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ABSTRACT

The University of Delaware's work with computer-based instruction since 1974 is summarized, with attention to the history and development of the Office of Computer-Based Instruction, university applications, outside user applications, and research and evaluation. PLATO was the system that met the university's criteria, which included: supporting instructional strategies such as gaming, testing, and self-paced instruction; a library of computer-based learning materials; a programming language that was easy to use; a student record-keeping capability to support educational research; computer graphics; and overall system reliability. Information is provided on credit and noncredit courses using computer-based instruction during 1983-1984. Activities of the 37 departments using computer-based instruction are summarized, and sample lessons and photographs are provided. Outside user applications are also described, including pre-college demonstrations and programming courses and courseware development. Materials include: a list of published lessons, a list of 1983-1984 conference and workshop presentations, a student evaluation form for PLATO, abstracts of computer-based education developments, and a catalog of PLATO and microcomputer programs under development. (SW)

Outline History of the Office of Computer-Based Instruction

Fall, 1974
- PLATO Project established following deliberations of the University's Computer Applications to Education Committee

Spring, 1975
- First authoring terminal installed
- Coordinating committee of faculty members from seventeen academic areas formed to demonstrate system
- Three student assistants hired
- Author training seminars begun
- Proposals from University departments solicited
- Ten departmental proposals submitted

Agriculture	Home Economics
Art	Music
Computer Science	Nursing
Continuing Education	Physical Education
Education	Sociology

Summer, 1975
- Ten departmental proposals approved
- Eight part-time student programmers hired

Fall, 1975
- Second authoring terminal installed
- Number of departments increased to fourteen
- First full-time professional programmer/analyst hired

Spring, 1976
- Number of authoring terminals increased to eight
- Proposal for twenty-four student terminals submitted and approved
- Student programmers increased to twelve
- New projects started in

Communications	Physics
Curriculum and Instruction	Psychology
Languages	Upward Bound

- Music organizes national consortium that becomes special interest group in ADCIS

Summer, 1976
- First Summer Institute in Computer-Based Education held for Delaware public school teachers; funded by the Delaware School Auxiliary Association
- Second professional programmer/analyst hired

Fall, 1976
- PLATO classroom established in room 009 Willard Hall Education Building
- Number of terminals increased to twelve
- New projects started in statistics and theatre

Spring, 1977
- Number of terminals increased to thirty-two
- Six student programmers promoted to junior programmer/analysts
- University of Delaware PLATO Project hosted the 1977 National Convention of the Association for the Development of Computer-based Instruction Systems
- Faculty Senate held open hearings on PLATO
- New projects established in

Chemistry	Honors Program
Counseling Center	Professional Services
Economics	Reading Center
Educational Foundations	Speech
French	

Fall, 1977
- Assistant to the Director hired
- Number of terminals increased to fifty
- New projects in

Anthropology	Military Science
English	Writing Center
Mathematics	

- Project selected as one of ten exemplary case studies in academic computing by HumRRO
- Dover site established in the Honors Center

Spring, 1978
- New projects in civil engineering and accounting
- New site established in Smith Hall
- Installation of the Delaware PLATO System (CYBER 173), officially accepted on St. Patrick's Day, March 17, 1978
- Funding granted by National Science Foundation and Delaware School Auxiliary Association for the second Summer Institute in Computer-Based Education for public school teachers in Delaware and surrounding states

Fall, 1978
- New site established for psychology
- New projects started in biology and sociology
- Staff additions of a senior electronics specialist, a user services coordinator, and two analyst trainees
- University awarded FAA services contract by the GSA
- Number of terminals increased to seventy-five on campus
- Central system resource doubled in capacity

Spring, 1979
- New projects in health education and microcomputing
- New sites for nursing and physical education
- Grants received from the National Science Foundation for projects in psychology and chemical engineering, and for the 1979 Summer Institute in Computer-Based Education for teachers of mathematics, chemistry, physics and social sciences
- Grant received from the Delaware School Auxiliary Association for the 1979 Summer Institute for the Teachers of Biology and Business
- College of Human Resources founds home economics interest group in ADCIS

Fall, 1979
- New site established in Drake Hall
- New projects started in political science and UDELI (University of Delaware English Language Institute)
- Staff additions of a manager, a peripheral design engineer, a PLATO services consultant, and four junior analysts
- New Castle County School District receives University Cooperative CBE grant from HEW
- Number of terminals increased to 120 on campus and 60 off campus

(continued on the inside back cover)

ACKNOWLEDGEMENT

The writing of this Ninth Summative Report has involved the work of many faculty and staff members at the University of Delaware, and I would like to acknowledge their efforts. To the 192 faculty members who are designing and implementing computer-based learning materials, I am grateful for the content of the applications section of this report. Their interest in using computer-based techniques to improve instruction has resulted in a library of high-quality lessons of which they can be very proud. I am also grateful for the dedication and expertise that the OCBI staff has shown in programming and administering the University's computer-based learning programs.

Many staff members helped write this report. I am grateful for the time they spent collecting and organizing information about their projects. A special note of thanks is due Patricia Harris, Kenneth Gillespie, Clella Murray, Mia Jones, Tim Byrne, Kathie Lyneis, and Jonathan M. Danoff for the many hours they spent editing and word processing this report. I really appreciate it.

Fred T. Hofstetter
Director

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INTRODUCTION

This Ninth Summative Report of the Office of Computer-Based Instruction (OCBI) summarizes the University of Delaware's work with computer-based instruction since 1974. Like previous summative reports, it concentrates mainly on developments of the past year. More information on the events of previous years can be found in prior summative reports, which are available from OCBI. The outline history that is printed on the inside front and back covers of this report provides a helpful list of the main events in each year.

If one were to characterize 1983-84 with a single phrase, it would be "The Year of the Micros." OCBI began its work with microcomputers in 1981 when it installed a laboratory for in-service teacher preparation under a grant from Apple®. Faculty members used the Apple laboratory for University courses, and they also included microcomputers in the publication sections of courseware development proposals as a way of disseminating CBI lessons to schools that do not have access to PLATO®.

In 1984 the University published its first two microcomputer products. The Latin Skills package, authored on PLATO from 1977 to 1982 by Professor Gerald Culley, was converted to run on the Apple, where a light pen substitutes for PLATO's touch panel. There are five programs in the Latin Skills package. Each program adjusts to the skill level of the student and increases in difficulty as the student learns. Instead of storing test questions in a data base, the programs contain a grammar generator that can produce millions of questions and "intelligent" responses to errors. The Latin Skills package can be ordered with a curriculum that is keyed to any one of six Latin textbooks.

Under a grant from Atari®, OCBI developed the first two modules of the AtariMusic Learning Series. AtariMusic I deals with note reading, whole steps, and half steps, and AtariMusic II teaches major scales, key signatures, and melodic dictation. There are four main menus. Each menu consists of a set of lessons and a game. The lessons contain tutorials, simulations, drills, and competency-based tests. The games are based on outer space themes and encourage students to sharpen and quicken the skills learned in the lessons. A joystick takes the place of touch on the Atari.

Substantial progress was made during 1983-84 on the micro conversion of three other PLATO packages. Professor Clifford Sloyer's mathematics enrichment package, which was developed under a grant from the National Science Foundation, will be published for the Apple; the University's Library Skills package is being converted for the IBM PC; and Professor Stanley Sandler's thermodynamics lessons are being programmed for the IBM PC.

To support the growing number of CBI lessons developed in engineering for the IBM PC, an Ethernet communications network was designed for the Departments of Chemical Engineering and Mechanical and Aerospace Engineering. This network will allow the IBM PC's to communicate with each other and with a centralized file server on which CBI lessons reside. At present there are ten IBM PC's in each department; the Ethernet will connect the PC's together by means of a coaxial cable.

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Microcomputers were integrated with the University's CBI mainframe when the PLATO system expanded from its former non-standard communication scheme to include an ASCII format. ASCII stands for American Standard Code for Information Interchange and provides a way for computers to talk to each other. In addition to providing communications for student terminals, the ASCII ports allow microcomputers to connect to the PLATO system. OCBI currently supports IBM PC, Zenith, and Atari microcomputers; a Macintosh PLATO emulator is scheduled to be available from Control Data later this year; and OCBI plans to support the Macintosh in 1984-85.

According to its philosophy of programming and evaluating materials on large systems before running them on stand-alone microcomputers, OCBI continued to develop lessons on VAX and PLATO mainframes. Under a grant from the Digital Equipment Corporation, a demonstration of lessons running in the Courseware Authoring System (CAS) was completed and debuted on a VAX at the 1984 ADCIS meeting in Columbus, Ohio. Programming of the College of Arts and Science Academic Advisement System was completed on the PLATO system under a FIPSE grant directed by Professor Peter Rees. Under OCBI's annual call for proposals, twenty-two faculty projects were supported. Of these, fourteen are on PLATO, three are on the VAX, and five are on microcomputers.

Over the years, OCBI has fostered the growth and development of national associations for computer-based learning. The mathematics, home economics, and music interest groups in the Association for the Development of Computer-Based Instructional Systems (ADCIS) were started by Delaware faculty members who have also served as officers in the association. In 1983-84, OCBI turned its attention to improving communication on a more local basis by forming the Greater Delaware Chapter of the Association for Educational Data Systems (AEDS). Roland Garton, an OCBI Project Administrator, is the first elected president of the new chapter, which includes Delaware teachers, faculty members, administrators, and directors from the Department of Public Instruction.

As 1983-84 draws to a close, OCBI is planning an upgrade of the University's student learning stations. Terminals that have been restricted to PLATO operations will be replaced by state-of-the-art microcomputers that can access the ASCII PLATO communications equipment. Students will be able to use the new machines as PLATO terminals or as microcomputers in their own right. The year of the micros will thereby extend its influence into the decade ahead.

Information about these and many other CBI projects are contained in this Ninth Summative Report, which is divided into four chapters, namely, "History and Development," "University Applications," "Outside User Applications," and "Research and Evaluation." The appendix contains a catalog of courseware under development at Delaware.

