EVALUATING MULTIMEDIA AS A MEDIUM OF DELIVERY FOR LARGE GROUP ECONOMICS INSTRUCTION

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ABSTRACT

While the use of multimedia in introductory economic education is growing, economic educators need to continue to research the its impact on student learning. There have been very few studies that have measured the impact of multimedia-based instruction on the academic performance of students and on student attitudes towards economics. This study reports results from classroom experiments where a multimedia-based approach in teaching introductory economics was compared to the traditional lecture-based instruction.

INTRODUCTION

Proper and increased use of current technology in the classroom may help generate more student interest in undergraduate courses. Bartlett and King (1990) noted that economics instruction has not kept up with the tremendous pace of technological growth in computer hardware and software. Other economic educators have become dissatisfied with the "chalk and talk" method of instruction (Becker, 1997; Becker & Watts, 1996). Today's technology allows users to combine full motion and still video, audio, computer graphics, and text. This is referred to as multimedia. Multimedia has been recognized as a major advancement in personal communications and has become a phrase that is widely mentioned in the world of computing, media, training and instruction. It is having, and will continue to have, a tremendous impact on education and learning. Educators are of the opinion that multimedia can inspire students by making learning exciting and relevant, thus helping to keep students' attention and encouraging them to stay on task for longer periods than conventional methods of teaching (i.e., lecture and text). Graphic representation of economic models provides students an excellent visual stimulus (Khandker & Wehrs, 1990). The ability of multimedia to offer this graphical representation could therefore make it a popular instructional tool.

Brodman (1993) identified three aims of multimedia: to engage the learner, to offer real-life simulations, and to keep the learner's interest while they learn. This is accomplished by providing students the opportunity to interact with the computer. Karstensson and Vedder (1974) stated that greater gains in economic understanding are likely to be generated in those classes where students acquire a greater interest in the subject. Motivating and stimulating the students allow us to create greater interest in economics with undergraduate students. The use of multiple media offers real-life simulations and may keep students from getting bored and improve their academic performance.

There is very little empirical data that demonstrates the effectiveness of multimedia as an instructional tool. Much of the evidence for its benefits was based on the personal beliefs of the users and other anecdotal evidence. This study attempted to investigate these claims. Therefore, this study attempts to determine whether a statistically significant difference in academic achievement and student attitudes results from the use of multimedia based instruction when compared to the traditional economics instruction (i.e., lecture and text) in an introductory college economics class.

RESEARCH QUESTIONS

Most anecdotal evidence and early empirical evidence has found multimedia to be effective in teaching and learning. Since there are different types of learning styles, multimedia offers students to choose one or more modalities of learning content. Today's students are accustomed to learning in new and innovative ways. Simulations and other forms of multimedia bring the real economic world into the classroom. Multimedia should therefore have some, negative or positive, effect on achievement and attitude. The three research questions are:

1.	Is there a significant difference between treatments over and above the student ability, math comfort, student attitude, expected grades, student learning and motivation strategies, and student's prior economic knowledge when predicting student academic achievement in economics?

2.	Is there a significant difference between treatments over and above student prior liking toward economics, gender, expected grades, self-efficacy, test anxiety, self-regulation, and the post-frustration of students toward economics in predicting student's post-liking toward economics?
3.	Is there a significant difference between treatments over and above student prior frustration toward economics, gender, expected grades, self-efficacy, test anxiety, self-regulation and the post-liking of students toward economics in predicting student's post-frustration toward economics?

METHOD

The study was conducted at The University of Akron with students enrolled in two sections of an introductory course in economics in spring 1996. The same instructor taught both sections of the course. One of the sections was randomly assigned to be the control group and the other the experimental group. The experimental group received lectures with the aid of multimedia-based presentations. The control group received lectures that used overhead transparencies. Both sections were taught on the same day. The control group had class in the morning and the experimental section had the class in the afternoon. There were 137 subjects in the experimental and 192 subjects in the control group.

Data was collected on a number of student characteristics. The results of the differences between the control group and the experimental group are shown in Table 1. As Table 1 shows, expected graded was the only variable with significant difference between the two groups.

Table 1
Mean and Standard Deviation of Pre-Experimental Variables

Variables		Control	Experimental	t
Prior Knowledge	M	0.56	0.54	- 1.60
	SD	0.12	0.11	

GPA	M	2.81	2.79	- 0.77
	SD	0.57	0.59	
Expected Grade	M	9.10	9.45	2.16*
	SD	1.99	1.88	
Prior Liking	M	4.37	4.44	0.25
	SD	1.31	1.27	
Prior Frustration	M	4.57	4.76	0.16
	SD	1.26	1.29	
Math Comfort	M	4.88	4.94	0.03
	SD	1.33	1.40	
Self Efficacy	M	4.84	4.87	0.03
	SD	1.08	1.13	
Cognitive self- regulation	M	4.64	4.75	1.87
	SD	0.84	0.80	
Rehearsal	M	4.46	4.40	- 1.28
	SD	1.12	1.07	
Elaboration	M	4.77	4.85	0.94
	SD	0.97	1.00	
Test Anxiety	M	4.18	4.13	- 1.84
	SD	1.32	1.54	

Note. n size - Control = 192, Experimental = 137; except Posttest (Control = 182, Experimental = 129); GPA (Control = 186). *Significant at .05 level .

