DOCUMENT RESUME

ED 076 045 EM 011 046

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TITLE	Commonwealth CAI Consortium. E.S.E.A., Title III.
INSTITUTION	Pennsylvania State Univ., University Park. Computer-Assisted Instruction Lab.
SPONS AGENCY	Office of Education (DHEW), Washington, D.C.
REPORT NO	PSU-CAI-R-32
PUB DATE	28 Feb 70
GRANT	OEG-0-8-055230-3479
NOTE	6p.; See Also ED 059 604
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	*Algebra; *Computer Assisted Instruction; *Curri um Development; *Grade 9; Individualized Instruction Mathematics Education; *Mathematics Instruction; Performance; Technical Reports
IDENTIFIERS	Elementary Secondary Education Act Title III

ABSTRACT

Algebra I and General Mathematics courses directed at a ninth grade population are being designed to include a tutorial program under computer control and a variety of supplemental learning experiences. Student performance data will not only control the flow of the program, but also will enable the classroom teacher to assign appropriate supplemental instructional materials to each student. Course revisions are accomplished through a monitoring of typewriter printouts by design personnel. (EM 011 037 through EM 011 043, EM 011 046, EM 011 047, and EM 011 049 through EM 011 058 are related documents.) (RH)

Commonwealth CAI Consortium

ESEA Title III Project No. 5523

Technical Report, February 28, 1970

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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.

A CAI course designed to teach the use of the slide rule has been sent to Lincoln High School and Schenley High School to supplement the existing CAI programs in algebra and general mathematics. The course was written by Mrs. Pearl Laird, a member of the Penn State CAI Laboratory staff and former instructor in the mathematics department at Penn State. The course will be made available to students in the Consortium algebra and general mathematics classes who, according to their teachers, are most likely to benefit from instruction on the slide rule.

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 on 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 department 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.

A conference of the Consortium CAI classroom teachers was held on February 2-3, 1970 at University Park. The purpose of the conference was to provide the teachers an opportunity to identify common problems encountered in CAI classrooms, to provide feedback for the Penn State Consortium personnel on the progress of the operation, and to establish priorities for developing new material based on the experience of the teachers with the program.

CAI teachers attending the conference were Miss Catherine Folger and Mr. Roland Lazzaro from Schenley, and Mr. Ray Bello and Mr. Warner Johnson from Lincoln. Dr. Sylvia Charp and Mr. Bernard Jacobs from Philadelphia and Mr. Ronald Confer from Pittsburgh also attended the conference. Dr. Thomas Kieran and Mr. Robert Igo represented Penn State. Dr. Harold E. Mitzel and Dr. Keith A. Hall were present during the planning session for the 1970-71 school year.

The on-line courses, algebra and general mathematics, were discussed in detail. Portions of the courses where students were having difficulty were identified. Recommendations for improving the courses in the areas so identified were discussed.

It was acknowledged that the off-line material was inadequate for portions of the program. This was particularly true for the algebra course. Recommendations were made to acquire more off-line materials. The teachers proposed that off-line activities be assigned by the on-line program more frequently than is currently being done.

Current student performance data retrieval was discussed. The present data gathering routines will be changed to provide data for a new performance record program to be developed by Fred Chase, systems manager of the Penn State CAI Laboratory.

The completion of the proposed course material was a major concern of the teachers. It was agreed that the CAI teachers at Lincoln and Schenley should participate in developing new course material for the unfinished chapters in algebra and general mathematics. The teachers accepted specific assignments for course development. The material to be submitted by the teachers includes the on-line instructional program, quizzes, tests, off-line assignments, and images for the image projector. The material will be edited by Dr. Kieran and Mr. Igo prior to being programed. No major revisions will be made to the submitted material without consulting the authors.

Evaluation

The proposed role of the CAI programs, algeb and genma, was to provide the main line of instruction in the CAI classroom. The CAI courses were to be supplemented by on-line drill programs and off-line activities prescribed by the teacher or the on-line program. The use of the on-line CAI programs may be evaluated by comparing the time students were on-line with the time available for instruction per class period. A comparison can be made of the average time on-line per class, the least time spent on-line by an individual, and the most time spent on-line by an individual with the time available for instruction per class period by schools, class periods, and courses from the data in Table 1.

Table 1

On-line Time in Minutes Through February 6, 1970

Course	School	Class Period	N	Total Time On-Line Per Class		Average Time On-Line Per Class	Least Time On-Line Per Class	Most Time On-Line Per Class
Algeb	Lincoln	1	16	19893		1243.3	875	1539
		3	15	17231		1148.7	918	1345
		5	16	18801		1175.1	1008	1327
		7	14	15947		1139.1	903	1273
					Mean	1176.5	926	1371
	Schenley	2	16	20995		1312.2	709	1545
		3	16	22543		1515.6	912	1755
		4	16	24249		1408.9	763	2030
					Mean	1412.2	795	1777
Genma	Lincoln	2	16	15523		970.2	416	1407
		4	16	14906		931.6	568	1154
		6	16	12236		764.8	257	1082
		8	15	12134		808.9	322	1340
					Mean	869.8	391	1246
	Schenley	6	16	21246		1327.9	522	1935
		7	16	18833		1177.1	418	1752
		8	16	18611		1163.2	499	2123
					Mean	1222.7	480	1937

Total time available for instruction per class through February 6, 1970

Lincoln - 4320 minutes

Schenley - 4275 minutes

The time available for instruction per class was determined by multiplying the number of days the schools were in session by the length of the class period. The time spent on-line was obtained from the Weekly Performance Summary. The Summary provides a record of the total time each student was on-line from the beginning of the course to the time the Summary was acquired.

It should be noted that the time available for instruction is not an absolute. It is subject to such variables as shortened periods for assemblies, administrative details, fire drills and other non-instructional activities.

The on-line drill time is not included in the time spent on the algeb or genma on-line programs.

Facilities

An IBM 1500 system with eight 1510 instructional stations with typewriter keyboards and light pens and eight 1518 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:

November 15, 1969, to February 28, 1970:	Complete Chapters 5 through 8 in algebra and Chapters 10 and 11 in general mathematics.
November 15, 1969, to February 28, 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.

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