

CASE STUDY

Optional Computer Multiple Choice Quizzes Affect Student Grade Performance ? ? ?

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Abstract

The use of optional computer multiple choice quizzes has received a degree of popularity with students and has been shown to increase students' overall term grades. This statement seems justified based on the following results of this study. Over 70 percent of the students, over a five-year period, have voluntarily chosen to take the optional multiple choice quizzes. Second, measurable grade differences showed that the group of students who participated in the quizzes outperformed non-participants. Third, statistically higher correlations for non-participants between term grade and first hourly, and between term grade and final examination indicate that additional factors (perhaps additional learning) were influencing the participating groups' term grades. The questions of causality between optional computer quizzes and overall level of performance and the students' motivation for taking the quizzes remain unanswered.

In order to meet the learning needs and interests of a large number of students, variation in instructional methods is essential. Perhaps Kendrick best sums up this philosophy:

"Effective teaching requires a flexible instructor who employs multiple teaching techniques which then create an environment where learning takes place both in and outside the classroom through multiple teacher-student interfaces and frequent student-to-student interaction." (Kendrick, 1973)

This study reports the results of the author's use of one teaching technique to generate student interest and participation in economics and to enhance one's knowledge and ability to see some practical applications of introductory microeconomic principles. The method employed was computer multiple choice quizzes with programmed learning feedback.¹ This technique allows students to take a series of multiple choice quizzes on the current principles and concepts. These quizzes are taken on typewriter consoles when the student finds time and at the desired pace. The questions are prac-

tically oriented and each answer selected gives an explanation feedback as to why the answer was correct or incorrect. For incorrect answers, the student is asked to consider other important elements in the decision choice.

Educational testing, as used in American education today, is generally recognized as achieving four major purposes: (HEW, 1978) (1) holding teachers, schools, and school systems accountable, (2) making decisions concerning individual students, (3) evaluating educational innovations and experimental projects, and (4) providing guidance to teachers in the classroom.

The method as reported in this paper mainly deals with evaluating one possible educational technique. The method of using computer experimental testing is also listed as one of the major recommendations of the "Chairmen's Report" that called for combining testing with teaching (HEW, 1978).

Background

In the fall of 1975, two sections of a Principles of Micro-economics course with different instructors but the same text, examination procedure, and course outlines were designed to give students the option of using extra credit multiple choice computer quizzes. After each class quiz (from 5 to 7 per semester) students were given the choice of doing specified computer quizzes for extra credit. The assignments were set to cover the same concepts on a series of make-up quizzes that were covered on each class quiz. It was further stipulated that any quiz taken must be completed in 10 school days and a 100-percent response (all questions answered correctly) was required for each assignment in order to obtain extra credit. However, students could take any quiz as often as they desired or as many quizzes as they desired; but extra credit would be given only once for the specific quizzes assigned.

If the students' class quiz grade was 79.9 or less they could obtain 10 additional points by doing the make-up quiz; if it was 80.0 or more they could obtain 5 extra points. Since total quizzes in the courses (5 to 7) account for about 30 percent of the total grade, each class quiz accounted for between 6.00 and 4.28 points. Each make-up quiz could, therefore, add between .214 and .600 total points ($4.28 \times .05$ or $6.00 \times .10$) depending on if 5 or 10 points were added.

All make-up quizzes could be taken on either videoscope or typewriter consoles; however, it was re-

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quired that the extra credit quizzes be handed in on hard copy (typewriter). It was stressed that a computer background was not necessary, that the quizzes were optional, and that no student would be penalized for non-participation. Student term grades were determined both absolutely (a set standard, 90+ = A, 80+ = B, etc.) and a relative curve based on total points to account for both extra credit quiz participation and non-participation.

Current Study

After five years of operation and based on the overall number of voluntary participants (70.9 percent) and complimentary remarks on student evaluations, the computer incentive quizzes seem to have been successful. On the other hand, since instructor time and effort (although fairly limited) and computer time are required as a continuing input, it seems reasonable to ask some questions pertaining to student performance.

This study was not intended to draw a direct causal relationship between those students who did and did not take computer make-up quizzes and the level of their performance as measured by examinations. Causal analysis would depend upon a large number of hypothesized relationships which were not examined.² The purposes of this study were to examine the two groups to see if there were significant differences between those who did and did not participate in the optional computer extra credit quizzes and to discover what influence such participation might have had on their examination test scores and term grade during a semester.

Two criteria were used to examine the significant differences between groups. First, means and standard deviations were examined for each examination and the term grade. Second, simple correlations between term grade and the other grading variables were examined.

Data and Results

The grades of 673 students who took Micro-economic theory over the past 5 years were included in the study. Although term grades were available on all students, the number of observations on other examinations varied due to excused absences.

