1. At the University level there must exist a strong international program. Staff members are needed who can handle the many time-consuming jobs that have to be done with precision. Directors are needed who know how to assist a tour leader when trouble arises at some distant location.
2. A college international tour coordinating program is needed with sufficient power to accomplish a number of very difficult tasks.
   A. To encourage, assist and enforce if necessary the high quality of all college tours.
   B. To enlighten administrators and faculty on the tremendous advantage of a tour as an educational vehicle. Extremely important for the continued success of the tour program.
   C. To recruit competent tour leaders.
   D. To encourage tours on a regularly scheduled basis for continuity and planning purposes.
   E. To establish and encourage scholarship so that needy students may also participate.
3. Specifics on conducting a tour – a lot of which are based only on personal opinion:
   A. Specific or general tour – it is much easier to recruit students for a specific tour and they will be better satisfied with the results and the end of the tour; however, I am not sure which fulfills the greatest individual student needs.
   B. Route for successful recruiting of students:
      (1) Convince faculty advisors of the tremendous educational benefits. This can best be accomplished by a strong hard-working program. Do not waste time on "non-believers" since student feed-back and time are the only possibilities of their being converted.
      (2) Personally explain the tour in detail to recommended students on a one-to-one basis.
      (3) Let student in turn explain program to parents.
      (4) Make sure advisor, student and parents are all convinced of the program's opportunities before proceeding.
   C. Student faculty ratio – one faculty for 10-15 students. Of course a lower ratio would be better but costs make it prohibitive. For a specific type tour, larger groups should be subdivided into separate tours.
   D. Student age. Maturity is the important quality but generally a Junior college level is desirable.
   E. Two universities cooperating or drawing students from other schools to participate in a tour – this will work provided the following are accomplished:
      (1) Eductional standards as outlined are maintained.
      (2) One university should be in charge because bi-leadership on a tour might be disastrous.
      (3) The university supplying the students will need to be personally responsible for screening their participating students.
      (4) Some system has to be worked out for waiving out-of-state fees since it is to the advantage of both universities to have a cooperative system. This could be handled on an individual school basis, or a regional basis by some organization such as the Committee on Institutional Cooperation (Big Ten + U. of Chicago) or a special coordinating body may be needed.
      (5) It will work much better if coordination is between schools on the same academic system (semester vs quarter) and with approximately the same time schedule.
   F. Should on-campus and tour portion be separate courses? From an administrative standpoint this would probably be an advantage provided the pre-tour preparation is an absolute pre-requisite for the tour portion.
   G. Time spent – specific tour type – time spent on this tour was appropriate. I would under no circumstances reduce the pre-tour time. If the tour members were younger, I would reduce the time on the tour by one week.
   H. Cost – average second class works well with some modification for individual country variations. Pre-payment of two meals per day is desirable to relieve tour leader of some of the problems of student budgeting and starvation.
   I. Should culture be included in an Agricultural tour? The answer to this appears obvious since the culture has a major influence on the agriculture; however, a few students and many agriculturists are not convinced of the value of a culture exposure. It is probably fair to say that academic faculty in Colleges of Agriculture would rate the culture experiences to be derived from a tour of this type second to the academic discipline benefits when they consider time limitations. The students can be shown the relationship between culture and agriculture in the pre-tour preparations but some faculty members do not have this advantage. For these reasons, I would certainly include cultural opportunities on a free choice basis after the agricultural portion has been completed but I would not emphasize this portion of the education in the recruiting or post-tour seminar phase.
   J. Assistant tour leader – an assistance tour leader should be designated (I chose a graduate student) in case the tour leader becomes ill.
   K. Tour itinerary – areas of the world to be visited should not be too great a cultural shock for students involved. For the current, average, College of Agriculture student, I believe Western Europe is suitable. Some areas of the world are not different enough and many are much too different for a maximum learning experience for the student.

The agricultural tour will definitely change student as well as faculty outlook and I personally, believe for the better.

Go ahead and try it – if you don't have enough students to fill a tour contact other colleges for available slots for your advisees – all good Colleges of Agriculture will one day be participating in this excellent educational vehicle.

NACTA J. Manuscript No. 11/2/74/34

AN ANALYSIS OF STUDENT ATTITUDES AND PERFORMANCES IN THE USE OF COMPUTER ASSISTED INSTRUCTION FOR TEACHING PRODUCTION ECONOMICS

Glenn C. Himes and David E. Hahn*

[The use of Computer Assisted Instruction (CAI) for supplementing the traditional classroom and textbook presentations of production economic principles and the related cost concepts was evaluated. The study indicates that the use of CAI is an effective supplemental instrument that enhances the learning process of students.]