CHAPTER I. HISTORY AND DEVELOPMENT OF THE OFFICE OF COMPUTER-BASED INSTRUCTION

Background

The Office of Computer-Based Instruction has its origins in deliberations of the University's Computer Applications to Education Committee during the fall of 1974. The committee planned a series of seminars and demonstrations for the purpose of making available to the Delaware faculty information on how a computer-based educational system may function in a university, and of evaluating what part such a system might play in the future of the University and its supporting community. A major portion of the committee's planning consisted of the review and selection of a computer-based educational system which could support the demonstration. The criteria used in making the selection provide a summary of what the University is looking for in a computer-based instruction system. These criteria require that such a system contain the following elements:

1. An overall system design that can support many instructional strategies such as gaming, simulation, testing, drill-and-practice, and self-paced programmed instruction

2. A library of computer-based learning materials encompassing many academic areas

3. A programming language that is both easy for faculty members to learn, and at the same time powerful enough to support instructional computing

4. A student record-keeping capability to support educational research in student learning behaviors

5. High-speed interactive graphics for both textual and pictorial displays

6. A very good overall system reliability

The only system that met these criteria in 1974 was PLATO, and with the installation of the first PLATO terminal on March 14, 1975, the Delaware PLATO Project began. A committee of faculty members selected from seventeen academic areas coordinated demonstrations of PLATO for each of the respective areas, encouraged interested faculty members to enroll in a seven-week seminar on author training, and solicited proposals from each college regarding the implementation of existing courseware and/or the development of new PLATO programs. By the end of May, nine departments had proposed to develop materials and to try out PLATO with students.

During the summer of 1975 the proposals were approved, and the University ordered seven additional PLATO terminals to support program development. The first full-time professional PLATO programmer/analyst was hired to teach PLATO seminars and assist faculty members with difficult programming problems, and eight part-time student programmers were employed to help write programs for individual departments. The Project was held back somewhat by the amount of lead time needed to procure the additional PLATO terminals. One terminal was available right away, and was installed in September of 1975. However, the other six took longer to procure and were not installed until February of 1976.

This delay prevented large-scale development of PLATO programs during the fall of 1975, when the two available terminals were used mainly for lesson review, demonstrations, author training, and planning the development of new material. During this period the faculty committee refined its PLATO proposals and made plans for the first large-scale use of PLATO with Delaware students to begin during the Fall Semester of 1976. On February 2, 1976, the committee submitted a proposal requesting the procurement of twenty-four terminals for student use. On April 28, 1976, this proposal was approved.

During the spring and summer of 1976, the faculty continued to prepare materials for student use. Utilization of the eight authoring terminals was high, averaging about sixty hours per terminal per week. PLATO continued to generate new interest, and by the beginning of the Fall Semester there were sixteen departments planning to use the student terminals. However, the Project was held back again because of the long lead time needed to order terminals and the care which had to be taken in negotiating a fair services contract for the University. In September the Project grew to a total of twelve terminals to support both development of programs and student use of PLATO during the Fall Semester of 1976. It was not until March 15, 1977, midway into the Spring Semester of 1977, that the Project reached the desired level of twenty-four student terminals and eight authoring terminals.

During the summer and fall of 1977, faculty members began to use PLATO in larger portions of their classes. In addition, the PLATO Project generated new interest in departments that had not previously used PLATO. The number of departments involved increased to a total of twenty-eight, and the average utilization of the thirty-two terminals exceeded sixty hours per terminal per week. In order to serve the dual purpose of reducing the level of frustration in getting to a PLATO terminal by lowering the average number of hours each terminal was used per week, and also to provide some growing room for the departments which had just begun using PLATO, it was decided to increase the number of terminals from thirty-two to fifty in preparation for the Spring Semester of 1978. Increasing the Project to a level of fifty terminals brought the University to a decision point regarding the future of the Delaware PLATO Project, because cost analyses had shown that once the Project grew to above forty-eight terminals it would become more economical for the University to purchase its own PLATO system than to lease services by means of long-distance communications lines.

Based on the steady growth which the Project had enjoyed since its beginning in March of 1975, and based on the encouraging results from controlled evaluations and studies of student opinions regarding the usefulness of PLATO in higher education, the University of Delaware purchased its own PLATO system from the Control Data Corporation. The system was delivered at the University of Delaware Computing Center on January 31, 1978. After the machine was assembled, powered up, and run through a long series of performance tests and acceptance tests, it was officially accepted on St. Patrick's Day, March 17, 1978.

The Delaware PLATO system uses a recent line of computer hardware offered by the Control Data Corporation. Based on a CYBER® 174 mainframe, it was initially configured to serve a load of 100 simultaneous PLATO users, with one central processor, ten peripheral processors, 98,000 60-bit words of central memory, 500,000 words of ECS-II (extended core storage), four dual-density disk drives, two tape drives, and two remote job entry stations.

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During the 1978-79 academic year, the number of PLATO terminals on the Delaware campus was increased from fifty to seventy-five, and the Project's outside user base also continued to grow, resulting in the need for enlarging the central system. On October 15, 1978, 32,000 60-bit words of central memory, 500,000 words of ECS-II, and four dual-density disk drives were added to the system resulting in a doubling of its capacity. During the 1979-80 academic year, the number of terminals in use on campus grew to 120, while the total number of terminals served by the system grew to 180. A second peripheral processing subsystem with four peripheral processors was added to the central system in order to handle increasing input-output needs.

In 1980-81 the one million words of ECS were replaced by two million words of extended semiconductor memory. Three peripheral processing units, a high-speed tape drive system, and an 885 mass storage system were added to provide greater capacity for research, faster and more extensive backups, and room for new users. The number of terminals on campus increased to 132, bringing the total number connected to the system to 228.

During 1981-82, the number of terminals on campus increased to 195, and the total number connected grew to 335. In order to support this expanding user base, a second processor and a second 885 mass storage system were added to the PLATO system. Due to the loss of a federal contract whereby the University was providing 71 PLATO ports to the Federal Aviation Administration (this contract was won by Florida State University in a competitive bidding situation), no new PLATO hardware was needed in 1982-83. By the end of 1983-84, there were 230 PLATO terminals on campus and 93 terminals in the outside user base for a total of 323 active ports.

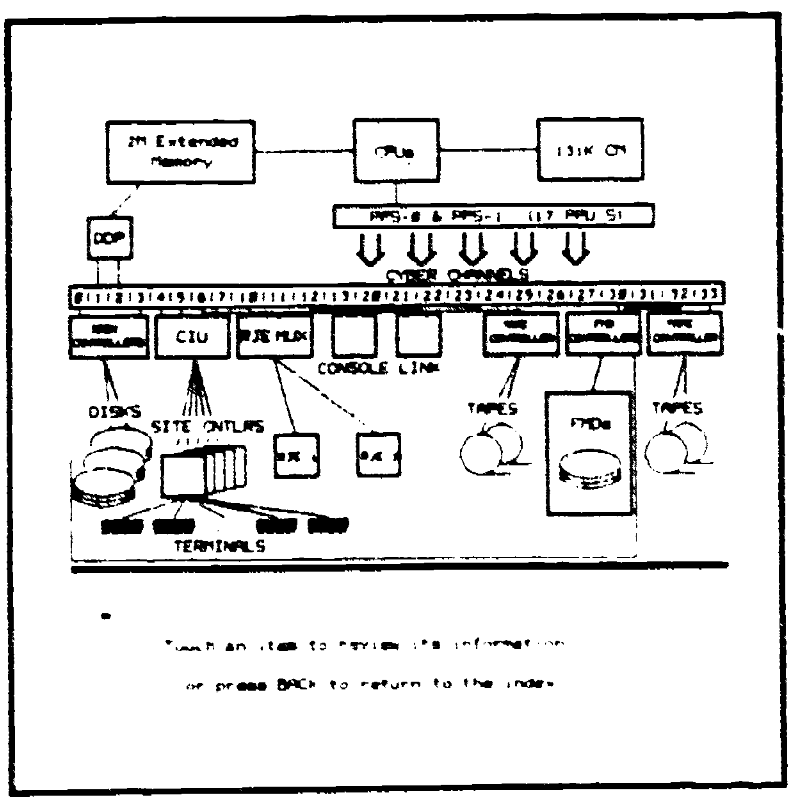

Figure 1. Delaware PLATO System Hardware Configuration, by Brand Fortner and David G. Anderer. Copyright © 1978 by the University of Delaware.

1983-84 marked the Delaware PLATO System's entry into the ASCII world. ASCII stands for American Standard Code for Information Interchange and provides a way for computers to talk to each other. A 2551 communications controller with 29 Communications Line Adapters (CLA's) provides 56 ASCII ports on the Delaware PLATO System. All future PLATO terminals will follow the ASCII format. The ASCII ports also allow microcomputers to access the PLATO System, and in the spring of 1984 OCBI announced mainframe PLATO support for Zenith, IBM, and Atari microcomputers.

The Delaware PLATO system is linked to a PLATO network that allows Delaware authors to exchange materials and ideas with other users on systems throughout the United States. Figure 1 shows the hardware configuration of the Delaware PLATO system. No longer viewed as an experiment, PLATO is now considered to be a primary tool for research, development, and delivery of high-quality computer-based learning materials in University courses and in the educational programs of schools, businesses, and institutions in its outside user base.

Throughout the 1970's, the Office of Computer-Based Instruction dealt exclusively with PLATO. 1981 marked the beginning of its involvement with microcomputers. Due to their low cost and the large amount of courseware developed for them by computer firms, software houses, and conventional textbook publishers, microcomputers had found widespread use in schools. As an East Coast teacher training site for computer-based education, the University responded to these developments by installing in 1981 a microcomputer facility that contains a variety of microcomputers, courseware packages, and peripherals such as printers, synthesizers, slide projectors, and videodisc players. This facility is being used in the Summer Institutes in Computer-Based Education for teachers, in the Summer Youth Campus for high school students, and in lifelong learning by the Division of Continuing Education. It is also being used as a benchmark laboratory for evaluating network strategies in the long-range planning of the OCBI. The microcomputer facility consists of two main parts. First, there is a classroom that contains twenty Apples which are used for teaching classes in educational programming, and second, there is a demonstration room that contains a variety of microcomputers. Systems currently represented in this demonstration area include Micro PLATO, Apple II+, Apple IIe, Atari 800, TI 99/4, Radio Shack TRS-80, Commodore PET, Commodore 64, IBM PC, and the IBM PCjr.

