ideas

Quiz Name	Description
Jumping Beans	Team quizzes are given, however the teams are re-organized for the quiz to force students to work with new people.
Bread & Butter	Your basic, run of the mill, standard quiz.
Oops	The problem and solution are given. The student must find three mistakes in the solution.
The Teaching Assistant	Students work in teams of two. Points are given for both completing the problem and for grading/correcting the teammate's problem.
The Designer	Several options are given for a certain component (a gear) and the student must select the correct and/or best possible alternative.
Creation	Each team creates a quiz. The instructor selects the quiz that is given. Each section gets a quiz from another section, so that no one team is given an advantage. The team that generates a quiz that is selected gets a 5 point quiz bonus.
The Barter System	5 points of the quiz can be traded for a hint. Up to three hints can be given.
The Relay	Groups do a relay race problem. Each member has to do a part of the problem that must be completed before the next person can continue. <i>Teammates can provide support, but not use variables and formulas in their descriptions during the solution process.</i>
Dante’s Quiz	Provide three levels of difficulty in the quiz. Graded on scale of 25 points. Maximum possible scores for each option - Easy [15 points], Medium [20 points], Hard [25points].
Who Wants to be an Engine-aire	Students work problem at board. They can poll the audience, get a hint from the instructor, or “phone” a friend. A 5 point deduction is given for each lifeline used.

Implementation

The implementation plan involved incorporating the results of the efforts from the Spring 2004/05 term into the Spring 2005/06 semester. There was a one semester lag since the course is not taught in the Fall term. This set the stage for the “Five Surprises” prototype testing now set to become a reality.

At the beginning of the term the authors shared with the students the work and results of their peers from the previous year. The students were told this is the first prototype attempt at reengineering the traditional quiz. Since the pool of eligible quiz alternatives contained ten distinct possibilities, it became necessary to chose five from this list to replace the five traditional quizzes.

Having the students determine which five “surprises” out of the ten that were offered provided an opportunity for the current students to buy into the concept. The Appendix contains the actual inquiry sheet given to the students. They were to rank their favorite five “surprises” according to the instructions on the sheet. Every student had the opportunity to rank the “surprises”.

After each student ranked the surprises according to their preference, the sheets were collected, tabulated with the results show in Table 2. Of the 87 students in three class sections, 74 responded (85 percent). A maximum possible score of 370 is possible based on the 74 responding students ranking a particular quiz with the highest ranking (five). Similarly, an average expected score would be 111.

Table 2 – Survey Results

Score	Quiz Name
181	Jumping Beans
135	Bread & Butter
135	Oops
117	The Teaching Assistant
109	The Designer
108	Creation
106	The Barter System
67	The Relay
64	Dante’s Quiz
39	Who Wants to be an Engine-aire

Results and Conclusions

The quizzes can be arranged into three distinct types: Team Involvement, Partial Solution or Presentation. Team Involvement quizzes allow more than one person to participate in a given

quiz. Examples from the above list include “Jumping Beans”, “The Teaching Assistant” and “Creation”. Partial Solution quizzes involve some aspect of the solution to be revealed. Examples from above include “Oops”, “The Designer”, and “The Barter System”. Lastly, Presentation quizzes require some action in front of the class, such as “The Relay” and “Who Wants to be an Engine-aire”.

Based upon the use of team learning in this course, it is expected that quizzes involving team concepts would be among the highest ranked options. The survey results support this assertion. Other research involving team learning in a quiz environment also supports the student preference for team quizzing.³

Based upon student nature, it is expected that 1) students would gravitate towards options that are partially solved or where hints are given, and 2) students would not choose options that required them to demonstrate their knowledge in front of the class. This is seen in the survey results in that both of the Presentation quizzes were not highly rated, while all of the Partial Solution quizzes are highly rated.

During the Spring 2005/06 term the instructors will implement four of the highest ranked alternative ideas, as well as the “Bread and Butter” choice, or the traditional quiz. Evaluation surveys will be distributed at the end of the course to evaluate how these quizzes are perceived by the student body in relation to the basic quiz, and plans for future modification will derive from the evaluation survey results.

Class size for the implementation varies from 25-30 students; however some of the quiz types could be applied to larger settings. In particular the Partial Solution quizzes and Dante’s Quiz could be used in large class settings since they are individually taken. Team Involvement quizzes could be used in larger classes, but most likely only if team exercises are already a part of the instruction. Presentation quizzes are not likely viable in large class settings.

References

1. Murray, S., “*Increasing Student Commitment to Class Preparation*” Proceedings, 2005 ASEE Annual Conference, Portland, OR, June 2005.
2. Lowman, J., “*Mastering the Techniques of Teaching*”, 2nd Edition, Jossey-Bass publishers.
3. Mazzei, A., “*An Approach for In-class Learning of Mechanical Engineering Design Subjects*” Proceedings, 2005 ASEE Annual Conference, Portland, OR, June 2005.

Appendix

Quiz Concept Student Input Survey

Assume you are given a choice for how your quiz will be formulated.

Choose five of the following quiz ideas which appeal to you.

Rank your five choices and from 1 to 5.

One should designate your **least** favorite of the five chosen.

Five should designate your **most** favorite of the five chosen.

Place the five rankings in the boxes provided and leave all other boxes blank.

Bread & Butter

Your basic, run of the mill, standard quiz.

Dante's Quiz

Provide three levels of difficulty in the quiz. Graded on scale of 25 points.

Maximum possible scores for each option

Easy Option = 15 points

Medium Option = 20 points

Hard Option = 25 points.

The Barter System

5 points of the quiz can be traded for a hint.

Up to three hints can be given.

Oops

The problem and solution are given.

The student must find three mistakes in the solution.

The Teaching Assistant

Students work in teams of two. Points are given for both completing the problem and for grading/correcting the teammates problem.

Jumping Beans

Team quizzes are given, however the teams are re-organized for the quiz to force students to work with new people.

The Designer

Several options are given for a certain component (a gear) and the student must select the correct and/or best possible alternative.

Who Wants to be an Engine-aire

Students work problem at board. They can poll the audience, 50/50 or "phone" a friend. A 5 point deduction is given for each lifeline used.

Creation

Each team creates a quiz. The instructor selects the quiz that is given. Each section gets a quiz from another section, so that no one team is given an advantage. The team who generate a quiz that is selected gets a 5 point quiz bonus.

The Relay

Groups do a relay race problem. Each member has to do a part of the problem that must be completed before the next person can continue. *Teammates can provide support, but not use variables and formulas in their descriptions during the solution process.*