When comparing the two instructors' classes, there were no significant measurable differences (at a .05 percent level) in the percentage of male-female ratio or the percentage of students who did or did not take the computer make-up quizzes. Significant mean differences were noted (at a .05 percent level), however, in four other numerical test measurements (first hourly, second hourly, final examination, and term grade). These differences could be the result of variations and emphasis on material covered or on the skills of individual instructors. For example, students' grades were significantly higher (at a .05 percent level) on the first hourly and term grade for one instructor and on the second hourly and final for the other.

Table 1. Means and Standard Deviations Scores for Groups of Students Who Did and Did Not Take Computer Extra Credit Quizzes (1975-79)

| | | Quiz Make-Up ¹ | | |
|-----|-------------------|---------------------------|--------------------|--|
| N | Exam | Average | SD | |
| 461 | Final | 71.08 | 10.84 ² | |
| 477 | Term ³ | 2.19 ² | .87 ² | |
| 477 | First Hourly | 77.11 | 12.50 ² | |
| 475 | Second Hourly | 69.79 ² | 15.94 ² | |
| | | Non-Quiz Make-Up | | |
| N | Exam | Average | SD | |
| 191 | Final | 70.16 | 11.90 | |
| 196 | Term | 2.56 | 1.04 | |
| 193 | First Hourly | 75.51 | 13.55 | |
| 192 | Second Hourly | 66.61 | 17.18 | |

¹ Any student who completed more than 50 percent of the extra credit quizzes was counted in the "Quiz Make-Up" group.

² Significant difference at .05 percent level.

³ Term grade value is inversely related to actual number, that is 1.0 = A; 2.0 = B; 3.0 = C; etc.

Analysis of Grade Averages

Two general observations were made in relationship to the computer make-up quizzes over the 5-year period. First, although a little over 70 percent of the students have voluntarily taken the make-up quizzes over the entire period, the percentage in the past few years has been closer to 80 or 85 percent. Second, the pattern each year is similar with a smaller number of students doing the make-ups after the first class quiz and the number increasing as more class quizzes are given.³

The means and standard deviations of the make-up and non-make-up groups are presented in Table 1. One noteworthy difference is that the group averages on all of the tests and final term grade are higher for the make-up quiz group. Furthermore, this group also has lower standard deviations (all significant at a .05% level) on all of their overall mean examinations. Of the three individual tests and the final term grade there was a statistical significance between the groups at the .05 percent level for the term grade and the second hourly.

In short, it would appear that there is a performance difference (as measured by mean examination scores) on the second examination and term grade between the groups who do and do not participate in the computer extra credit make-up quizzes. Furthermore, it would seem logical that part of this difference was due to the extra credit added to the term grades for the make-up students and, as a result, this at least partially explains the significant difference in the groups on term grades, and should be subject to further investigation.

Correlations Between Grades

In explaining the variation in term grade by examination scores, multiple regression analysis was rejected as a tool of analysis because of highly inter-related variables. Simple correlation coefficients between all the variables are presented in Table 2. Three

facts are apparent from the table. First, as was expected, all of the variables are fairly strongly correlated with each other. Second, in all but one case that was not significantly different, non-quiz make-up correlations are higher than the same correlated variables for the make-up group. Finally, in the case of term grade there is a statistically significant difference (at the .05 percent level) between the correlation coefficients of the two groups on the first hourly and final examination. There was also a statistically significant difference between group correlation coefficients between final examinations and the first and second hourly examinations.

For both the make-up and non-make-up groups the strongest correlation with term grade was the grade on the first hourly and the grade on the final examination. In terms of simple correlations there was a significant difference between the values obtained by the two groups with the non-quiz make-up group obtaining significantly higher correlations. These results can at least be partially explained by the fact that extra credit points have been added to the term grade (in the make-up group) and, therefore, account for some of the total variation and result in lower overall correlation coefficients in this variable.

A second interesting hypothesis as to why quiz make-up scores are less strongly correlated than non-quiz make-up scores is that additional learning has taken place (via the make-up quizzes) between examinations. This hypothesis is further supported by the fact that the mean test scores are higher and standard deviations less for the quiz make-up group. In view of the limitations of the number of variables and data, however, hypothesizing beyond this point does not seem justified.

Conclusions

The purpose of this study was to report the results of the use of computer multiple choice quizzes with programmed learning feedback to generate student interest and participation in economics. Based on the 5-year average of 70 percent of those who voluntarily participated it would appear that interest was generated. It was difficult to evaluate how much of the

Table 2. Simple Correlations Between Term Grade and Other Grading Variables by Quiz Make-Ups and Non-Quiz Make-Ups¹

| | Quiz Make-Ups | Non-Quiz Make-Ups | |
|--------------|-------------------|---------------------|--------|
| Term Grade | vs. First Hourly | -.7080 ² | -.7906 |
| | Final Exam | -.7026 ² | -.8018 |
| | Second Hourly | -.6836 | -.6615 |
| Final Exam | vs. First Hourly | .5445 ² | .6464 |
| | Second Hourly | .5981 ² | .6803 |
| First Hourly | vs. Second Hourly | .5887 | .5995 |

¹ Any student who completed more than 50 percent of the extra credit quizzes was counted in the "Quiz Make-Up Group."