MEASURES OF PERFORMANCE

Student Attitudes Towards Economics

Background information about the subjects was initially collected. This instrument gave the researcher information on the students' math and economics

background, attitudes about economics and their course load for the semester, etc. The questions used to measure the attitude of the students were adapted from one previously developed to measure attitudes toward statistics (Schau, Dauphinee & Veechio, 1993). The survey measures student attitudes (liking and frustration) toward economics.

Academic Achievement of Students

A pretest and posttest determined the knowledge of the students at the start and end of the experiment. A content analysis helped determine the content validity of the instrument. Three experts ascertained whether the questions on the instrument sufficiently tested the objectives of the course content.

Student Motivation and Learning Strategies

The third instrument, the Motivated Strategies for Learning Questionnaire (MSLQ), helped to collect and document student motivation and their learning strategies (Pintrich, Smith, Garcia, & McKeachie, 1991). The MSLQ is divided into two sections: motivation and learning strategies. The motivation section consisted of 31 items, which among other things assess the goals of the students in taking the class and their beliefs about whether they would succeed in the course. The learning strategy section consisted of 50 questions regarding the student's use of different cognitive and metacognitive strategies and student management of different learning resources.

Pintrich et al. (1991) found the predictive validity for the motivational scales to have significant correlations with the student's final grade. The same was true of the learning strategy scales, with the exception of rehearsal strategies and the use of peer learning and help-seeking. These correlations were recalculated with data collected from this sample.

The reliability of the instrument for the six motivational scales is measured by the internal consistencies (Cronbach's alpha) that range from .62 to .93. Internal consistencies (Cronbach's alpha) for the nine learning strategy scales range from .52 to .80. These alphas were recalculated for the data collected. Below is a discussion of the Cronbach alpha coefficients, which measure the internal consistency of the variable. The coefficients show that students in the study answered most of the questions consistently.

The self-efficacy variable, which measures the confidence of an individual in performing well in the economics class, had a coefficient alpha of .92 in comparison to the .93 that was found in the *Motivated Strategies for Learning Strategies Questionnaire Manual* (Pintrich et al., 1991). The variable was based on eight questions that were asked on the questionnaire. An example of a statement that

measures self-efficacy would be: "I believe I will receive an excellent grade in this class."

The other motivational variable, test anxiety, which relates to one's worry about performance on a test, had an alpha of .78 in comparison to the .80 listed in the MSLQ manual. A sample of a statement on the MSLQ that measures test anxiety is: "When I take a test, I think about how poorly I am doing compared with other students."

The learning strategy variables in the study were rehearsal, elaboration and metacognitive self-regulation. The coefficient alpha of rehearsal was .64 in this study and was .69 in the manual. One of the statements that measured this learning strategy was: "When I study for this class, I practice saying the material to myself over and over."

Elaboration had a coefficient alpha of .72 in comparison to the .76 in the manual. An example of a statement that measures elaboration would be: "When I read for this class, I pull together information from different sources, such as lectures, readings, and discussions."

The last learning strategy variable used in this study was metacognitive self-regulation. The coefficient alpha scores were very similar for this study (.78) in comparison to the manual (.79). An example of a statement that measured metacognitive self-regulation was: "I try to think through a topic and decide what I am supposed to learn from it rather than just reading it over when studying for this course."

DATA ANALYSIS AND RESULTS

Regression models were used to test the hypothesis that Multimedia-based instruction has no impact on academic performance and attitude of students towards economics.

Academic Performance of Students

The effect on the posttest showed significance at the .05 a level, $\underline{F}$ (1,280) = 10.14, $\underline{p}$ = 0.13. The results (as shown in Table 2) show students in the experimental group did significantly better than those in the control group. However, the treatment the student received accounted for 3% of the variance in predicting posttest scores. The variable expected grade is significant. However, there seemed to be a difference in expected grades between the two treatment groups at the start of the treatment. The proportion of variance accounted for in predicting the posttest scores was small. (0.009).

Table 2
Summary of Regression Analysis for Variables
Predicting Posttest Scores (N = 291)

Variable	b	t	Probability Level	R^2
Prior Knowledge	0.37	5.10	0.01*	0.07
Section	0.05	3.14	0.02*	0.03
GPA	0.00	6.53	0.01*	0.12
Grade Expectations	0.00	1.63	0.05*	0.01
Post-Liking	0.01	2.80	0.01*	0.02
Post-Frustration	0.01	1.53	0.06	
Math Comfort	0.02	3.30	0.01*	0.03
Self Efficacy	0.00	0.80	0.34	
Cog. Self-regulation	- 0.01	- 1.28	0.19	
Rehearsal	0.00	0.23	0.99	
Elaboration	0.00	0.31	0.59	

Note. $R^2 = 0.48$. *$p < .05$.

Attitude (Liking) Towards Economics

The effect on the post-attitude showed significance at the .05 a level, F (1,320) = 10.79, p = 0.94. The results (Table 3) show the liking toward economics in both groups reduced, but it reduced more in the control group.

