Using Microcomputers in Teaching

Norman F. Rohrbach, District Supervisor
Missouri Department of Elementary and Secondary Education
Jefferson City, Missouri

Bob R. Stewart, Professor
Agricultural Education
University of Missouri-Columbia

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During the past 40 years, the United States has experienced the evolution of the computer into society. Progress has been made to the point that small, inexpensive computers with expanded capabilities are available for innumerable uses. Many schools have purchased and are purchasing microcomputers for infusion into their directed learning programs. Technology may have outrun planning in that the exact role of microcomputers in the teaching-learning process has not been well established.

Most individuals seem to agree that the microcomputer will hold an important role in education. Gubser (1980) and Hinton (1980) suggested phenomenal increases in the numbers of computers both in the school and the home in the near future. There are always problems with a sudden onslaught of new technology. Like any new tool that has not been fully tried and tested, the role of the computer is in question. How should the computer be used in the classroom? Should the computer be the teacher or used as a tool in the classroom in the same way as an overhead projector? Can teachers do a better job of teaching certain types of materials with the microcomputer than with conventional teaching methods? Will the microcomputer have different effects on students with varying levels of experience? Schmidt (1982) identified three types of microcomputer use in classrooms: the object of a course, a support tool, and a means of providing instruction. Foster and Kleene (1982) cite four uses of microcomputers in vocational agriculture: drill and practice, tutorial, simulation and problem solving.

The findings of studies examining the use of various forms of computer-assisted instruction (CAI) have been mixed. Studies by Hickey (1968) and Honeycutt (1974) indicated superior results with CAI while studies by Ellis (1978), Caldwell (1980) and Belzer (1976) indicated little or no significant effect. Research reported to-date has suggested that more studies be conducted to ascertain the effects of microcomputer-assisted instruction in teaching various subjects in a variety of learning situations. Therefore, this study was designed to provide data about the effectiveness of the use of microcomputers in teaching economic principles to graduate students in agricultural education. The information taught during the study related to the principles of cost recovery and investment credit on agricultural assets. This topic was identified as being of importance to teachers in providing them the necessary background to teach lessons in farm records.

Purpose and Objectives

The purpose of this study was to ascertain the effect of using microcomputer assisted instruction as compared to a lecture-discussion technique in teaching principles and methods of cost recovery and investment credit on agricultural assets to graduate students in agricultural education (Rohrbach, 1983). The general research question was:

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How does microcomputer-assisted instruction compare with a lecture-discussion technique in teaching principles and methods of cost recovery and investment credit on agricultural assets?

More specifically, the study attempted to answer the following questions:

1. To what extent is there a difference in the performance of students when one group is subjected to a lecture-discussion technique, a group of beginner-level microcomputer users is subjected to microcomputer-assisted instruction, and another group of intermediate-level microcomputer users is subjected to microcomputer-assisted instruction?

2. To what extent is there a relationship between the amount of time spent using the microcomputer-assisted learning modules and student performance?

Procedures

The study was conducted as a three-group controlled pre-experiment following the static-group comparison design (Campbell & Stanley, 1963). It involved the use of three experimental groups, including a control Group A, a treatment group consisting of beginner-level microcomputer users Group B, and a treatment group consisting of intermediate-level microcomputer users Group C (see Figure 1).

A Control n=21 persons	B Treatment n=25 persons	C Treatment n=16 persons
Lecture-discussion technique 2 two-hour class sessions Evaluation by written tests	Microcomputer-assisted instruction (no experience) Maximum of 4 hours for instruction Evaluation by written test Record of actual time used	Microcomputer-assisted instruction (intermediate experience) Maximum of 4 hours of instruction Evaluation by written test Record of actual time used

Figure 1. Design of the Study

Population

The population for the study consisted of graduate students in agricultural education at the University of Missouri-Columbia. Participants in the study were enrollees in courses offered through agricultural education at the University of Missouri-Columbia during the summer of 1983. This provided 21 students for control Group A, 25 students for beginning microcomputer Group B and 16 students for intermediate microcomputer Group C. The assumption was made that the participants represented a time, place sample of graduate students in agricultural education. Therefore, the findings and implications of the study should be generalized to the extent that future groups of students are similar to the participants.

Experimental Procedures

The 21 students designated as the control group were taught using a lecture-discussion technique. Forty-one students were divided into two treatment groups to receive microcomputer-assisted instruction. The class consisted of two sections with placement determined by previous microcomputing experience. Students with the ability to run and edit software programs were assigned to the intermediate-level group, and the remaining students were assigned to the beginners group.