The beginning course in Agricultural Economics at The Ohio State University introduces the student to basic economic principles. It is a required course for most of the students in the College of Agriculture and in the School of Natural Resources, being taken during the student's freshman or sophomore year. The course is taught in sections of approximately 75 students, meeting five days per week with the same instructor. The approximate annual enrollment is 1000 students.

An important segment of the course deals with production principles and the related cost concepts. These concepts are difficult for many of our students to master. Many students, therefore, need a supplement to the text and classroom discussions to adequately grasp the material in the alloted time.

After consideration of a number of alternative methods, Computer Assisted Instruction was selected as the method for providing supplemental teaching of production principles. CAI met a number of important criteria:

1. It could provide realistic problem situations that reinforced the learning process;
2. It provided the opportunity for the student to schedule his own learning experience;
3. It permitted the student to proceed through the material at his own pace;
4. It provided comparable treatment of subject matter topics in a multisection course;
5. The programs could be authored by the instructors themselves;
6. The programs and language were very flexible allowing personalized interaction;
7. It provided extensive record keeping and evaluative capabilities; and
8. It provided a review tool for students enrolled in advanced courses in agricultural economics.

The CAI Program

The instructional material includes four major segments on the basic production principles and the related short run cost concepts. While these segments are logically sequential, each one is self-contained and may be taken independently of the others.

*Associate Professors, Department of Agricultural Economics and Rural Sociology, The Ohio State University

Following each learning experience, the student is questioned to learn if the concept was comprehended. Each answer is compared with known correct answers, anticipated wrong answers and unanticipated answers.

With a correct response from the student, the program branches into the next unit of the CAI materials. For an anticipated wrong answer or unanticipated answer, however, additional touring or explanation is provided. This amplification of the topic allows additional exposure to the material. The interface between the student and the computer is a teletypewriter terminal. However, the degree of typing skill required of a student is minimal as his answers are usually single words or numbers. The student may keep the typed copy of the questions and his answers for review.

Student Reaction

A study was conducted to evaluate student attitudes toward this program during the spring quarter of 1971. The primary objective of this study was to analyze student reactions and attitude changes brought about by exposure to the CAI materials developed for the course. The participating class consisted of 59 students; 53 males and 6 females.

In order that student reactions to the use of CAI could be analyzed, an attitude test was administered to the sample prior to and immediately following CAI exposure. Responses on a five point scale to the attitude statements after CAI exposure generally exhibited attitudes that were interpreted to be more favorable toward auto-tutorial instruction. Twelve of the eighteen statements showed a significant change in attitude at the 95% level or above (see Table 1).

Table 1. Attitude Statements and Mean Responses before and after CAI with T-Values for Difference in Means

Attitude Statement	Mean Before CAI	Mean After CAI	T-Value
1. I prefer the standard (conventional) form of education to auto-tutorial instruction.	2.186	2.831	3.564**
2. Auto-tutorial instruction helps the student conceptualize concepts better than lectures.	2.610	3.305	4.064**
3. Being able to ask questions in class is important.	1.542	1.407	1.262
4. I like the freedom auto-tutorial instruction provides.	3.596	3.898	2.282*
5. Most students would use auto-tutorial facilities much more if they were located in convenient places.	2.203	1.864	2.260*
6. I like being able to go to an auto-tutorial facility at my convenience rather than being required to go to a scheduled class.	3.729	3.627	.551
7. The use of auto-tutorial instruction is of little help to me since I cannot ask questions of it.	2.780	1.576	4.851**
8. Auto-tutorial instruction is better than teacher contact in learning routine concepts.	2.610	2.525	.479
9. I can learn more by studying my notes and reading the text than by going to a listening booth or some other auto-tutorial facility.	2.831	3.610	[illegible]**
10. I would like to be able to go to an auto-tutorial facility to learn basic information for my courses.	3.593	3.898	2.736**
11. Auto-tutorial instruction does not provide adequate individual attention.	2.339	3.169	5.247**
12. I would like to be able to go to an auto-tutorial facility to review basic information for my courses.	3.950	4.220	2.109*
13. Auto-tutorial instruction is probably a waste of my time.	3.610	4.237	4.676**
14. Computers provide many public services for our society.	4.217	4.458	1.714
15. Computers are too complex to be useful to me.	3.644	4.136	4.472**
16. I would like to take a course in computer programming.	3.085	3.169	.500
17. The computer devalues the importance of the individual in our society.	3.102	3.492	2.178*
18. Computers perform many routine tasks in our technological age.	4.136	4.271	1.227

