Computer Multimedia Instruction versus Traditional Instruction In Post-Secondary Agricultural Education

David L. Marrison, Graduate Assistant
Martin J. Frick, Assistant Professor
Purdue University

The use of microcomputers has increased dramatically in schools across the nation during the past decade. In 1981, there were only 31.000 computers in use in secondary schools. This number grew to over 325,000 by 1983 and has doubled every year since (Johnson, Johnson, & Stanne, 1985). As computer technology grows, educators must continue to seek out and find situations in which the use of computer applications are beneficial.

Newcomb, McCracken. and Warmbrod (1986) stressed that students learn what they practice. By operating computers to solve problems and learn instructional material, students obtain valuable experience they need to perform optimally in the agricultural work-place. Utilizing computer technology in the classroom also adds diversity to the presentation context. **A** relatively new dimension of microcomputer technology entitled, "multimedia" possesses the potential to influence student learning and knowledge acquisition. Multimedia is a multi-faceted approach to computer-based education that brings together text, graphics, animation, video, still images, audio, and motion video.

Sensing the vast capabilities of multimedia in the educational realm, computer companies have developed multimedia software packages that can be used as teaching tools by instructors. Multimedia serves as a trenchant teaching tool since it facilitates more complete use of a student's senses in learning. Multimedia instructional material allows the learner to actually see. hear, and use the content learned (Roden, 1991). Because multimedia software and hardware furnishes students with these experiences, it has the potential to be applied in a variety of educational settings. Hooper (1986, p. 3) cited the need for more research in her report on multimedia in education. She stated, "We need examples that make explicit the wide range of ways that sights and sounds can add to educational experiences, and specific evaluations on how these contribute to the learning process."

One can look at business and industry to see the impact of multimedia. Studies (Roden, 1991; Carlson & Falk. 1989) have shown that superior academic performance was achieved when multimedia forms of instruction were utilized. The Comsell Company found that multimedia students move through the learning experience 30 percent faster than in a traditional classroom (Roden, 1991). **A** Department of Defense study (cited in **Amthor,** 1991) also provided favorable findings for multimedia. When interactive video instruction was compared to more traditional methods of instruction, achievement was improved by over 38 percent while the time needed to teach the subject matter decreased by 31 percent.

A continual dilemma experienced by agricultural educators is how to respond to the changing face of society and stay abreast of the possible impacts that technology could have in the teaching-learning context. The potential use of computer multimedia in agricultural education settings is significant. Practical applications inherent to

agriculture make computer multimedia a good candidate for applying this technology to the teaching-learning situation. If agricultural educators can adapt and utilize multimedia technology as a new teaching tool, capable of improving students' ability to learn, then all individuals involved in agricultural education will benefit.

This study was conducted in an introductory agricultural economics course at a major land-grant university. Although this is not a traditional agricultural education context for research, it provides an appropriate setting for agricultural educators to learn more about a potentially innovative teaching tool. In agricultural education, we can strengthen our own discipline by studying relevant aspects of education in other agricultural settings.

Purpose and Objectives

The purpose of this study was to compare the effectiveness of computer multimedia that incorporated text, graphics, and still pictures as an instructional technique to a traditional instruction method. The main objectives for the study were to determine:

The effects of two different instructional techniques on academic achievement in the short-term and long-term.

Students' perceptions of computer multimedia instruction compared to their perceptions of traditional instruction.

The effects of computer multimedia when used as a supplemental study tool.

Procedures

Methodology, Population, and Sample

This study was planned and conducted using a pre-test-posttest control group experimental design. The population of this study was undergraduate students (N=75) in the School of Agriculture at a major land-grant university enrolled in Agricultural Economics 100 during Spring Semester, 1992. Agricultural Economics 100 is the introductory agricultural economics course. The population and subsequent sample was purposefully selected for the conduct of this study. The course was selected as freshmen in all majors in the School of Agriculture have the opportunity to enroll in this course. This population provided the researchers with a wide breadth and diversity of students from the School of Agriculture to be represented in the sample group. Students were randomly assigned to one of three experimental groups: 1) multimedia instruction only, 2) lecture instruction with multimedia as a supplemental learning tool, and 3) lecture only. Student absences prevented 22 students from completing all phases of this experiment, thus reducing the sample size for this study to 53 students.