Just as low-cost microcomputers found their way into schools in the late 1970's, so also did they enter homes in large numbers during the early 1980's. Excited about the graphics and sound chips in the Atari home computer, the University approached Atari with an idea for a home music learning system whereby lifelong learners of age nine and up could learn music right at home. Atari did a survey and found there to be a large market for such a package, and in 1982 they funded its development by the University of Delaware. The University became a certified Atari development site, and a teaching laboratory containing twenty-one Atari home computers was established in the Department of Music for the purpose of developing, evaluating, and implementing courseware on Atari home computers. In addition to developing the music courseware, the University has also served as a test site for Atari's word processor and LOGO cartridges.

The University established its first IBM personal computer laboratory in 1982. Located in the College of Business, this laboratory contains twenty-six IBM PC's. In 1983-84, OCBI worked with the College of Engineering to design an Ethernet network of personal computers for the Departments of Chemical Engineering and Mechanical and Aerospace Engineering. Each department has ten IBM PC's, which will be connected by means of a coaxial cable. CBI lessons reside on a centralized file server. OCBI supports lesson development for faculty projects in geography geology, and engineering, and teaches seminars in BASIC, PASCAL, and busine. computing on the IBM PC's.

In addition to the Apple, Atari, and IBM classrooms, the University has also added another mainframe to its cadre of CBI machines. This new super-minicomputer is a VAX 11/780 that was obtained under a grant awarded in 1982 by the Digital Equipment Corporation. Figure 2 shows the initial configuration of the system. With two megabytes of main memory, 1024 megabytes of mass storage, and a CPU with a floating-point accelerator capable of performing an addition of 32-bit real numbers in 800 nanoseconds, the system is estimated to have the capacity to support over forty simultaneous CBI users. Running under the VMS operating system, the VAX provides a great deal of flexibility. In addition to supporting traditional computing languages and packages like BASIC, FORTRAN, PASCAL, APL, SPSS, and MINITAB, it also supports in the same environment a new CBI facility called the Cours ware Authoring System (CAS). CAS contains a language that can best be described as a structured TUTOR®. Under its grant with Digital, the University is converting six PLATO lessons to run under CAS using color GIGI terminals. It is also developing a first-semester interdisciplinary statistics course that will contain tutorials, drills, and problem-solving exercises in descriptive, exploratory, probabilistic, and inferential statistics.

Summing up all of the above, in 1984 the Office of Computer-Based Instruction is supporting development, teacher training, and student use on PLATO and VAX mainframe systems and on Apple, Atari, IBM, and Micro PLATO personal computers.

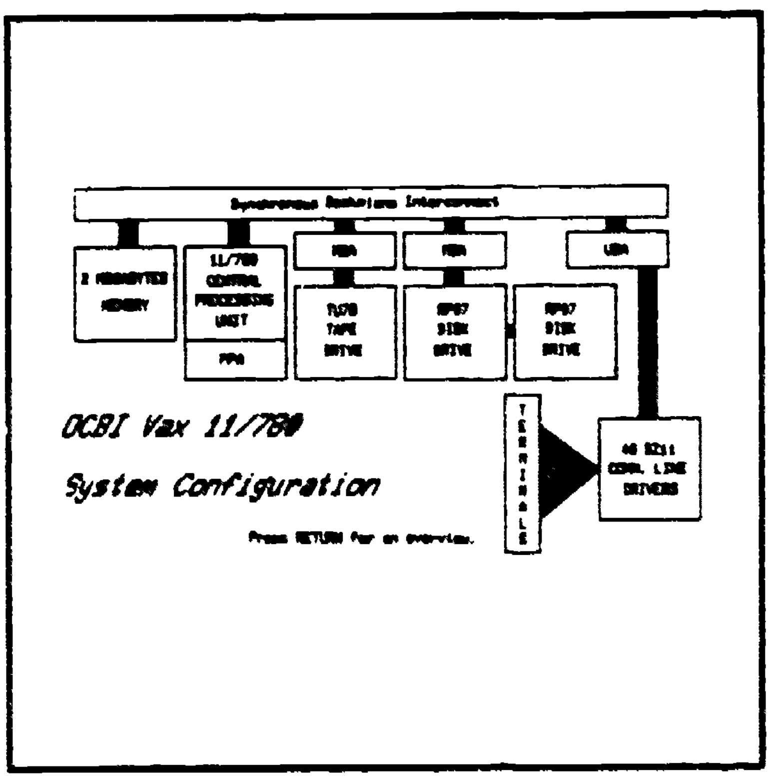

Figure 2. OCBI Vax 11/780 System Configuration, by David G. Anderer. Copyright © 1983 by the University of Delaware.

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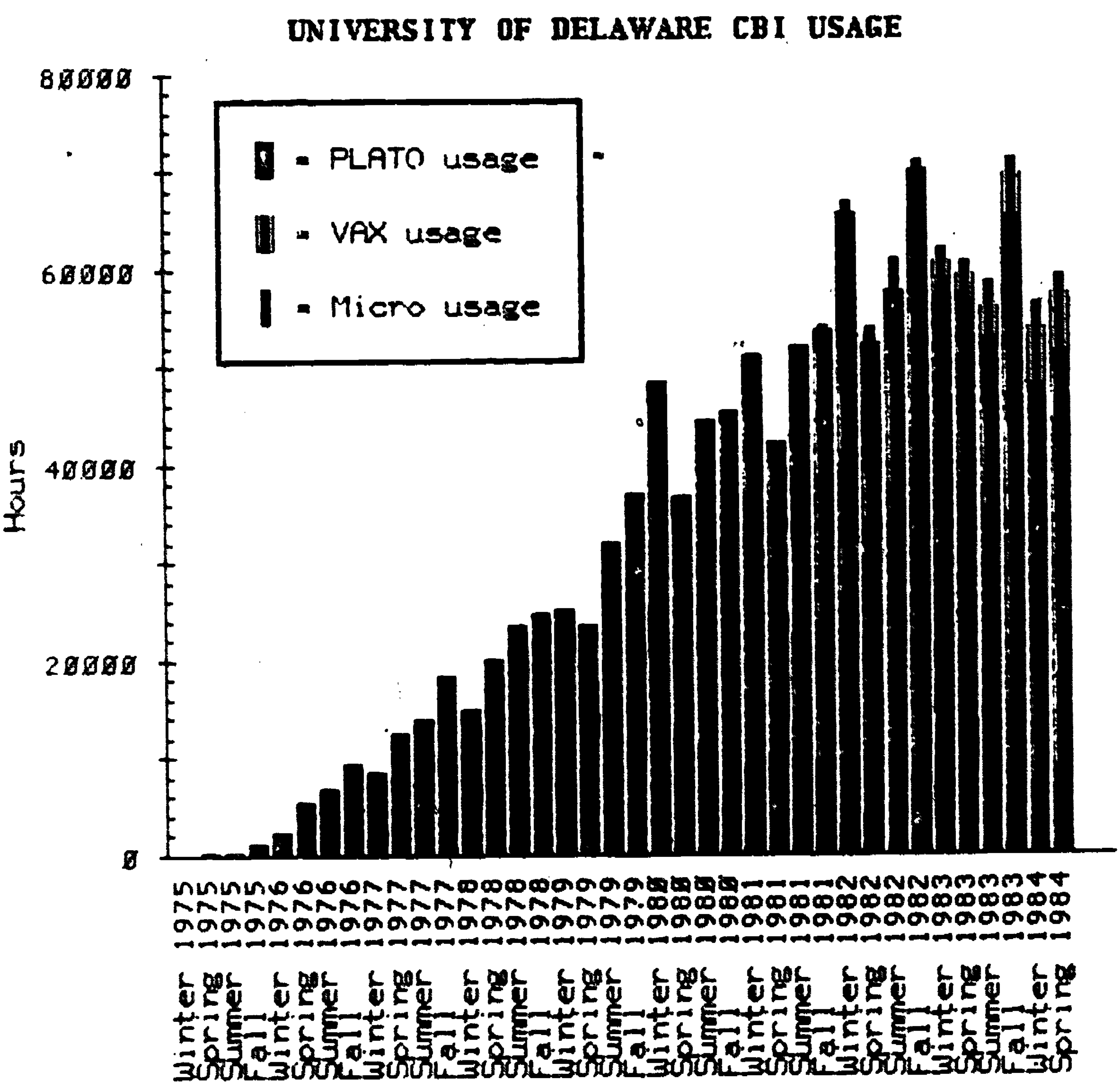
Utilization

From the beginning there has been a steady rise in the utilization of CBE terminals at the University of Delaware. Figure 3 shows this growth in terms of hours of usage per quarter.

Figure 3.



In 1982 the University delivered its millionth hour of PLATO services. In the fall of 1981 the Office of Computer-Based Instruction expanded its hardware base and began to support the development and student use of microcomputer programs. There are now rooms full of Ataris, Apples, and IBM PC's and in 1982, Delaware added to its cadre of CBI machines a VAX 11/780 dedicated to running Digital's Courseware Authoring System.

Table 1 shows how 174 courses used computer-based instruction during the 1983-84 academic year. Column one gives the course symbol and number from the University's course catalog. Column two contains the descriptive title for the course. Column three gives the number of credits. Column four shows how many students used CBI in the course. Column five gives the average number of hours each student used CBI. Column six shows the total number of contact hours for the course. The last four columns indicate whether the course used CBI in the Summer Session, the first semester, the Winter Session, or the second semester. During 1983-84, 29,877 students in 138 courses used PLATO, accumulating a total number of 93,641 hours; 1340 students in 35 courses accumulated 7,101 hours on microcomputers. For the first time there was student usage of the VAX with 57 students using 472 hours of terminal time. The total number of hours accumulated by students using computer-based instruction during 1983-84 was 105,868, of which 66,051 were spent in credit courses, and 39,817 in non-credit courses.