Table 3
Summary of Regression Analysis for Variables
Predicting Post-Liking Scores (N=328)

Variable	b	t	Probability Level	R^2
Prior-Liking	0.59	12.88	0.01*	0.33
Post-Frustration	0.22	4.94	0.01*	0.06

Section	0.33	3.14	0.01*	0.02
Gender	- 0.17	- 1.46	0.14	
Grade Expectations	- 0.07	- 2.36	0.01*	0.01
Self Efficacy	0.13	1.97	0.04*	0.01
Test Anxiety	- 0.01	- 0.40	0.68	
Cog. Self-regulation	0.10	1.33	0.18	

Note. $R^2 = 0.57$. *$p < .05$. An F test was used to analyze the data at a .05 Alpha level.

Attitude (Frustration) Towards Economics

The effect on the post frustration showed it was not significant at the .05 a level, F (1,320) = 0.25, p = 0.97. The results (Table 4) show the frustration toward economics in both groups decreased, but it decreased more in the control group.

IMPLICATIONS AND CONCLUSIONS

As discussed earlier, multimedia-based instruction was found to have a significant effect on student academic performance. However, the type of instruction accounted for only about 3% of the variance. The question that arises is whether multimedia is economically viable. Taking into consideration that using this method of instruction does involve high start-up costs, one needs to find out whether such an approach to instruction is worthwhile. It is our opinion that multimedia is indeed a viable option. One has to acknowledge the start-up costs on using such an approach are indeed very high in terms of equipment costs and time. But, once one gets past these costs, the advantages of multimedia do outweigh its disadvantages. Having course material in an electronic format would help in giving students access to class notes on-line. Instructors can make changes in their instruction at minimum cost. Albeit little, this study has shown that multimedia does indeed improve academic performance of students. Enhanced use of video, audio, and animation may further improve student academic performance. Researchers also have to reassess the use of traditional forms of assessment when innovative and new instructional tools are used. Becker (1997) concluded that standardized multiple-choice tests have not been successful in identifying differences in traditional learning environments. Katz and Becker (1999) suggested that researchers and economic educators look at other quantifiable measures to assess the impact of new technology on learning.

Table 4
Summary of Regression Analysis for Variables Predicting Post-Frustration Scores (N = 328)

Variable	b	t	Probability Level	R^2
Post-Liking	0.21	4.85	0.01*	0.06
Prior Frustration	0.54	10.07	0.01*	0.23
Gender	- 0.06	- 0.51	0.60	
Section	0.04	0.41	0.67	
Grade Expectations	- 0.03	- 0.97	0.32	
Self Efficacy	0.13	1.95	0.05*	0.01
Test Anxiety	- 0.10	- 2.31	0.02*	0.01
Cog. Self-reg.	0.00	1.07	0.99	

Note. $R^2 = 0.55$. *$p < .05$. An F test was used to analyze the data at a .05 Alpha level.

If students' liking toward economics diminishes less by taking an introductory course in economics that offers multimedia-based instruction, then it is likely that this will have an effect on enrollment numbers in higher level economics courses. This may also increase the number of students that pursue a degree in economics. Multimedia-based instruction could be used as a tool to attract students to economics.

There are implications for other courses taught in a way similar to that used as a sample in this study. There are many courses that have very high-class sizes and are required courses for all undergraduate students. Multimedia-based instruction for an introductory economics course is likely to have implications for other such courses in terms of student expectations. Once students are exposed to a multimedia-based approach to instruction, they may have similar expectations of other courses.

Electronic formats give students easy access to course materials. They can spend time in class trying to understand the material being taught, rather than writing notes or drawing graphs. This is especially useful for courses in economics where extensive use of graphs and diagrams confuse students.

Adaptation of new techniques such as multimedia can be used as an effective tool to fight teacher burnout. Teaching the same courses for many years can make

it difficult for instructors. Multimedia offers exciting avenues that will help avoid burnout.

Multimedia instruction can help increase the content of coursework. As mentioned earlier, electronic presentation formats allow for easy distribution of course materials. In traditional lecture-based courses, the instructor spends an inordinate amount of time waiting for students to copy graphs from the chalkboard or from transparencies. Electronic distribution would help instructors cover more course material in class and reduce the pressure of time on instructors.

Multimedia also has implications for faculty rewards. Solomon (1994) raised the question of whether innovative teaching practices such as multimedia-based instruction should count toward tenure and promotion. Acceptance of this notion may result in wider use of such innovative teaching techniques. Also, multimedia-based instruction is likely to affect teacher evaluations. Student evaluations could affect faculty remuneration, though the policy of study evaluations being criteria for faculty remuneration varies from department to department.

Implementation of multimedia-based instruction requires additional support staff. If done on a school-wide basis, faculty would need support for the maintenance and technical support of the hardware and software.

New and innovative methods of instruction such as multimedia can have implications on the way students learn and retrieve information. It can also help to connect prior knowledge with new information.

With the growth of multimedia and internet technologies in economic education, in our schools and universities, there is a need for continued research to study the impact of current technologies in economic education.

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