Instrumentation

Instruments were developed to measure the dependent variables and to record perception, personal, and situational data. Data was collected using **a** demographic questionnaire, agricultural economics demand knowledge test, Multimedia Perception Questionnaire, and the Lecture Perception Questionnaire. Reliability coefficients were

calculated for the three achievement tests and the perception questionnaires using Cronbach's Coefficient Alpha. The achievement test instruments produced reliability coefficients of .63 for the pretest, .66 for the short-term posttest. and .68 for the delayed posttest. Coefficient Alpha of .93 and .49 were computed for the multimedia and lecture perception questionnaires respectively.

Administration

Prior to the pretest, the students were randomly assigned to a multimedia only group (Group I), a lecture group with multimedia supplementation (Group II), or the lecture control group (Group III) using the students' identification numbers and a table of random numbers. All students took the agricultural economics demand knowledge pretest and completed the demographic questionnaire during the class period preceding the first treatment segment.

All students then received instruction on the selected topic, "Demand Principles". Topics discussed in the instructional lesson included: definition of demand, marginal utility, factors that shift demand, and factors that change quantity demanded. Both the lecture discussion and computer multimedia instruction taught these concepts. The experimental group (Group I) did not attend the traditional class on thii topic; rather they were asked to work with the computer multimedia instructional packet. The students had up to 50 minutes to work with the multimedia program. Instructional time spent on the demand module for each student was kept both manually and through tracking procedures within the multimedia module. Upon completion of the computer multimedia instructional module. the students filled out a questionnaire to determine their perceptions of the computer multimedia module. The students in Group II attended the traditional lecture with the control group (Group III). The lesson demand concepts were 50 minutes long and were taught in the regular classroom by the agricultural economics instructor.

One week after the completion of the instructional unit, all students were given the agricultural economics short-term demand knowledge posttest. The students in Group II and III also completed the Lecture Perception Questionnaire at this time. Group II, the traditional group that used multimedia as a supplement learning tool. was then given a set of written instructions and had one week in which to work with the multimedia module in the computer center and complete the Multimedia Perception Questionnaire. The delayed demand knowledge posttest was given to all students three weeks following the instructional unit on Demand. The length of this study was 23 days from the initial pretest to the delayed posttest.

Analysis of Data

The data collected from this experiment were checked, coded, and entered into data files on the main frame computer. The procedures used to statistically analyze and summarize the data were as follows:

The Statistical Package for the Social Sciences (SPSSx) was used to analyze the data.

Dependent variable gathering instruments, including the pretest, posttests, and perception questionnaires were analyzed for reliability. Cronbach's Coefficient Alpha was used to estimate the reliability for this analysis.

Descriptive statistics, analysis of variance, multifactor analysis of variance, and inferential statistics were used to determine differences between treatment groups and pretest and posttest scores.

Questions on the perception questionnaires designed to elicit negative responses were recorded for data analysis purposes. Thus providing uniform responses for calculation of individual and group means.

Descriptive statistics and analysis of variance were used to analyze data of the perception questionnaires.

Paired T-test analysis was employed to determine differences between lecture and multimedia perceptions for Group II.

Results

Description of Sample

As previously stated, the sample size was decreased to 53 students due to attrition. Available SAT, pretest, and posttest scores of the students dropped from the study were analyzed and were determined not to be significantly different from those in the sample group. For this study, a majority of the student population (62.3%) was white male. No members of the sample group or population were minority students. All students were enrolled in the College of Agriculture. Agricultural Economics and Agricultural Education majors, respectively, made up 42 and 21 percent of the sample group. Undecided Agriculture majors composed 10 percent, Animal Science 8 percent, Agribusiness 6 percent, Agronomy 5 percent, Agricultural Management 3 percent, and Food Science, Ag Systems Management, Ag Communications & Pre-Veterinary composed the remaining 5 percent.

Academic Achievement Analysis

Using pretest and SAT scores, the treatment groups were found to be statistically equivalent at the .05 level. Using a three treatment by time of measurement repeated measures analysis of variance, test scores were checked for main effects and interactions. Results from this analysis indicated that the three groups did change over time as a time main affect did occur. However, a group by time interaction affect was not found. One form of treatment did not have a greater significant affect on the agricultural economics demand knowledge test. A comparison of the Group Demand Knowledge Test scores can be viewed in Table 1. It should be noted that the students using computer multimedia as the only instructional method moved through the instructional unit 32 percent faster. It was also revealed that the group which received multimedia as a supplemental tool did not significantly increase on delayed posttest scores when compared to the scores of the other experimental groups.