TABLE 1

Credit and Non-Credit Courses Using Computer-Based Instruction During 1983-84

PART I: PLATO Usage in Credit Courses

Course Symbol and Title	Descriptive Title	Number of Credit Hours	Number of Students	Average Hours of Use per Student	Total Contact Hours	Time of Utilization			
						Summer	Fall	Winter	Spring
ACC 207	Accounting I	3	537	2.8	1504	x	x	x	x
ACC 208	Accounting II	3	207	1.7	352	x	x	x	x
AEC 605	Food Marketing Management	3	31	1.7	53				x
AGE 104	Farm Mechanics	4	51	0.9	46		x		
ALL 267	Word Power	3	27	2.5	68				x
ALL 267	Word Power	3	M*	-	19				x
ANT 101	Introduction to Social and Cultral Anthropolgy	3	13	2.0	26				x
ANT 101	Introduction to Social and Cultral Anthropolgy	3	M*	-	309		x		x
APS 101	Introduction to Animal Science	3	93	0.9	84		x		
APS 133	Anatomy & Physiology of Domestic Animals	4	70	13.6	952		x		
APS 134	Anatomy & Physiology of Domestic Animals	4	50	9.4	470				x
APS 300	Principles of Plant & Animal Genetics	3	21	1.4	29				x

*M means multiple type sign-on was used. Number of students is unknown.

PLATO Usage in Credit Courses (continued)

Course Symbol and Title	Descriptive Title	Number of Credit Hours	Number of Students	Average Hours of Use per Student	Total Contact Hours	Time of Utilization: Summer	Fall	Winter	Spring
APS 310	Animal Genetics Lab	1	10	6.5	65				x
ARC 671	Examination of Art Materials II	3	1	6.0	6			x	
ART 200	Visual Communi- cations I	3	14	12.4	174		x		
ART 201	Visual Communi- cations II	3	25	1.6	40				x
ART 202	Production Techniques I	3	27	17.6	475		x		
ART 203	Production Techniques II	3	6	1.2	7				x
ART 216	Commercial Photography II	3	5	3.2	16				x
ART 300	Corporate Design	3	20	23.7	474		x		
ART 301	Environmental Graphics	3	20	3.5	70				x
ART 400	Design for Art Students	4	13	2.3	30				x
ART 401	Design for Adver- tising Agencies	4	23	26.7	614		x		

* M means multiple type sign-on was used. Number of students is unknown.

Course Symbol and Title	Descriptive Title	Number of Credit Hours	Number of Students	Average Hours of Use per Student	Total Contact Hours	Time of Utilization Summer	Fall	Winter	Spring
B 115	Human Heredity & Development Lab	1	104	4.0	416		x		
B 115	Human Heredity & Development Lab	1	M*	-	1		x		
B 303	Honors: Genetic Evolutionary Biology	4	118	10.9	1286		x		
BU 230	Introduction in Business Information Systems	3	136	3.3	449		x		
BU 230	Introduction in Business Information Systems	3	M*	-	2		x		
C 101	General Chemistry	4	329	15.7	5165		x		x
C 101	General Chemistry	4	M*	-	8		x		x
C 102	General Chemistry	4	175	10.9	1908		x	x	x
C 102	General Chemistry	4	M*	-	5		x		
C 103	General Chemistry	4	618	5.9	3646		x		x
C 103	General Chemistry	4	M*	-	147		x		x
C 104	General Chemistry	4	226	1.9	429		x		x
C 104	General Chemistry	4	M*	-	46		x		x

* M means multiple type sign-on was used. Number of students is unknown.

Course Symbol and Title	Descriptive Title	Number of Credit Hours	Number of Students	Average Hours of Use per Student	Total Contact Hours	Time of Utilization: Summer	Fall	Winter	Spring
C 105	General Chemistry	5	178	13.7	2439		x		
C 105	General Chemistry	5	M*	-	11		x		
C 111	General Chemistry	3	738	1.0	738		x	x	
C 111	General Chemistry	3	M*	-	1			x	
C 213	Elementary Organic Chemistry	4	36	14.5	522	x	x	x	x
C 213	Elementary Organic Chemistry	4	M*	-	3		x		
C 321	Organic Chemistry	3	M*	-	196		x		x
CHE 342	Heat and Mass Transfer	3	65	3.8	247				x
CHE 401	Chemical Process Dynamics & Control	3	15	0.2	3		x		
CHE 825	Chemical Engineering Thermodynamics	3	27	5.3	143		x		
CJ 420	Criminal Justice Administration	3	54	1.5	81		x		x
E 110	English Essentials	3	2750	1.6	4400	x	x		x
EC 1C1	Introduction to Economics I	3	1208	4.7	5678	x	x	x	x

*M means multiple type sign-on was used. Number of students is unknown.

PLATO Usage in Credit Courses (continued)

Course Symbol and Title	Descriptive Title	Number of Credit Hours	Number of Students	Average Hours of Use per Student	Total Contact Hours	Time of Utilization: Summer	Fall	Winter	Spring
EC 101	Introduction to Economics I	3	M*	-	31	x	x		
EC 102	Introduction to Economics II	3	560	4.0	2240	x	x	x	x
EC 102	Introduction to Economics II	3	M*	-	9	x	x		
EC 667	Economics Special Problems	3	38	3.7	141	x			
EDD 335	Elementary Curriculum: Math	3	73	2.4	178		x		x
EDS 633	Introduction to Computer Instruction	3	12	53.1	637		x		
EDS 634	Instructional Design of CBE	3	10	45.5	455				x
EG 125	Introduction to Engineering	3	105	5.8	609		x		
ENT 205	Elements of Entomology	3	41	1.5	62		x		
ENT 214	Apiology and Apiculture	3	43	0.7	30				x
ENT 305	Concepts in Entomology	3	26	3.1	81		x		

*M means multiple type sign-on was used. Number of students is unknown.

PLATO Usage in Credit Courses (continued)

Course Symbol and Title		Descriptive Title	Number of Credit Hours	Number of Students	Average Hours of Use per Student	Total Contact Hours	Time of Utilization Summer	Fall	Winter	Spring
ENT	305	Concepts in Entomology	3	M*	-	4		x		
FR	100	Elementary French I	4	91	7.8	710		x		x
FR	101	Elementary French	3	472	6.9	3257	x	x	x	x
FR	102	Elementary French II	3	62	5.6	347		x		
FR	102	Elementary French II	3	M*	-	2				x
FR	111	Intermediate French	3	4	1.0	4		x		
FR	111	Intermediate French	3	M	-	30		x		x
FR	201	Reading French & Composition I	3	21	2.2	46		x		
FR	401	Advanced French Grammar	3	26	1.8	47				x
FSN	303	Food Nutritution and Health	3	16	1.9	30				x
FSN	440	Nutrition & Disease	3	52	4.4	229		x		x
LAT	100	Individualized Latin Instruction	3	68	12.9	877		x		x

* M means multiple type sign-on was used. Number of students is unknown.

PLATO Usage in Credit Courses (continued)

Course Symbol and Title		Descriptive Title	Number of Credit Hours	Number of Students	Average Hours of Use per Student	Total Contact Hours	Time of Utilization Summer	Fall	Winter	Spring
LAT	101	Elementary Latin I	3	68	5.1	347		x	x	
LAT	101	Elementary Latin I	3	M*	-	1		x		
LAT	102	Elementary Latin II	3	5	3.8	19				x
M	010	Intermediate Algebra	0	174	8.9	1549		x		x
M	015	Algebra Review Lab	0	230	4.1	943		x	x	x
M	067	Math 221 Review	0	56	5.2	291	x		x	
M	115	Pre-Calculus	3	590	6.9	4071		x		x
M	117	Algebra	3	12	9.0	108	x			
M	167	Trigonometry	2	18	8.3	149	x			
MU	105	Fundamentals of Music I	3	188	3.6	677		x	x	x
MU	185	Ear Training and Sight Singing I	2	48	12.9	619		x	x	
MU	186	Ear Training and Sight Singing II	2	24	27.5	660				x
MU	195	Harmony I	3	69	15.9	1097		x	x	
MU	196	Harmony II	3	6	30.8	185				x
MU	285	Advanced Ear Training & Sight	1	22	36.8	810		x		

* M means multiple type sign-on was used. Number of students is unknown.

PLATO Usage in Credit Courses (continued)

Course Symbol and Title	Descriptive Title	Number of Credit Hours	Number of Students	Average Hours of Use per Student	Total Contact Hours	Time of Utilization: Summer	Fall	Winter	Spring
MU 286	Advanced Ear Training & Sight	1	25	43.7	1093				x
N 305	Determinants of Wellness	10	188	1.3	244		x		
N 332	Pharmacological Nursing	3	175	1.0	175				x
N 430	Death and Dying	3	11	0.9	10				x
PE 120	Aerobicise	1	215	1.8	387		x		x
PE 120	Fitness Dance	1	100	1.4	140	x	x	x	
PE 120	Ice Hockey	1	13	0.9	12			x	
PE 120	Racquetball I & II	1	131	0.8	105		x	x	x
PE 120	Slimnastics	1	20	2.1	42			x	
PE 120	Volleyball	1	56	1.5	84				x
PE 130	Introduction to Health, Physical Education, and Recreation	1	73	1.1	80		x		
PE 220	Anatomy & Physiology	3	24	0.6	14		x		
PE 251	Skills/Technique/ Rhythm/Dance	1	36	2.1	76				x

* M means multiple type sign-on was used. Number of students is unknown.

