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ABSTRACT

In 1980, Wichita State University received a grant to introduce microcomputers as interactive teaching tools in large science classrooms. Through this grant, 18 faculty in 11 departments developed software modules illustrating concepts that are often difficult to teach by usual lecture methods. To determine whether the use of microcomputers in large screen interactive demonstrations would promote more positive student attitudes towards computers, a questionnaire was administered to two groups of students (experimental and control) on a pre- and post-test basis. Students exposed to computer instruction (the experimental group) included 78 in engineering courses, 57 in chemistry, 47 in physics, and 18 in computer science. The control group consisted of 148 students enrolled in a non-microcomputer biology course. Part 1 of the questionnaire was a 17-item "Beliefs about Computers" scale designed to reflect students' general attitudes toward computers. Part 2 consisted of 12 items concerning the use of computers for instructional purposes. Statistically significant differences were found between the experimental and control groups on post-test belief scores supporting the notion that exposure to the microcomputers in classroom demonstrations fosters more positive beliefs about computers. Analysis of Part 2 items showed positive mean pre-post attitude changes on all 12 items, while a positive attitude change was noted for the control group on only one item. A list of six references and author biographies are provided. (JB)

Using Microcomputers Interactively in Large Classrooms

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Abstract

In 1980, Wichita State received an NSF CAUSE grant to introduce microcomputers as interactive teaching tools in large science classrooms. The goals and results of this project, now in its final year, include increased computer literacy of faculty and students, improved student attitudes toward computers, and development and utilization of imaginative software. This paper discusses the use of these programs in conjunction with Apple II+ microcomputers and large screen video displays to teach difficult concepts to large classes. The interactive nature of the project is illustrated with a videotape.

Introduction

Engineering students traditionally have learned computer skills on large, main-frame computer systems using punch cards and CRTs. Recently, microcomputers have been introduced as teaching supplements or alternatives to large systems. While micros are not suitable for solving complex engineering problems, they do possess other capabilities that make them ideal teaching tools, especially for first-time hands-on experiences. The current invasion of microcomputers on college campuses attests to the usefulness of these instruments in education.

In 1980, Wichita State received an NSF CAUSE award which afforded the university an opportunity to utilize microcomputers in a new and unique manner: as lecture tools in large science classrooms.[1] Through this grant, eighteen faculty in eleven departments have developed (or are developing) software modules illustrating concepts that often are difficult to teach by usual lecture methods. These modules, programmed in Applesoft BASIC for Apple II$^+$ computers, are projected on to large video screens for demonstration purposes. A chemistry instructor, for example, can graphically display Boyle's law; an astronomy instructor, the ages of stars; and an industrial engineer instructor, probability distributions (1). When programs are used during lecture to illustrate a concept, students suggest new values for variables, the instructor enters them, and then the students and instructor discuss the changes that occur. Thus, students become active participants in the learning process. In addition, the color graphics and animation capture the attention of video-game infatuated students in a way that traditional lecture often cannot.

The development and use of software as described above was a major goal of the project. The success of this goal, as well as that of two other goals - to increase the computer literacy of faculty and students, and to improve student attitudes toward computers - are discussed.

Software Development

During the fall semesters of 1980, '81, and '82 science and engineering faculty were invited to submit subproposals to a Science Education Development Committee requesting summer salary support to develop computer programs for their classes (see Fig. 1.) Early each spring semester, six subproposals were selected for support. Each awardee was supplied with an Apple$^+$ computer with disk drive and a color monitor, as well as disks containing development

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	First Funded Year			Second Funded Year			Third Funded Year			
Fall 80	Spr 81	Sum 81	Fall 81	Spr 82	Sum 82	Fall 82	Spr 83	Sum 83	Fall 83	Spr 84
	First Equipment Purchases			Second Equipment Purchases			Third Equipment Purchases			
preliminary and final subproject proposals	Selection of Sub-Projects	Familiarization, development	Implementation	Dissemination						
			Preliminary and final Subproject proposals	Selection of Subprojects	Familiarization, Development	Implementation	Dissemination			
						Preliminary and Final Subproposals	Selection of Subprojects	Familiarization, Development	Implementation	Dissemination

First Round of Subproposals

Second Round of Subproposals

Third Round of Subproposals

Figure 1. Timetable of Activities

programs. The familiarity of awardees with computers and programming varied widely, from those who had never used a computer to those with extensive backgrounds with computers (experience with computers and programming was not a primary factor in awarding subproposals.) Faculty were encouraged to become acquainted with their Apple during spring semester, to learn Applesoft programming, and to try their hand at graphics development. Programs developed during the summer were used in classes for the first time during fall semester. The eighteen faculty selected over the three year period represent the Departments of Biological Sciences, Chemistry, Computer Science, Economics, Electrical Engineering, Engineering Technology, Geology, Industrial Engineering, Mathematics, Mechanical Engineering, and Physics.

Subproposal awardees selected during the first two years of the project have developed a wide variety of programs. Most of the developers succeeded in producing more than one program, and some have collaborated with colleagues to produce interdisciplinary modules. The interest in development and microcomputers has resulted in many more than the original twelve proposed programs.

The success of the project can be measured in terms of quality as well as quantity. The project director, Dr. Richard Cornelius of the Department of Chemistry, has made existing Apple II programs, such as those on low and high resolution graphics and characters, more accessible and easier to use (2, 3.) Through the use of these developmental programs, awardees have produced imaginative and creative software, some of which has attracted national attention. The graphics and animation are particularly noteworthy. Project participants meet frequently, evaluating and discussing each others' work, offering suggestions and programming help. This interaction between participants - and nonparticipants, as well - has proved to be one of the most exciting outcomes of the project, and is in large part responsible for the high-quality programs that have resulted. Project software also has another important characteris-ic that contributes to its quality: programmers have attempted to thoroughly document programs and to include all information essential to their use.