² Significant difference at 5 percent level.

participation was in an effort to increase grades and how much was oriented toward interest in learning.

No direct before/after measure of knowledge gained was attempted. One might expect, however, because of the repetitive nature of the concepts, the programmed learning nature, and additional exposure, that additional knowledge would be gained. In terms of practical applications, by taking the additional quizzes, a student would be exposed to a number of different applications.

Two generalizations seem justified. First, there was a measurable performance difference in grades between the groups who did and did not take the computer make-up quizzes. The mean scores of the three measurable examinations for the quiz make-up group were higher and all their standard deviations less than the non-quiz group. Although these results may be expected for term grade (because of the addition of quiz scores) there does not appear to be a good explanation why the final and hourly grades should be higher, and many indicate that some additional learning via the computer quizzes had taken place.

A second point is that there was a significant difference in simple correlation coefficients between the groups that did and did not take the make-up quizzes. Higher correlations with term grade were found in the non-quiz group. Although some of this difference can be explained by additional points added to the term grade, in terms of the second hourly, this explanation does not hold. It is possible that some additional variation in the make-up quiz group could be explained by the learning that took place via the extra credit quizzes although current data do not support this hypothesis.

Epilogue

As with many other tried and tested teaching techniques over the years, one is clearly led to the conclusion that there are very few panaceas in teaching for effective learning. Things that seem to work well for one group of students seem at best to work only marginally for others.

Educators seem to agree that almost all students need to be motivated to learn. Although motivation is very complex, it seems triggered by a large number of factors such as activity, curiosity, self-advancement, competition, increased knowledge, state of suspense, concrete form of reference, real work experiences, and others (Newcomb, 1980). In the sense of enhancing motivation, it would appear that computer multiple choice quizzes are helping students to learn.

A second point in the defense of computer learning in general (and computer multiple choice quizzing specifically) is that it provides a condition of rapid feedback and reinforcement, both of which contribute to the conditions under which students learn more and better (Newcomb, 1980).

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Notes

- 1 Computer Learning Quizzes were developed at the University of Notre Dame based on Samuelson's Economics (9th Edition).
- 2 For a good review of the literature and problems in measuring learning in economics see Siegfried and Fels.
- 3 The same computer make-up quiz test bank questions were used over the five-year period as well as the same procedure and grade incentive. Twenty-two individual quizzes were used on the rotating basis for the extra credit assignments. Since each extra credit quiz had to be handed in on hard-copy computer paper and each printout had the time and date printed on it, even if students had the correct answers they would have to work each assignment and select the answers one question at a time. In short, to obtain the extra credit at least some additional exposure would have to take place. It is also noteworthy if a student obtained 10 extra points on each quiz, it would only raise the total grade point by 3 points (.6 pts. per quiz x 5 quizzes). A maximum of three points on a total scale of 100 points would not seem a very strong grade incentive to do all extra credit quiz assignments.

CASE REPORT

Diffusing Low Energy Agricultural Technology To Florida Professionals

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Few subjects have generated such heated debate or prolonged public discussion as have the energy problems of recent years. Because of the United States' highly industrialized, energy intensive economy, and huge consumption of energy per capita (six times the world average), the economy has become highly vulnerable to foreign energy producers. In Florida the problem is particularly acute since the major income producing activities of the state — agriculture, construction, and tourism — are high energy demanding industries.

Florida's 13 billion dollar agricultural industry is characterized by its diversity; its concentration on fruits, vegetables, and ornamentals; its extensive

mechanization in the production and harvesting of specialized crops; and its heavy use of fertilizer, pesticides, irrigation, and drainage. On a per acre basis, Florida leads the nation in both total pesticide and insecticide use and ranks third in consumption of fertilizer. Florida agriculture, directly and indirectly, consumes approximately 97 trillion B.T.U.'s of energy, roughly 6 percent of the state's total energy consumption. Therefore, if Florida's agricultural industry is to continue to grow and contribute to the economic prosperity of the state and nation, a major effort must be directed towards improving agricultural technologies by making them less energy-intensive while retaining the high yields and quality necessary to compete in both United States and world markets (Delaney, 1978).

In the spring of 1979, the Florida legislature moved to assist the energy strained agricultural industry in the state by authorizing additional money to the Institute of Food and Agricultural Sciences (IFAS) at the University of Florida for research, development, and diffusion of low energy technologies (LET) in agriculture. As part of IFAS, the Department of Agricultural and Extension Education restructured some of its major goals in order to contribute to the diffusion of low energy agricultural technology. The thrust areas of the department were providing inservice educational programs; instructional materials development; and the development of an interdisciplinary course. The following is a brief description and discussion of the three thrust areas.

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