PLATO Usage in Credit Courses (continued)

Course Symbol and Title		Descriptive Title	Number of Credit Hours	Number of Students	Average Hours of Use per Student	Total Contact Hours	Time of Utilization Summer	Fall	Winter	Spring
PE	324	Measurement and Evaluation	3	65	3.4	221		x	x	x
PE	324	Measurement and Evaluation	3	M*	-	24		x	x	x
PE	364		3	8	1.3	10				x
PE	386/486	Tension Control and Relaxation	3	132	1.6	211	x	x	x	x
PE	426	Biomechanics	3	55	6.0	330		x	x	x
PE	426	Biomechanics	3	M*	-	4		x		
PE	432	Individualized Physical Fitness	3	13	1.1	14	x			
PLS	101	Botany I	4	55	2.4	132		x		
PLS	101	Botany I	4	M*	-	3		x		
PS	133	Introduction to Astronomy I	3	M*	-	3		x		
PS	134	Introduction to Astronomy	3	7	0.9	6				x
PS	134	Introduction to Astronomy	3	M*	-	2				x
PSC	803	Seminar: Public Administration	3	M*	-	111		x		

* M means multiple type sign-on was used. Number of students is unknown.

PLATO Usage in Credit Courses (continued)

Course Symbol and Title		Descriptive Title	Number of Credit Hours	Number of Students	Average Hours of Use per Student	Total Contact Hours	Time of Utilization Summer	Fall	Winter	Spring
RU	105	Elementary Oral & Written Russian	4	25	2.1	53		x		
SOC	210	Population Problems	3	26	2.0	52				x
SOC	210	Population Problems	3	M*	-	188				..
SP	101	Beginning Spanish	3	74	7.3	540		x		
SP	102	Elementary Spanish II	3	3	3.7	11				x
TDC	200	Consumer Economics	3	68	11.6	789				..
TDC	211	Clothing 1a: Basic Processes	3	86	1.1	95		x		x
TDC	216	Clothing 1b: Advanced Processes	3	36	1.2	43		x		x
TDC	216	Clothing 1b: Advanced Processes	3	M*	-	1		x		
UA	812	Management Decision Making	3	M*	-	58		x		

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* M means multiple type sign-on was used. Number of students is unknown.

PART II: PLATO Usage in Non-Credit Courses

PLATO Group	Descriptive Title	Number of Students	Average Hours of Use per Student	Total Contact Hours	Time of Utilization Summer	Fall	Winter	Spring
ACADVISE	Advisement Center	M*	-	781		x		x
ACP	Art Conservation Project	11	0.7	8			x	
ACP	Art Conservation Project	M*	-	3			x	
ALCHED	Alcohol Abuse Educators for Health Education	31	6.6	205	x	x	x	x
CAREERS	Career Search	385	3.3	1271	x	x		x
CAREERS	Career Search	M*	-	1058	x	x	x	x
CHEMFAME	Forum to Advance Minorities in Engineering	33	14.5	479	x			
DEMO	Demonstration	M*	-	2859	x	x	x	x
EATINGED	Peer Educators for Eating Disorders	14	11.3	158			x	x
EDDMATH	Education Math Review	M*	-	32		x		
FITED	Fitness Educators for Health Education	18	2.6	47				x
FIVE	Pre-School	42	4.5	189		x		x
FIVE	Pre-School	M*	-	48				x
HONORS	Honors Center	M*	-	797		x	x	x
INTROCOM	Introduction to Computers	38	4.5	171	x	x		

* M means multiple type sign-on was used. Number of students is unknown.

PLATO Usage in Non-Credit Courses (continued)

PLATO Group	Descriptive Title	Number of Students	Average Hours of Use per Student	Total Contact Hours	Time of Utilization Summer	Fall	Winter	Spring
MCC	Mary Campbell Center	36	22.1	796		x		x
NEWARK	Educational Research	38	0.7	27		x	x	x
NEWLIB	Newark Free Library	M*	-	2083		x	x	x
PEERED	Peer Educators for Health Education	23	3.7	85		x	x	x
PROG I	Pre-College: Beginning TUTOR Programming	M*	-	5				x
PROG II	Pre-College: Beginning TUTOR Programming	M*	-	5				x
READERS	Reading Center	17	6.1	104				x
READERS	Reading Center	M*	-	120		x		x
SBDC	Small Business Development Center	174	3.1	539	x	x	x	x
SCD	Student Clinical Dieticians	30	3.0	90	x	x	x	x
SEMINARS	Beginning TUTOR	35	11.3	396		x		x
SEP	Training for Peer Educators	10	1.9	19	x	x		x
SEXED	Peer Educators for Health Educaion	27	21.4	578		x	x	x
SHSS	Student Health Service Staff	19	6.3	120	x	x	x	x
SHSRN	Student Health Service Registered Nurses	19	6.3	120	x	x	x	x
SICBE	Summer Institute in Computer-Based Education	47	0.9	47	x			

* M means multiple type sign-on was used. Number of students is unknown.

PLATO Usage in Non-Credit Courses (continued)

PLATO Group	Descriptive Title	Number of Students	Average Hours of Use per Student	Total Contact Hours	Time of Utilization Summer	Fall	Winter	Spring
SICBE	Summer Institute in Computer-Based Education	M*	-	235	x			
SOAC	Student Organizations and Activities Center	2	0.5	1			x	
SOAC	Student Organizations and Activities Center	M*	-	2		x		
SPONS I	Sponsored Student Programming I	15	11.0	165		x	x	x
SPONS II	Sponsored Student Programming II	1	3.0	3				x
UDBASIC	Introduction to BASIC	30	16.6	498	x	x		x
UDELI	University of Delaware English Language Institute	200	13.5	2700	x	x	x	x
UDELI	University of Delaware English Language Institute	M*	-	30	x			
UDGAMING	Group for Gaming Period	74	4.5	333	x	x	x	x
UDKIDS	Pre-College Student Use	M*	-	3611	x	x	x	x
UDPARALLEL	University of Delaware Parallel Program	758	3.7	2805		x		x
UDPARALLEL	University of Delaware Parallel Program	M*	-	1548		x		x
WCWRITER	Writing Center	230	6.4	1472		x		x
WCWRITER	Writing Center	M*	-	165		x		x
WELLSPRI	Health Education	M*	-	6038	x	x	x	x

* M means multiple type sign-on was used. Number of students

PART III: Microcomputer Usage in Credit Courses*

Course Symbol and Title		Descriptive Title	Number of Credit Hours	Number of Students	Average Hours of Use per Student	Total Contact Hours	Time of Utilization: Summer	Fall	Winter	Spring
B	207	Introduction to Biology I	4	10	0.7	7		x		
C	267	Chemistry Problem Solving Using Computers	3	248	0.7	168			x	
CE	467/652	Transportation Facilities Design	3	11	3.3	36				x
EC	667	Special Problems	3	18	.5	9	x			
EDD	306	Language Arts in Nursery/Kindergarten	3	28	1.8	51				x
EDD	335	Elementary Curriculum: Math	3	62	4.6	288		x		x
EDD	667	Microcomputers in Education	3	50	22.8	1140	x			
EDD	892	Educational Data Systems	3	10	1.4	14	x			
EDS	654	Counseling Theory and Interviewing	3	20	6.7	134		x		
ENT	667	Special Problems	6	50	10.1	505		x		
FSN	200	Food Culture & Dietary Adequacy	3	248	.7	168		x		
FSN	309	Principles of Nutrition	3	19	2.3	44				x

* M means multiple type sign-on was used. Number of students is unknown.

Microcomputer Usage in Credit Courses (continued)

Course Symbol and Title	Descriptive Title	Number of Credit Hours	Number of Students	Average Hours of Use per Student	Total Contact Hours	Time of Utilization Summer	Fall	Winter	Spring
FSN 367	Computer Applications in Food Science Systems Management	2	8	4.6	37			x	
FSN 470	Coordinated Dietetics	3	8	3.0	25				x
G 470/670	Computer Cartography	3	8	1.1	9				x
GEO 107/113	General Geology	4	20	5.4	108		x		
M 249	Elements of Linear Systems	3	15	12.6	189		x		
M 266	Independent Study	1-6	2	5.5	11		x		
M 302	Ordinary Differential Equations	3	10	7.5	75		x		
MU 195	Harmony I	3	17	2.4	41		x		
MU 267	Computer Science in Music	3	19	45.1	857		x		x
PSY 340	Cognition	3	12	4.4	53				x
PSY 467	Computer Applications in Psychology	3	20	15.0	300				x
SC 491	Science Materials and Approaches	3	10	0.4	*		x		

* M means multiple type sign-on was used. Number of students is unknown.

Group	Descriptive Title	Number of Students	Average Hours of Use per Student	Total Contact Hours	Time of Utilization Summer	Fall	Winter	Spring
Continuing Education	Intoduction to BASIC	42	5.9	266	x	x		
Continuing Education	Introduction to PASCAL Programming for Microcomputers	10	7.9	79				x
Continuing Education	Introduction to Personal Computers	150	3.5	521	x	x		x
Continuing Education	Popular Applications	15	2.0	30		x		
Continuing Education	National Conference on Computers and Young Children	40	1.9	76				x
Continuing Education	Summer Youth Campus	140	28.2	3948	x			
OCBI	Seminars	63	-	214		x	x	x
Open Hours	University Open Hours	M*	-	340		x	x	x
Other	Miscellaneous Use	M*	-	322	x	x	x	x
Public Hours	Community Public Hours	M*	-	686	x	x	x	x
SICBE	Summer Institute in Computer-Based Education	75	23.8	1785	x			
Small Business Development	Using Microcomputers in Small Business	40	1.2	55	x			

* M means multiple type sign-on was used. Number of students is unknown.

PART V: VAX usage in Credit Courses

Course Symbol and Title	Descriptive Title	Number of Credit Hours	Number of Students	Average Hours of Use per Student	Total Contact Hours	Time of Utilization			
						Summer	Fall	Winter	Spring
CHE 432	Chemical Process Analysis	3	57	8.2	472				x

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Organization

There are two main components in the organization of educational computing at Delaware, namely, faculty CBI leaders and centralized support staff. In each department using computer-based education there is a faculty member identified as "CBI Leader" who coordinates the setting of priorities and the allocation of resources within the department. To each department, OCBI provides programming support for student use of CBE facilities through part-time student course aides; research and development projects are supported through part-time student programmers and full-time professionals.