** Significant at 99% probability level
* Significant at 95% probability level

The results in Table 1 show that the most significant difference in the means of pre-CAI and post-CAI responses occurred in attitude statement 11, dealing with the ability of auto-tutorial instruction to provide adequate individual attention. Comparison of the responses showed that thirty of the fifty-nine students in the sample had shifted toward agreement that auto-tutorial instruction does provide adequate individual attention after exposure to CAI.

After CAI exposure, only two students agreed with statement 13 indicating they felt auto-tutorial instruction was probably a waste of their time. After CAI exposure, thirty-three students responded that auto-tutorial instruction was a better use of their time than they had previously thought.

Statements 1, 2, and 9 compared auto-tutorial methods to standard or conventional forms of education. Responses to these statements after CAI exposure showed that the students still exhibited a preference toward conventional methods, but they were significantly more favorable toward auto-tutorial techniques.

Responses to statements 4 and 5 showed that the students agreed that they liked the freedom of auto-tutorial instruction and that most students would use auto-tutorial facilities much more if they were located in convenient places. They further agreed in statements 10 and 12 that they would like being able to go to an auto-tutorial facility both to learn and to review basic information for their courses. Also, the students were slightly less willing to agree that a) they liked being able to go to an auto-tutorial facility at their convenience rather than being required to go to a scheduled class or b) auto-tutorial instruction was better than teacher contact in learning routine concepts.

Responses to the attitude statements after CAI exposure generally exhibited attitudes that were interpreted to be more favorable toward auto-tutorial instruction. Analyzing these changes in attitude in terms of the face validity of the items suggested that CAI was a useful experience for the students.

Student Performance

A major concern with CAI was the degree to which it assisted students in the learning process. It was hypothesized that students utilizing CAI materials would have a better understanding of the material than students not having access to these materials. Examination scores were used as the measure of evaluation.

The four sections of the Agricultural Economics 100 course taught during winter quarter, 1973, were divided into two control and two treatment groups (Table 2). Each section contained approximately the same number of students.

Table 2. Experimental Design for Evaluating Effectiveness of CAI, The Ohio State University, 1973

Time of Class	Instructor	Treatment
9 a.m.	A	No CAI (Control)
10 a.m.	B	CAI (Treatment)
11 a.m.	A	CAI (Treatment)
2 p.m.	B	No CAI (Control)

The sequence of the control and treatment sections were reversed for each of the two instructors to eliminate any carry-over effect from one section to another. The classroom format was further standardized by using a common course outline and a coordinated set of lecture notes. A conscious effort was made by each instructor to offer an "identical course" between instructors and between assigned control and treatment sections.

Higher midterm test scores were achieved in the sections of the course utilizing CAI. The two sections not utilizing CAI had a mean test score of 60.6 (from a possible total of 84 points), while the two sections utilizing CAI had a mean test score of 64.9. This treatment difference was significant at the 1 percent level (Table 3).

Test scores were also evaluated to determine if a statistical difference existed between instructors. The mean scores for Instructors A and B were 61.8 and 63.5, respectively. This interaction effect was insignificant and indicates that the treatment effect existed independent of instructors. Hence, the students had a similar learning experience from each of the instructors.

Summary and Conclusions

The evaluation of student attitudes toward CAI revealed favorable student acceptance to this type of supplemental teaching method. Student performance measured by exam scores was higher for sections of the course utilizing the CAI materials. Because of these results, the program continues to be regularly used in the course and additional materials are being developed for this teaching method.

Table 3. Student Performance and Instructor Differences for Control and Treatment Sections of Agricultural Economics 100, The Ohio State University, 1973

Instructor		CAI	No CAI	Instructor Total	Instructor $\bar{X}$	
A	Class Size	51	66	117	61.8	
	Time	11 a.m.	9 a.m.			$F_{1, 261} = 1.05$
B	Class Size	83	65	148	63.5	
	Time	10 a.m.	2 p.m.			
Treatment Total		134	131	265		
	$\bar{X}$	64.9	60.6		62.8	

$F_{1, 261} = 6.76$

BIBLIOGRAPHY

1. Stitzlein, James L., David E. Hahn and Glenn C. Himes, "The Use and Evaluation of Computer Assisted Instruction for Teaching Introductory Principles of Production Economics," Department of Agricultural Economics and Rural Sociology, ESO No. 108, The Ohio State University, Columbus, Ohio, August, 1972.
2. Himes, Glenn C. and David E. Hahn, "Evaluation of the Use of Computer Assisted Instruction for Teaching Introductory Principles of Production Economics," Department of Agricultural Economics and Rural Sociology, ESO No. 158, The Ohio State University, Columbus, Ohio, August, 1973.

