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ABSTRACT

An individualized, computer-assisted instruction (CAI) program of courses in Algebra and General Mathematics was developed for ninth graders. The courses are "on-line", with students receiving instruction and their performances being recorded to direct the flow of instruction and to assign appropriate off-line instructional materials. On-line tests and remedial activities have been developed, and a procedure for providing feedback regarding course revisions has been devised. Local student teachers and classroom teachers in classes where the program has been field tested have also contributed to the course development. EM 011 037 through EM 011 043, EM 011 046, EM 011 047, and EM 011 049 through EM 011 058 are related documents. (SH)

Commonwealth CAI Consortium
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Course Development

The Algebra I and General Mathematics courses under development are directed to a ninth grade student population. The essential innovative feature of these courses is a tutorial instruction program under computer control. This "on-line" program is supplemented by a variety of more conventional individualized learning experiences.

The students receive basic instruction in mathematical concepts from the computer-assisted instruction program. A record of the student's interaction with the CAI program is stored in the computer. These performance data serve to direct the flow of the "on-line" instruction. The student whose performance indicates rapid acquisition of the mathematical concepts by-pass the detailed instruction required to bring a less able student to criterion.

In addition to controlling the flow of the CAI program, the student performance data enable the CAI classroom teacher to assign appropriate "off-line" instructional materials to meet the individual needs of each student. These materials include filmstrips, mathematical games, programed instruction materials, printed materials, and manipulative materials.

Professor Thomas Kieren, mathematics educator in the College of Education, has assumed the responsibility of authoring the unwritten chapters in algebra and general mathematics. He is assisted by Consortium staff members who have had experience teaching high school mathematics.

Tests have been developed for on-line administration at the end of each chapter of the algebra and general mathematics courses. The test items parallel the format and content of questions presented in the instructional portion of the program and the on-line quizzes. The chapter tests should be viewed as criterion tests for the chapters. If a student's performance is unsatisfactory, the areas of difficulty may be identified by the teacher and remedial activities prescribed.

On-line tests for chapters six, seven, eight, and nine for general mathematics and an on-line test chapter five for algebra were completed and sent to the schools. The completed sections of chapter six in algebra were also sent to the schools.

Two additional on-line drills were developed and sent to the schools for use with algebra chapter six. A student is to be assigned to the appropriate drill routine when the teacher's analysis of the performance records indicate the student's need for the drill. Each drill has three levels of difficulty containing randomly generated problems. A student progresses to a higher level of difficulty upon making a predetermined number of consecutive correct responses.

Course Correction and Revision

A procedure for providing feedback regarding corrections and revisions has been established with the Consortium personnel in Lincoln and Schenley schools. Errors in the on-line program are noted on a form by the teachers or systems managers in the schools. The forms are mailed to a member of the Penn State Consortium staff who is responsible for making the necessary corrections in the computer program at Penn State. Up-dated versions of the computer program are placed on magnetic tape and sent to the Lincoln and Schenley schools periodically. Urgent problems in the computer program are reported by telephone to Penn State. The necessary corrections to the program are determined and given to the systems managers at Lincoln and Schenley by telephone.

When a student signs off at the student terminal, a message is printed out at a typewriter proctoring the student terminals. This message contains data on the student's performance on the course material. A provision is made in the program for the teacher to enter comments about student performance or course irregularities. The comments are also printed out at the typewriter terminal. Copies of the typewriter printout are sent to Penn State from Lincoln and Schenley schools each week. The printouts are scanned for irregularities in student performance as indicated by the proctor messages and for teacher comments. When a proctor message indicates that students are having difficulty with a particular section of course material, appropriate changes are made to the program.

Data from Student Performance Records were compiled for eighteen students at Schenley and twenty-four students at Lincoln. An evaluation of these data served to identify questions with a high error rate. The incorrect responses were surveyed for clues to the reasons for the high error rate of a particular question. If the question was judged to be ambiguous, changes were made in the text of the question. In other cases, the information in the feedback to a response was revised. A series of related questions with high error rates suggested that the development of the corresponding concept needed revision. These were referred to the mathematics educators for future action.

Personnel

Student teachers from the mathematics education program in the College of Education at Penn State were assigned to Lincoln High School and Schenley High School for the Winter Term, January 5, 1970 through March 13, 1970. One student teacher was assigned to each CAI classroom teacher. The student teachers were given the opportunity to observe individualized instruction through the use of CAI. They also had the unique experiences of managing a CAI classroom. Consortium personnel used the experiences of these student teachers to determine the efficacy of utilizing student teachers in the proposed expansion of the CAI systems at Lincoln and Schenley for the 1970-71 academic year.

Informal reports by the student teachers indicate that they considered their experience in the CAI classrooms to be most rewarding. They acquired an appreciation for the efficacy of individualized instruction that was fostered by the utilization plan in effect in the CAI classrooms at Schenley and Lincoln schools. From the performance of the student teachers at Schenley and Lincoln, it will be recommended that student teachers be utilized in the proposed expansion of the CAI systems at Schenley and Lincoln for the 1970-71 academic year.

It was recommended at the conference of the Consortium CAI classroom teachers held on February 2-3, 1970 at University Park, Pennsylvania, that the four CAI classroom teachers should contribute to the course development. Specific assignments were made at that time. Miss Catherine Folger and Mr. Roland Lazzaro at Schenley are documenting needed revisions to the existing on-line program. They are also recommending off-line activities to supplement the on-line programs. Mr. Ray Ballo and Mr. Warner Johnson at Lincoln are authoring sections of chapter ten in general mathematics. The major portion

of chapter ten is being developed at University Park. This presents some difficulty because the material being authored at Lincoln is not pedagogically consistent with the development at University Park. The situation is compounded by the lack of communication between the two groups due to the remotness of the two operations.

Miss Sherry Posner, an undergraduate student in mathematics education at Penn State, selected and coordinated a variety of off-line activities with part of the algebra on-line program. She also developed off-line exercises with a beam balance to be used with the algebra program. Miss Posner is now student teaching at Lincoln High School

Facilities

An IBM 1500 system with eight 1510 instructional stations with typewriter keyboards and light pens and eight 1510 image projectors are operating in Lincoln and Schenley High Schools. The Consortium staff continued to use approximately fifty per cent of Penn State's CAI system during the present report period.

Schedule

Target dates for the current funding period:

March 1, 1970, to May 30, 1970:	Complete Chapters 6 through 8 in algebra and Chapters 10 and 11 in general mathematics.
November 15, 1969, to June 15, 1970:	Continue formal CAI mathematics education program at two high schools--Lincoln High School, Philadelphia, and Schenley High School, Pittsburgh.

Note to accompany the Penn State Documents.

In order to have the entire collection of reports generated by the Computer Assisted Instruction Lab. at Penn State University included in the ERIC archives, the ERIC Clearinghouse on Educational Media and Technology was asked by Penn State to input the material. We are therefore including some documents which may be several years old. Also, so that our bibliographic information will conform with Penn State's, we have occasionally changed the title somewhat, or added information that may not be on the title page. Two of the documents in the CARE (Computer Assisted Remedial Education) collection were transferred to ERIC/EC to abstract. They are Report Number R-36 and Report Number R-50.

Joe McCall; ERIC/EM