Student Perceptions of Computer Multimedia

Students in Group I and Group II completed the Multimedia Perception Questionnaire to ascertain their perceptions of the computer multimedia instructional method. This questionnaire consisted of 30 statements that gauged the students' perceptions of

Table 1. Pretest, Short-term Posttest. and Delayed PosttestScore Comparison

Score	Group I		Group II		Group III	
	Mean	SD	Mean	SD	Mean	SD
	n=15		n=22		n=16	
Pretest	41.73	17.53	45.18	19.89	43.50	21.84
Short-term Posttest	60.13	16.84	58.64	16.99	58.12	18.50
Delayed Posttest	64.27	18.20	67.82	14.42	61.87	16.16
Gain Pre=PT1	18.40		13.46		14.62	
Gain Re-PT2	22.54		22.65		18.37	
Gain PT1-PT2	04.14		09.18		03.75	

multimedia. The questionnaire was divided into subsets to allow for in-depth analysis of the following categories: multimedia as a study tool, multimedia features, computer multimedia as an instructional tool, general computer use. and attitudes towards agricultural economics. The students responded to the statements on a 5-point Likert Scale.

A two treatment one way **ANOVA** showed that the overall perceptions of students who received computer multimedia instruction as the only form of instruction were not significantly different from those students who used the multimedia module as a supplemental study tool. While the overall perceptions of the two groups who utilized the computer multimedia did not differ, item analysis revealed that they did significantly differ with respect to some of the questions. A complete list of these differences can be viewed in Table 2.

Table 2. Multimedia Perception Differences of Group I and Group II

Question	F-ratio	F-Prob.
#3 I would prefer to learn from the computer than a traditional class	7.68	.009**
#8 If given the choice, I would not want to learn from this type of program	8.21	.007**
#9 The graphs included in the multimedia program helped me to learn	5.39	.026*
#10 I would prefer to learn from a computer than read a textbook	8.27	.007**
#14 The computer multimedia module did not increase my understanding on the concepts of demand	4.17	.049*
#20 I could learn faster using this program than attending a lecture class	9.98	.003**
#21 The computer program was not an effective way to teach the concepts of demand	5.34	.027*
#28 Self-directed computer lessons are more exciting than lecture presentations	8.82	.005**

*Significant at the .05 level
**Significant at the .Ol level

In each of the corresponding values in Table 2, the students who used the computer multimedia module as a supplemental tool (Group II) had significantly lower mean values or feelings toward the computer multimedia module. When asked if they would prefer to

learn from the traditional class rather than from a computer multimedia module, Group II had a significantly lower mean rating (2.27, SD-1.16) whereas students in Group 1 rated learning from a computer higher at 3.33 (SD=l.ll).

Students in Group II also rated their preference for the use of the computer versus reading a textbook significantly lower when asked question #10. They rated this question at 3.23 (SD=1.31) compared to Group I's mean rating of 4.27 (SD=.59). Group I students also rated higher (question #8) when if asked given the choice would they want to learn from this type of program. Students in Group I had a significantly higher mean rating of 3.80 (SD=1.15) when compared to Group II's mean rating of 2.64 (SD=1.26).

These students also significantly differed from Group II students when asked to indicate if the graphs in the multimedia module helped them to learn. Group I students had a significantly higher mean rating than Group II as their mean ratings respectively were 4.13 (SD=.83) and 3.59 (SD=.59).

When asked about the effectiveness of multimedia instruction, students in Group II cited significantly lower mean ratings than Group I. Question #14 asked the students to indicate if they believed that the computer module helped increase their understanding of demand concepts. Group II students had a lower mean rating of 3.77 (SD=.92) as compared to a rating of 4.40 (SD=.91) for Group I students. Question #20 asked the students to estimate if they could learn faster using this program rather than attending a lecture class. Students in Group I rated this question higher at 3.60 (SD=.91) compared to a significantly lower mean average of 2.45 (SD=1.18) for students in Group II.