NACTA Manuscript No. 11/2/74/32

INCREASED LEARNING AND RELEVANCY IN A BASIC SOILS COURSE FOR TWO-YEAR AGRICULTURAL TECHNOLOGY STUDENTS[1]

Terence H. Cooper, Henry D. Foth, and Paul E. Rieke[2]

Learning accountability and forms of individualized learning have stimulated much of the recent research in education. Teachers are being challenged to account for the variability of students within their classes. Since learners vary widely in rate of achievement, interests, and motivation, methods of individualized instruction to account for these facts have been developed. Individualized instruction is not synonymous with providing individualized materials, but means "meeting the specific learning needs of each student" (3). Bjorkuist states that teachers are increasingly becoming managers of the learning process rather than dispensers of knowledge (2). With a properly managed individualized learning system, differences in the amount of student learning may be reduced, since students will be allowed their own learning pace and activities.

One of the key factors in the success of individualized instruction is the specification of objectives of instruction in behavioral terms. The most important characteristic of a useful objective is that it identifies the kind of performance which will be accepted as evidence that the learner has achieved the objective. This may be especially important in vocational education, in trying to produce a graduate who can be described to prospective employers in performance terms (4). The ability to describe in performance terms is directly dependent on behavioral objectives. For mastery of objectives to occur it is necessary that the slow learners be provided with more time to learn since over the same period of time slow learners will achieve fewer objectives that the high aptitude learner (2). In most situations, the amount of time required for the slow learner to obtain complete mastery is not available to him and he thus achieves less. Therefore, the responsibility of the vocational teacher is to manage the learning situation so that the slow learner can master the learning objectives and have some saleable skills at the end of a period of instruction. The true evaluation of a vocational training graduate will come when he has to prove his worth in the world of work.

Recent studies on the effectiveness of individualized instruction for vocational agricultural students in high schools (McCarley, 1969; McVey, 1970) have reported significant improvement over the lecture discussion methods for student achievement and course evaluation. In four-year degree programs in agriculture, favorable results have been obtained for individualized instruction in both the plant and soil science curricula (Green et al., 1973; Foth, 1973). An audio-visual tutorial program for presentation of course content was used in these studies.

Studies in Ohio have shown that the two-year student considers placement training and agricultural classes as the two most important factors for job placement after graduation (7). In the two-year agricultural technology programs at Michigan State University, it is known that there are wide ranges in capabilities among the students along with differences in psychological and motivational factors (5). Thus, many of the classes in the two-year programs at MSU meet the requirements for some form of individualized instruction.

This study was conducted to determine the effectiveness of an audio-visual tutorial, individualized learning program with a modified mastery learning format in basic soil science for the two-year vocational student.

Background to the Problem

Soil Science 051 is an introductory class in soil science required for the two-year agricultural student at Michigan State University in the turfgrass and landscape-nursery programs and is an elective for the floriculture majors. The class consists of approximately 100 students each year. Classes have been conventionally run by offering two lectures per week and one two-hour laboratory. Students in the class have shown a wide range in learning capabilities in three specific groups. In the past, it has been impossible to provide those students with slower learning capabilities all of the individualized help that they require to complete an understanding of the course. It has also been difficult to provide well-trained graduate teaching assistants with the necessary practical experience to be able to fulfill the student's desires for topical information. The learning facility available for the laboratories was mainly for a demonstration type of laboratory rather than an individualized learning experience.

Purpose of the Study

The main objectives of this study were to: 1) increase the relevancy of what the student learns in lecture and laboratory to the soil problems he will ultimately face on the job, 2) increase student achievement, 3) determine if the two-year agricultural technology student can learn effectively through the audio-visual tutorial mastery learning system, and 4) determine the

[1] Michigan Agricultural Experiment Station Journal Article Number 6893. This project was supported in part by a grant from the Educational Development Program, Michigan State University.

[2] Graduate Assistant and Professors, respectively, Department of Crop and Soil Sciences, Michigan State University, East Lansing, MI 48824.