Demographic data were collected from all subjects in relation to age, teaching experience, and knowledge and use of principles and methods relating to cost recovery and investment credit. Prior experience with the information was calculated on a nine-point scale.

Before receiving instruction, each group was introduced to the study by giving them the same orientation to the procedures to be used. It was explained that the learning sessions would be followed with a written evaluation on the material presented. They were told that the evaluation score would not count toward their grade in the course, but that it was important that they do as well as possible.

The classes comprising the control group were organized into two-hour class sessions. The instructor used two-hour sessions on two consecutive days for teaching using a lecture-discussion technique. The written evaluation was given during the first hour of the third day.

The treatment groups were given general instructions about operating the microcomputer learning program and were told they could spend a maximum of four hours in the laboratory working with the microcomputer-assisted instruction. The instructor who taught the control group was in the microcomputer laboratory to respond to questions and monitor student progress. Students were given two days to complete the task, were asked to keep a record of the amount of time used, and were given the written evaluation during a one-hour time period on the third day.

Development of Materials and Instrument

The materials used in teaching principles and methods in cost recovery and investment credit with the lecture-discussion method have been in place for three years and were the basis for writing a computer teaching program. The microcomputer learning modules, written in BASIC Language for the Apple IIe microcomputer, contained the principles, methods, examples, objectives, problems and so forth to be learned by students in the segment of the class devoted to cost recovery and investment credit. The modules were designed to present the concepts using the same problems and examples used in the lecture discussion procedure. All teaching materials and related microcomputer learning modules were checked for technical accuracy by a professor of agricultural economics responsible for preparing inservice materials related to tax law changes, a professor of agricultural education responsible for inservice education in farm management and a graduate research assistant in farm management.

The evaluation instrument used in the study was developed to measure the attainment of concepts in the learning package. The written evaluation was subjected to the Kuder-Richardson 20 test which yielded a reliability coefficient of .89. Validity of each question was established by a panel of experts with experience in teaching the concepts related to the material. There were 29 questions on the test which were worth one point each.

Statistical Analysis Procedures

Null hypotheses were developed to test the research questions of the study. A one-way analysis of variance was used to test the first null hypothesis of no difference in performance among the groups (Ho_1). Differences were isolated using the Scheffe' post hoc procedure. A Pearson correlation coefficient was used to ascertain the relationship between time spent on microcomputer-assisted instruction and student performance (Ho_2). Demographic data were examined to ascertain the homogeneity of the control group and experimental groups. An alpha level of .05 was used in testing the hypotheses. The data were analyzed with the Statistical Analysis System library computer package at the University of Missouri-Columbia (Ray, 1982).

Results

The age, teaching experience, prior experience with materials and time on task varied somewhat among groups as shown in Table 1. Time on task was held constant at 200 minutes for the control group, but ranged from 30 to 221 minutes for Group B and from 45 to 180 minutes for Group C.

Table 1

Characteristics of Participants

		Age (years)		Teaching Experience (years)		Relative Prior Experience With Materials		Time on Task In Minutes	
	N	Mean	Range	Mean	Range	Mean	Range	Mean	Range
Control Group A	21	29.8	22-53	5.9	0-25	4.29	0-9	200	200-200
Treatment Group B	25	33.0	22-44	8.4	0-17	4.08	0-9	112.2	30-221
Treatment Group C	16	35.6	24-50	11.4	1-24	4.81	0-9	90.4	45-180
Total	62	32.6	22-53	8.3	0-25	4.34	0-9	136.3	30-221

To help explain differences in student scores, correlational coefficients were calculated to ascertain if there were significant relationships between scores on the test and the subjects' age, prior experience with material, and years of teaching experience. As shown in Table 2, there was a significant positive relationship between prior experience or knowledge of the material and test scores (i.e., more prior experience influenced a higher test score). When prior experience

scores (from Table 1) were compared on a group-by-group basis, Group A was not found to differ significantly at the .05 level from Groups B or C (t values of .212 for A-B and 4.93 for A-C).

Table 2

Correlation Coefficients for Test Scores With Prior Experience With Material, Age and Years of Teaching Experience

	(n)	Prior Experience With Material (r)	Age (r)	Years of Teaching Experience (r)
Control Group A	21	.639	-.522	-.447
Treatment Group B	25	.670	.166	.239
Treatment Group C	16	.658	-.102	.040
All students	62	.563	-.242	-.162

Note. Critical value at the .05 level of significance=.25.