Computer Literacy of Faculty and Students

When the project began in the fall of 1980, the majority of students and faculty at W.S.U. had not been exposed to computers. Since that time the original goal of introducing "microcomputer instructional techniques to a total of 2,000 students in introductory science courses per semester" and increasing the "expertise of the faculty in the use of microcomputing technology in the classroom" has definitely been achieved.

Colleagues of participants have adopted project software for their own course instruction thereby exposing ever larger numbers of students to microcomputer techniques. In addition, some of the software has been suitable for student use outside of class, and many students have been introduced to microcomputers in this manner. Obviously, not all students having first-time contact with computers have done so through this project; it is apparent, however, that the project has contributed significantly toward the computer literacy of Wichita State students.

Faculty who were not subproject awardees have benefited as well. Three "Microcomputers in the Classroom" conferences have been held on campus (4.) These one and a half day conferences, featuring software demonstrations by project participants and educators from across the state, have been open to W.S.U. faculty. Workshops on computer graphics conducted by the project director are well-attended and have provided faculty from all disciplines an opportunity to become acquainted with micros. Departments as diverse as industrial education, nursing, and graphic arts have been represented at workshops.

Through the project, nineteen Apple computers have been purchased. A portion of these are dedicated to subproposal awardees actively engaged in software development. The remaining microcomputers have been made available to all W.S.U. faculty and can be checked out for a week at a time. At the conclusion of the project, all nineteen computers become available for campus-wide faculty use. Video projectors and large projection screens have been installed in eleven large classrooms and auditoria across the campus making them accessible to all faculty interested in this mode of instruction.

Improved Student Attitudes Toward Computers

Many studies have been conducted involving computer based instruction (CBI) where students interact directly with programs through computer terminals. The literature on CBI with college students presents a generally favorable, though unspectacular, picture of the effectiveness of CBI on student learning and attitudes toward courses. This available literature, summarized in Bowman and Ellsworth (5), concerns research conducted with computers in a manner quite different from that developed during this project.

A primary goal of Wichita State's project was to determine whether or not the use of microcomputers in large screen interactive demonstration situations would promote more positive student attitudes toward computers and the use of computers for instructional purposes. Research literature on the effectiveness of using computers in this manner seems nonexistent.

To evaluate this goal, a non-equivalent control group design was used. Early in fall semester, 1981, two groups of students were adminstered a questionnaire on a pre and post test basis. These groups included classes where microcomputers and large video screens were used occasionally in group instruction as well as students in classes where microcomputers were not used. Students exposed to computer instruction (the experimental group) included 78 in engineering courses, 57 in chemistry, 47 in physics, and 18 in computer science.

The control group consisted of 148 students enrolled in biology courses.

The questionnaire used in the study consisted of two parts with students responding to all items on a 5-point Likert scale ranging from strongly agree to strongly disagree. Part I of the questionnaire was a 17 item "Beliefs about Computers" scale designed to reflect students' general attitudes toward computers such as "Computers are beyond the understanding of the typical person." One month test-retest reliability for this scale was determined to be .85 with internal consistency at .77. A more detailed description of the items on this scale and asssociated reliability and validity indices appears in Ellsworth and Bowman (6).

Part II of the questionnaire consisted of 12 items concerning the use of computers for instructional purposes such as "If I had to use a computer in my college course work it would make me nervous." Items from this part of the scale were analyzed individually. Two questions also were asked concerning whether the student had ever (1) taken a high school or college course where computers were used for instructional purposes (CBI) or (2) participated in a high school or college course in computer programming. This information was used as a control variable in analyzing the effects of microcomputer use on student attitudes. The detailed statistical analysis of the study (two separate 2 x 2 analyses of covariance) is discussed in Bowman and Ellsworth (5).

Statistically significant differences were found between the experimental and control groups on posttest belief scores supporting the notion that exposure to the microcomputers in classroom demonstration situations foster more positive beliefs about computers. Further support for this interpretation comes from an inspection of changes in belief scores by classroom instructor. Ten instructors participated, and in 8 out of ten instructional situations students demonstrated more positive beliefs, on the average, after the course was completed (one class showed no change and one demonstrated a slight negative change).

For Part II of the questionnaire all 12 items were analyzed individually for both experimental and control groups. In the experimental group positive mean pre-post attitude changes were noted on all 12 items while a positive attitude change was noted for the control group on only one item. Positive attitude shifts were not dramatic (often representing about 1/4 of a point on a five point scale) but the consistency of the experimental and control groups across all items lends further support to the belief that student attitudes are positively effected by the exposure they received to microcomputers in this study.

Conclusions

As Wichita State's CAUSE project, "Interactive Microcomputing in the Classroom", enters its final year, indications are that three of its primary goals are being accomplished. The computer literacy of the institution's students and faculty is being effected through the development of high-quality microcomputer software and its use in an interactive mode in large science and engineering classrooms. Positive student attitudes toward computers and their use in instructional settings are being promoted as well.

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Biographies

Dr. Barbara E. Bowman is Assistant Dean of the College of Engineering and Assistant Professor of Biological Sciences at Wichita State. Her research interests include science instruction in higher education. She was instrumental in establishing audio-tutorial instruction at W.S.U. as well as being involved with microcomputers in classrooms. Dr. Bowman is also project director of the NSF-funded Women in Science and Engineering Project.

Dr. Randy Ellsworth is Associate Professor of Educational Psychology at Wichita State. His teaching and research interests are in the area of statistics and research design. Prior to joining W.S.U., Dr. Ellsworth was associated with the Sarasota, Florida Public School System. His Ph.D. was awarded by George Peabody College of Vanderbuilt University.