The CBI leader serves as an intermediary between the OCBI staff and the rest of the faculty in the department. The CBI leader coordinates all CBE activities for the department, including evaluation. Most CBI leaders use a peer review process whereby they obtain help from their colleagues in making these decisions. The energy, enthusiasm and dedication of the faculty has been a very important factor in the implementation of CBE at the University. Table 2 contains a list of the CBI leaders.

A Faculty Committee on Computer-Based Instruction reviews CBE projects both at the proposal stage and after the first year of their development, and it can be asked by the Director of OCBI to review older projects as well. The following faculty members served on this committee during 1983-84:

Michael Arenson, Music
Gerald Culley, Languages and Literature, Chairperson
James Morrison, Textiles, Design and Consumer Economics
Raymond Nichols, Art
Richard Sylves, Political Science

The charge to this committee is as follows:

"The faculty committee on Computer-Based Instruction shall review new projects proposed by faculty members for feasibility, soundness of conception and design, and appropriateness to computer-based instructional techniques, and shall report its findings and recommendations to the Director of the Office of Computer-Based Instruction. It shall also review approved projects after one year to determine whether their initial promise is being realized, and it may undertake other reviews at the request of the Director of the Office of Computer-Based Instruction. To the extent that they find possible, the members shall offer advice and counsel informally to less experienced faculty members, at their request. The Committee shall review proposals to the Center for Teaching Effectiveness that involve computer-based instruction and make recommendations for support to the Associate Provost for Instruction."

As requests for the use of educational computing have increased, the University has developed a highly trained support staff. At the beginning of the PLATO Project, the staff consisted of three graduate assistants. When the faculty's request for expansion to a level of eight PLATO terminals was approved in the summer of 1975, a senior applications programmer/analyst became the first professional staff member of the Project, and the number of student assistants was increased to eight. During the summer of 1976, in preparation for large-scale use of PLATO, a second professional programmer/analyst was hired, and the number of student assistants was increased from eight to twelve. During the winter of 1976-77, six of the student assistants demonstrated that they had met the qualifications for junior staff positions, and they were promoted to junior applications programmer/analysts.

Table 2

CBI Leaders at the University of Delaware

Departments	CBI Leaders
Accounting	Jeffrey Gillespie
Advisement Center	Peter Rees
Agriculture	Paul Sammelwitz
Anthropology	Juan Villamarin
Art	Raymond Nichols
Art Conservation	Joyce Hill Stoner
Biological Sciences	David Sheppard
Business Administration	James Culley
Chemical Engineering	Stanley Sandler
Chemistry	John Burmeister
Civil Engineering	Eugene Chesson
Continuing Education	
Access Center	Ed Kepka
Lifelong Learning	Ed Crispin
PLATO-based Courses	Matt Shipp
Microcomputer-based Courses	Celeste Williams
Counseling	Richard Sharf
Economics	Charles Link
Education	
Instruction	William Moody
Research	Victor Martuza/Richard Venezky
English	George Miller
Geography	Franklin Gossette
Geology	John Wehmiller/James Pizzuto
Honors Program	Katherine Carter
Human Resources	James Morrison
Institutional Research	Carol Pemberton
Languages	Gerald Culley
Library	Sylvia Fatzer
Mathematics	Ronald Wenger
Museum Studies	Barbara Butler
Music	
Aural Skills	Fred T. Hofstetter
Written Theory	Michael Arenson
Nursing	Madeline Lambrecht
Physical Education	David Barlow/James Kent
Physics	Richard Herr
Political Science	Richard Sylves
Psychology	James Hoffman
Small Business Development Center	Charles Maass
Statistics	Victor Martuza
Student Center	Marilyn Harper
UD English Language Institute	Patricia Dyer
University Parallel Program	Jay Gil
Urban Affairs	Jeffrey Raffel
Wellspring Health Education	Paul Ferguson
Writing Center	Louis Arena

During the 1977-78 academic year, four more student assistants demonstrated that they had met the qualifications for junior staff positions, and they were similarly promoted to junior applications programmer/analysts. In addition, three new professional analysts were hired from outside the University, two at the junior level, and one at the middle level. Two systems programmers were hired in order to coordinate system programming, operations, and communicatons for the new system. A second secretary was hired to handle the increased load of paper work in the Project. Finally, funds sufficient to hire one full-time operator were allocated to the University of Delaware Computing Center, which is operating the PLATO machine.

During 1977-78, it also became evident that the two senior staff members namely, James H. Wilson and Bonnie A. Seiler, had been taking on more and more of a supervisory role. In addition to overseeing the work of several junior staff members, they each had a major managerial component of the Project. Bonnie A. Seiler was in charge of lesson design, evaluation, and scheduling, and James H. Wilson managed the operations side of the Project. Recognizing the increased level of responsibility of these two staff members, two new managerial positions were created, and Bonnie and James were promoted to these positions effective July 1, 1978.

During the 1978-79 academic year, a senior electronics specialist was hired in order to coordinate maintenance for the growing number of PLATO terminals on campus, and a PLATO user services coordinator was hired to manage the Project's growing outside user base.

Several new positions were added to the Project during the 1979-80 academic year, namely, a third manager to supervise all PLATO sites on campus and several academic projects, a peripheral design engineer to head the Project's hardware development component, a junior programmer/analyst to direct the new seventeen-terminal PLATO classroom in Drake Hall, an additional PLATO services consultant to provide additional on-line consulting, and three junior programmer/analysts to support new projects.

Recognizing the increasing activity and diversity of the Project, the staff structure was reorganized during the winter and spring of 1980. With promotions of Bonnie A. Seiler to Associate Director for Administration and of James H. Wilson to Associate Director for Operations, a new level of staff was formed called the "director's staff" consisting of the director, the assistant to the director, and the two new associate directors. Keith Slaughter and Judith Sandler were promoted to the senior staff to assume the managerial responsibilities formerly done by Bonnie A. Seiler and James H. Wilson.

When the PLATO Project evolved into the Office of Computer-Based Instruction on July 1, 1980, the organization was further expanded. A research component was added consisting of a professional coordinator and four graduate research assistants. Housed in the College of Education, this component is called the Center for Interdisciplinary Research in Computer-Based Learning (CIRCLe). Jessica R. Weissman was promoted to the senior staff to head the newly-formed Customer Courseware Development group. An additional PLATO services consultant and seven applications programmer/analysts were added during the year to support development projects.

In 1981, Patricia Bayalis was promoted to the senior staff to fill a vacancy, and Roland Garton was added to manage the new microcomputer component of the Office. A junior programmer/analyst was hired to coordinate the CBE development activities in the College of Agriculture, and a middle level position was created to support instructional microcomputer activities. During the year, an additional seven junior level programming positions and two middle level positions were added to the staff to develop courseware supported by two federal grants and three contracts from computer vendors.

Seven new positions were added in 1982-83. An Assistant to the Director for Financial Management joined the director's staff. Two junior level programmers were hired, one to work on a federally funded development project and the other to augment OCBI's customer services group. A second senior electronics specialist joined the staff in order to maintain IST-I terminals in-house rather than through a maintenance contract. The acquisition in 1982 of the VAX computer for CBE development resulted in the addition of two systems programmer positions, two middle level programmer positions, and an operator.

In 1983-84, the staff members working on four IBM PC projects merged to form a unified IBM development team in order to share code and make the best use of staff expertise. Similarly, the staff of the three development projects for the VAX mainframe combined to form a VAX team. Coordinators of the IBM and VAX teams were promoted and joined the project manager group.

Along with the growth of the OCBI staff, an organizational structure evolved which has proven to be a highly effective way of managing a computer-based educational project. Figure 4 shows the organizational chart. The director of OCBI reports to the Provost and receives recommendations from the faculty advisory committee. The Office of Computer-Basd Instruction consists of six main components, namely, operations, sites, user services, student use, research, and campus program development. Table 3 lists the OCBI staff. The numbers in column three identify each staff member in the task assignment chart given in figure 5. This chart shows which staff members are responsible for carrying out the many activities in the six components of OCBI.

Operational duties include the running of the Delaware PLATO system; the management of files such as instructional programs, utility routines, and work spaces in computer memory; maintenance of terminals and peripheral equipment; data storage and transfer from PLATO to the University's computers and vice versa; printing of graphic displays, programming code, and data files as requested by users; programming of utility routines; on-line and off-line cataloging of lesson materials available on the Delaware PLATO system; maintenance of PLATO data communications and hardware; diagnosis of needed improvements in CYBER software; and research and development of new and existing equipment which would enhance CBE services, such as music synthesizers, microprocessor interfaces, and floppy disk units.

Each CBE site is overseen by an OCBI staff member who insures that the physical environment is conducive to student learning and to safe operation of the equipment. The site director also insures that the terminals do not use more than their proper allocation of computer resources. To date, PLATO sites have been established in the Willard Hall Education Building, Smith Hall, Drake Hall, Purnell Hall, Amy duPont Hall, the OCBI office in the Academy Building, the OCBI Annex at 42 East Delaware Avenue, Agriculture, Art, Career Planning and Placement, the Center for Counseling, Chemical Engineering, the CIRCLe Office, the Computing Center, Continuing Education,