Each experimental group was given the same written test after being subjected to the lecture-discussion or microcomputer-assisted instruction sessions as outlined in the design and procedures of the study. Mean scores and general results from each of the three groups are presented in Table 3, and the results of the analysis of variance test are reported in Table 4.

Table 3

Test Scores of Control and Experimental Groups

	N	Mean Score	Standard Deviation	Low Score	High Score	Variance
Control Group A	21	21.19	4.996	11	28	24.962
Treatment Group B	25	14.16	5.080	7	26	25.807
Treatment Group C	16	16.25	6.923	7	29	47.933
All students	62	17.08	6.294	7	29	

Table 4

Analysis of Variance for Differences Among Control and Treatment Group Scores

Source	df	SS	F	PR<F
Model	2	578.990	9.29	0.0003
Error	59	1837.598		
Corrected Total	61	2416.597		

Testing the Hypotheses

Ho_1: There is no significant difference among the group mean scores for students when one group is subjected to the lecture-discussion technique, one group of beginner-level microcomputer users is subjected to microcomputer-assisted instruction, and one group of intermediate-level microcomputer users is subjected to microcomputer-assisted instruction (CAI).

The F value of 9.29, reported in Table 4, indicated a significant difference in group mean scores. Therefore, Hypothesis 1 was rejected. The Scheffe' test was used to isolate more specifically where those differences occurred. There was a significant difference between the control group and each of the CAI groups. There was not a significant difference found between the two CAI groups. The test scores from the control group were higher than from either treatment group.

Ho_2: There is no significant relationship between the amount of time utilized by the students with microcomputer-assisted instruction and students' test scores.

A Pearson correlation coefficient of -.016 indicated no significant relationship between time spent with the microcomputer-assisted instruction and test scores of students. Therefore, Hypothesis 2 was not rejected.

Conclusions and Discussion

The following conclusions were subject to the conditions and limitations of this study: (a) the lecture-discussion approach was more effective than the microcomputer-assisted instruction in teaching the application of principles and concepts; (b) experience with the microcomputer had no effect on test scores, so it appears that the microcomputer-assisted learning modules were as easy for the beginners to use as for the intermediate-level users; and (c) the amount of time spent by students subjected to the microcomputer-assisted instruction did not significantly affect their scores when given freedom to select the amount of time spent.

The influence of prior experience with the subject matter was examined in two ways. As expected, there was a positive correlation between experience and student scores. However, there was not a

significant difference for prior experience between Group A and treatment Groups B and C. Therefore, it did not appear that prior experience with subject matter was a confounding variable in this study.

The findings indicated that the lecture-discussion method of teaching was more effective than the microcomputer-assisted technique in teaching the principles and concepts presented under the conditions described. Given a choice, students in the microcomputer groups spent less time than did the students in the control group. Students in the control group were taught during regular class hours while the treatment groups participated during laboratory time.

Since most studies indicated that students using CAI have generally performed as well or better than students under conventional instruction, the implication is that the differences in performance found in this study should be carefully evaluated. The findings might have been different if all students had spent a minimum of four hours using the computer program. Additional studies should compare groups using a mix of traditional instruction and CAI and require groups to spend a specified amount of time on task. The challenge for agricultural educators is to better utilize the capabilities of microcomputer assisted instruction in the learning environment.

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people in the fields do rather than the names of the departments teaching the courses. The disciplinary nature of agricultural education will not be de-emphasized but will become a two-step process in which the students first learn some of the interesting career opportunities for agricultural graduates and then the names of the departments teaching these courses. The poster to be used for the event will have more verve and color than in the past, using abstract symbols associated with high technology. A minority outreach administrator has been hired through the dean's office whose job is to make contact with high schools with high minority enrollments. This year the college will be sharing costs with inner-city school districts of transporting high school seniors to Agricultural Sciences Field Day. The research unit has begun a collaborative project with the California Farm Bureau to evaluate their Summer Agricultural Institute intended to acquaint classroom teachers with the role of agriculture in the state's economy and, through the teachers, to reach students.

Recent problems connected with the so-called killer bees in California illustrate the ways in which a media event can be used to focus attention on important career options for students. Robert Washino, Chair of the UCD Entomology Department, is one agriculturalist who appreciated the media attention. He observed that "It makes young people see that entomology is an exciting area, and we need good young people in the field who have a background in economics, agriculture and entomology" (Jaffe, 1985).

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