Question #21 attempted to ascertain **whether** the students felt that the computer module was an effective way to teach the concepts of demand. Once again students in Group I had a significantly higher mean rating of 4.27 (SD=.88) as compared to Group II's rating of 3.55 (SD=.96). Group I also believed self-directed computer lessons are more exciting than lecture presentations (question #28) as their mean score of 3.53 (SD=1.19) was significantly higher than Group II's 2.45 (SD=1.01) mean score.

Lecture versus Multimedia **Perceptions**

Students in Groups II and III were asked to complete the Lecture Perception Questionnaire during the first class period following the instruction unit to ascertain their perceptions of the lecture on demand concepts. The lecture questionnaire consisted of 10 statements that gauged the students perceptions of lecture. Questionnaire items were divided into subsets to allow for in-depth analysis of the following categories: lecture as an instructional tool. lecture as an instructional tool to teach demand, computer use. and attitude towards agricultural economics. The students responded to the statements using a 5-point Likert Scale.

A dependent paired T-test showed that the overall perceptions of computer multimedia and lecture instruction for Group II students did not differ significantly. These students did, however, significantly rate learning from lecture higher than from computer multimedia and indicated that they felt that the lecture instructional method was more exciting. These students also indicated that using the computer multimedia did not significantly increase their understanding of the demand concepts.

Qualitative Analysis

Qualitative analysis of the two methods of instruction, showed that the students had favorable responses to both approaches. Students were positive with respect to the computer multimedia and its value as a study tool. The students, however, issued caution that computer multimedia should never totally replace classroom instruction.

Conclusions

The findings of this investigation, revealed the comparative effectiveness of computer multimedia to traditional lecture instruction as student achievement was essentially equal when taught using the computer multimedia form of instruction as compared to the traditional lecture strategy.

Furthermore, it was found that computer multimedia instruction had no significant affect on student achievement on the agricultural economics demand knowledge test when used as a supplemental **study tool. It is the researcher's** contention, however, that since the computer multimedia module was strongly patterned after the lecture material, the module proved to be well modeled after the concepts learned in lecture. Student learning time was decreased by 32 percent when learning from the computer multimedia module with no significant effect on student performance on the demand knowledge test.

Students' perceptions were more favorable to the method of instruction they received first. Students learning from multimedia only preferred this method of instruction whereas the students who received it as a supplemental tool preferred to learn from lecture. Students qualitatively stated that they would like learning from both computer multimedia and traditional lecture situations. It was also stressed that computer multimedia would serve as a valuable supplemental tool to lecture.

Recommendations

Based on these conclusions, the following recommendations were made. Multimedia computer modules should be used by agricultural education teachers to supplement or replace a portion of traditional classroom instruction, thus allowing the teacher more time to attend to individual needs of students. The discipline of agricultural education also lends itself well to the use of computer multimedia because of the variety of courses and topics presented within the curriculum.

As this was a base-line study, there is a need for further research to substantiate these findings and to see if the findings are consistent in different agricultural disciplines. Future studies should also look at the impact of a more sophisticated (i.e., sound, animation, and motion video) computer multimedia module on academic performance and perceptions. The effect of using computer multimedia as a precursor to lecture should also be investigated as well as addressing the impact of computer multimedia in the secondary agricultural education classroom · where there may be more variability in academic performance and teaching abilities. Finally, teachers who utilize this technology should strive to identify learning contexts in which computer multimedia applications produce superior academic achievement and positive perceptions.

References

Amthor, G.R. (1991. September). Interactive multimedia in education. IBM Multimedia Magazine, pp. 2-5.

Carlson, H.L.. & Falk, D.R. (1989). Effective use of interactive videodisc instruction in understanding and implementing cooperative group learning with elementary pupils in social studies and social education. Theory and Research in Social Education, 17, pp. 241-258.

Hooper K. (1986). Multimedia in education: Summary chapter. (ERIC Document Reproduction Service No. ED 302 196).

Johnson, R.T.. Johnson, D.W., & Stanne. M.B. (1985). Effects of cooperative, competitive, and individualistic goal structures on computer-assisted instruction. Journal of Educational Psv ychogy, 77(6). 688-677.

Newcomb, L.H., McCracken, J.D., & Warmbrod, J.R. (1986). Methods of teach agriculture. Danville. IL: The Interstate Printers & Publishers, Inc.

Roden, S. (1991). Multimedia: The future of training. Multimedia Solutions, 5(1), 17-19.