Figure 4
Organizational Chart

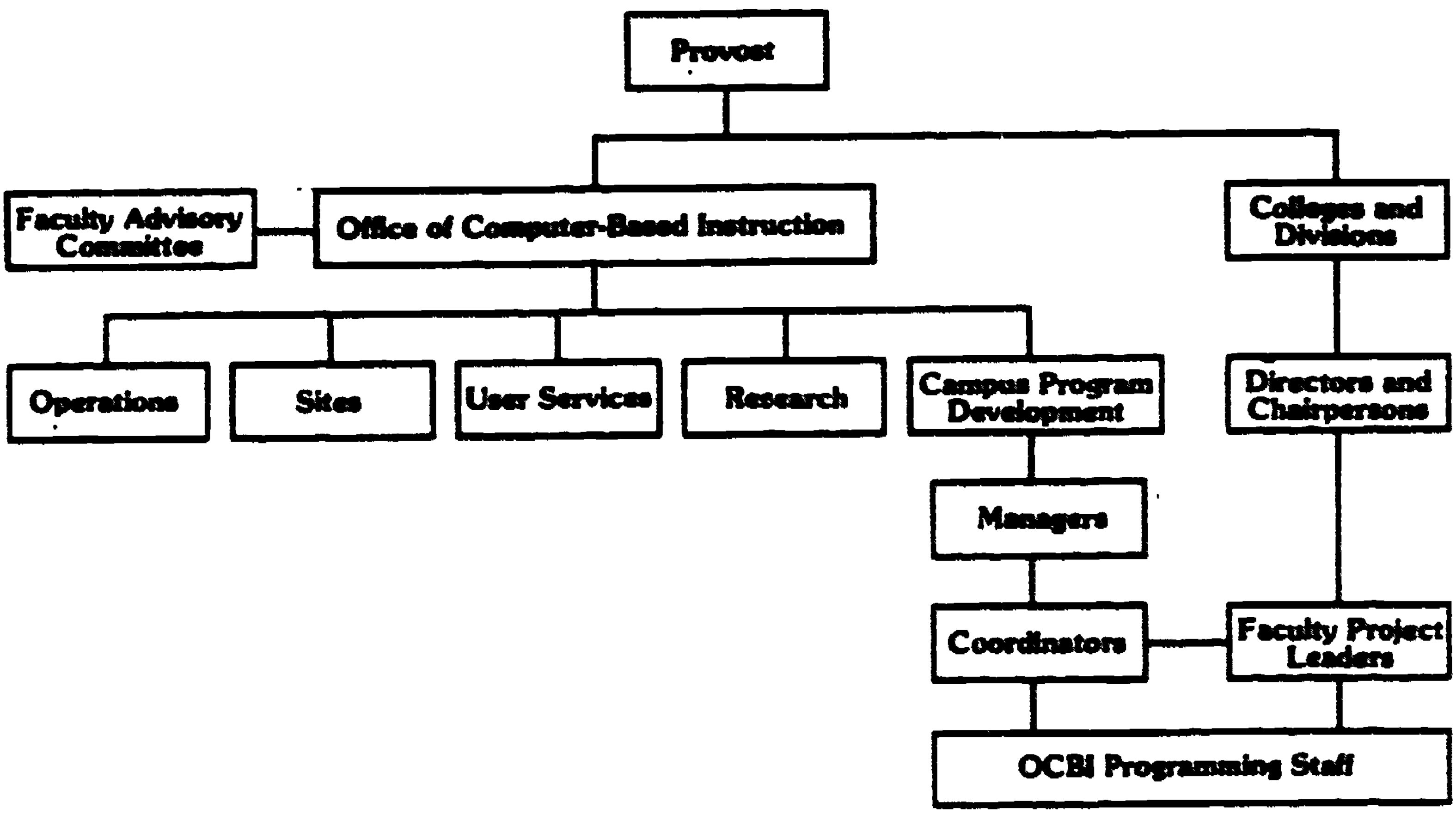

Table 3

Staff of the Office of Computer-Based Instruction

Position	Name	Number
Director	Fred T. Hofstetter	1
Associate Director for Administration	Bonnie A. Seiler	2
Associate Director for Operations	James H. Wilson	3
Assistant to the Director for Financial Management	Wilhelmina Simms	4
Assistant to the Director	Marianna K. Preston	5
Senior Secretary	Charlotte P. Coletta	6
Senior Secretary	Patricia Porter-Revels	7
Senior Secretary	Carol-Anne G. Ritter	8
Secretary	Diana Gemmill	9
Secretary	Kathie E. Lyneis	10
Project Administrator	Morris W. Brooks	11
Project Administrator	Roland Garton	12
Project Administrator	Patricia Bayalis Harris	13
Project Administrator	Judith Sandler	14
Senior Applications Programmer/Analyst	George Reed	15
Senior Applications Programmer/Analyst	Mary Jac Reed	16
Senior Systems Programmer/Analyst	David G. Anderer	17
Systems Programmer/Analyst	Steven Bertsche	18
Systems Programmer/Analyst	Shawn Hart	19
Systems Programmer/Analyst	Sadanand Sthalekar	20
Peripheral Design Engineer	George Harding Jr.	21
Senior Electronics Specialist	Lankford Boyd	22
Senior Electronics Specialist	Linda Everett	23
Computer Hardware Technician	Mark Grulke	24
Senior Services Consultant	Dan Williams	25
Applications Programmer/Analyst	Christine M. Brooks	26
Applications Programmer/Analyst	Jon Conrad	27
Applications Programmer/Analyst	Gary Feurer	28
Applications Programmer/Analyst	Louisa Frank	29
Applications Programmer/Analyst	Michael Frank	30
Applications Programmer/Analyst	James Hadlock	31
Applications Programmer/Analyst	Carol Leefeldt	32
Applications Programmer/Analyst	Richard Payne	33
Applications Programmer/Analyst	Catherine B. Phillips	34
Applications Programmer/Analyst	Deborah E. Richards	35
Applications Programmer/Analyst	Lynn H. Smith	36
Applications Programmer/Analyst	Rae D. Stabosz	37
Applications Programmer/Analyst	Evelyn V. Stevens	38
Instructional Developer	Ed Schwartz	39
Services Consultant	George W. Mulford	40
Junior Applications Programmer/Analyst	Phyllis Andrews	41
Junior Applications Programmer/Analyst	Nancy J. Balogh	42
Junior Applications Programmer/Analyst	Sharon Correll	43
Junior Applications Programmer/Analyst	Vickie Gardner	44
Junior Applications Programmer/Analyst	Deborah G. Mellor	45

Table 3 (continued)

Junior Applications Programmer/Analyst	Clella B. Murray	46
Junior Applications Programmer/Analyst	Cynthia Parker	47
Junior Applications Programmer/Analyst	Michael Porter	48
Junior Applications Programmer/Analyst	Patricia Sine	49
Junior Applications Programmer/Analyst	Amy Sundermier	50
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*Trainee Staff are miscellaneous wage earners. Those listed between the dotted lines are funded all or in part by departments other than the Office of Computer-Based Instruction.

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D - Associate Director in Charge; M - Manager in Charge; C - Coordinator of Project
Numbers refer to column 3 of Table 3

the Delaware Small Business Development Center, Educational Research, the Health Center, the Honors Center, Human Resources, the Languages Laboratory, the Morris Library, Nursing, Physical Education, the University Parallel Program in Georgetown and in Wilmington, and the Writing Center. A microcomputer lab and an Apple classroom were established in the education building in 1981, and a classroom of Atari and IBM PC microcomputers was added in 1983 in the music building. Three microcomputer development labs were set up during 1983-84 to accommodate the increased programming activity on IBM PC and Apple microcomputers.

User support services include training seminars for campus users, especially prospective new authors; workshops and courseware development for off-campus users; CBE institutes for educators; consulting on programming, instructional design, and netw rking; assistance for students using CBE classrooms and for off-campus users; special programs for pre-college students; instructional utility programs that can be used by many departments; publication of the Greater Delaware AEDS Newsletter and OCBI's summative report as well as courseware for mainframes and microcomputers; and evaluation tools. The CBE Library houses microcomputer software used by University students in addition to a representative sampling of commercially available CBE packages for learners of all ages, from pre-schoolers to senior citizens. The library also includes videodiscs, which store up to 54,000 still video frames, thirty minutes of motion pictures, thirty minutes of stereo sound, or computer programs and data.

Students from forty-three University units use OCBI's CBE facilities. Course instructors are assisted by part-time student aides, who orient the students to using computers, enter rosters and curricula into the computer, and assist faculty members in responding to students' on-line comments and in administering end-of-the-semester evaluations.

The research activities of OCBI are coordinated by CIRCLe, which sponsors colloquia and conferences, maintains a comprehensive library of research materials in CBE, and assists faculty members in writing research proposals and in evaluating the effectiveness of computer-based instruction. CIRCLe also maintains a comprehensive library of research materials in CBE and publications dealing with the PLATO system. More information about these activities is contained in the CIRCLe section of this report (cf. below, pp. 178 to 179).

Twenty-six campus development projects and nine outside development contracts and grants are managed by members of the project management staff. Each project team consisting of the faculty principal investigator, the OCBI coordinator, and programmers is supported by a project manager who both advises team members as the lessons develop and helps them set appropriate goals and target dates.

Courseware Development Process

Nievergelt* has pointed out that "Today it makes no sense to start a CAI project unless one is willing to write most of the necessary courseware." Whereas this is not true for every subject, it was recognized by the faculty committee in 1974 that although good examples of the use of PLATO could be found in existing program libraries, there were many new applications that needed to be explored, and therefore a heavy emphasis upon program development was planned. Figure 6 shows the present state of the evolution of the Delaware model for courseware development. Using a systems approach, it contains a proposal stage, a design stage, a programming stage, and a dissemination stage. It departs from the traditional systems approach in that it does not contain a separate evaluation stage; rather, evaluation is incorporated throughout the model in a variety of feedback loops.

The process begins with the proposal stage, in which the faculty member works with an OCBI staff member to develop a written proposal for courseware development. The proposal addresses the student need that would be met by each lesson; justifies the use of CBE for this application; describes departmental commitment, potential use and impact, evaluation, and publication plans; and projects the need for programming and design support. Proposals are reviewed by the Faculty Committee on CBI and by the OCBI managers. Some proposals are recommended for funding, while others are referred back to the faculty member for revisions. Once the proposal has been funded, a coordinator and a student programmer are allocated to the new project, forming with the faculty member a development team, which is overseen by a project manager. Where appropriate, several projects targeted for the same computer are assigned to a larger team of professional designers and programers, plus student programmers. In 1983, two such development teams were formed for the IBM PC and the VAX mainframe. Each multi-project team is made up of a project manager; coordinators for each funded project, who serve as liaison with faculty; an analyst responsible for all code and documentation; plus additional programmers and designers who can be assigned to work on more than one of the projects, shifting assignments when necessary.

Since 1983, requests for research and development support by OCBI have been administered by means of a formal Request for Proposals (RFP) process. The first call for proposals in February of 1982 emphasized the following four program areas: faculty/staff initiation, courseware development, lifelong learning, and research. Of the fifty proposals submitted by University faculty and staff, twenty-one were funded and began in the fall of 1982. In the 1983 call for proposals, a fifth program area was added, namely, intelligent computer-assisted instruction (ICAI). Of the forty-seven proposals submitted, twenty-one were funded to begin during the 1983-84 fiscal year. The proposal titles and their principal investigators are listed in Table 4. Copies of the OCBI Request for Proposals may be obtained from the Office of Computer-Based Instruction.

During the design stage, the development team plans each lesson in detail and works out the design, display by display, in the form of a paper script. Teams submit the script to a Lesson Review Committee while ideas are on paper and not yet in the computer, so that suggestions can be incorporated before the costly programming stage begins.

Once the script has been approved, the lesson progresses to the programming stage. Whereas the lesson may be coded by a professional programmer/analyst or part-time student programmer, the quality of the code and its documentation are the

*Jurg Nievergelt, "A pragmatic introduction to courseware design," IEEE Spectrum, September, 1980, pp. 7-21.

Figure 6

The Delaware Model for Courseware Development

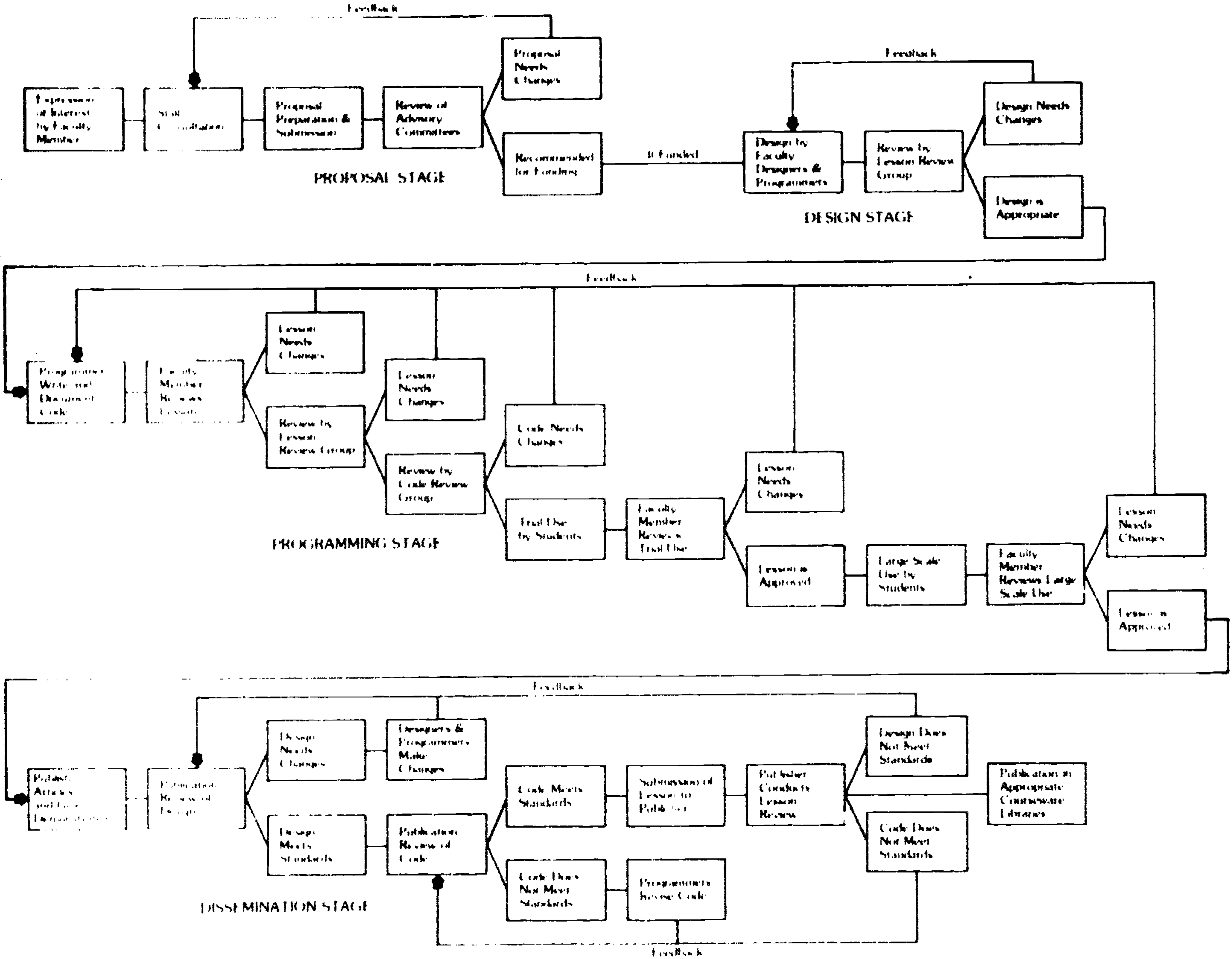

Table 4

Proposals Funded by OCBI in 1983-84

Principal Investigator	Department	Proposal Title
Leta P. Aljadir	Food Science and Human Nutrition	Computer-Based Lessons on the Nutritional Implications of Diabetes Mellitus and Chronic Renal Failure
Lou Arena, Marcia Peoples, Gina Harwanko, Debbie Fox-Nai	U of D Writing Center, Mary Campbell Center	PLATO Project for the Multiply Handicapped
Michael A. Arenson	Music	Computer-Based Instruction Project for Lower-Division Music Theory
Patricia Arnott	Morris Library	Using the Citation Indexes
Theodore Braun, Bonnie Robb	Languages	French Verb Drills
Gerald R. Culley	Languages and Literature	Conversion of UD PLATO Latin Curriculum to BASIC
Edward Davis	Chemistry	Completion of Valence Shell Electron Pair Repulsion Theory Lesson and Problem Driver
S. Farnham-Diggory, James Hoffman	Education / Psychology	An Intelligent Reading Tutor: Preliminary Studies
Alice Eyman, Dene Klinzing	University Preschool	Computer Active Preschool Project
Franklin E. Gossette	Geography	A Microcomputer Based Cartographic Learning System
Fred T. Hofstetter, Gary Feurer, Michael A. Arenson	Music	Toward the Development of an Intelligent Harmony Coach
Janet Johnson, Ed Hall, Teresa Thomspon, Valerie Hans, Allan McCutcheon	Political Science / Communications	Social Science Research Methods: An Interdisciplinary Project

Table 4 (continued)

Madeline Lambrecht	Nursing	A Correlation of Cognitive Styles ... with Self-Reported Satisfaction Using a Computer ... to Facilitate Awareness of an Individual's Own Death and Dying
Charles Mason, Doug Tallamy	Entomology	A PLATO Program for Identifying Insect Families
Fred Masterson	Psychology	AMPL: A Student Programming Language for Statistics Instruction
Frances W. Mayhew	Textiles, Design and Consumer Economics	Completion of Alterlab
C. J. Meisel	Educational Studies	Social Comparison Among Adolescent Handicapped Children
James L. Morrison, Judith Van Name	Textiles, Design and Consumer Economics	An Instructional Model for Applying Basic Personal Finance Principles to Investment Portfolio Management
James L. Morrison, Yvonne Puffer	Human Resources / Newark Free Library	Utilizing the PLATO System for Delivering University Education to the Lifelong Learning Consumer
Betty Paulanka, Mary Unruh	Nursing	Open Curriculum Challenge Examinations
Mary Jac Reed Michael A. Arenson	OCBI	Effective Use of Color in CAI Lessons
Deborah Richards	Morris Library	Conversion of PLATO Library Lessons to the IBM PC
Stanley I. Sandler	Chemical Engineering	Computer-Based Chemical Engineering Instruction Using PLATO and Microcomputer Systems
Richard Sharf, Charles Beale	Counseling	Maintenance of Existing Counseling Lessons

Table 4 (continued)

Clifford Sloyer, Lynn Smith	Mathematics	Conversion of Math Enrichment Modules to the Apple Microcomputer
Richard Venezky, Suzanne McBride	Education	Learning TUTOR LOGO: A Procedural Model of Young Children's Computer Programming
John Wehmiller, Peter Leavens, James Pizzuto	Geology	Flood Plain Simulation Lesson
Ronald H. Wenger Clifford Sloyer	Mathematical Sciences Teaching and Learning Center	A Robust and Friendly Environment for Mathematical Modeling and Problem solving

responsibility of the team's analyst. The design of the lesson is often reviewed again as it goes on-line. After the programming is completed, the lesson's code is reviewed in a Code Review Seminar in order to improve the programming techniques and the documentation of the lesson. The lesson is further refined as trial use by students provides feedback on its strengths and weaknesses.

After the lesson has been successfully used by students on a large scale and has been incorporated into a curriculum, it is ready for the dissemination stage. Faculty members are encouraged to publish articles about their lessons and to give demonstrations both on and off campus. Each lesson goes through OCBI's publication review process, which includes a publication lesson review and a publication code review. In these reviews, the lesson is checked to make sure it meets the publisher's standards as well as those of OCBI, which are often more stringent. The lesson is then submitted for publication and distribution to other CBE users.

Publication

As described above in the section on OCBI's Courseware Development Process, the last stage in lesson development includes distribution. After the lessons pass the code reviews and the lesson reviews included in the Delaware Model for Courseware Development, copyrights are secured, and the authors document the content and performance of the lessons. When the internal review is completed, the lessons are made available to other institutions.

Table 5 contains a list of Delaware PLATO lessons published by the Control Data Corporation. Table 6 lists lessons that the University has published itself.

Table 5

Delaware PLATO Lessons Published by the Control Data Corporation

Lesson Titles	Lesson Author(s)	Submitted	Published
Cursus Honorum	Culley	9/78	12/79
The Verb Factory	Culley	9/78	12/79
Volleyball	Viera, Markham	10/80	4/82
Hang-a-Spy	Weissman	11/80	4/82
Film Motion Analysis	Barlow, Markham	2/81	5/83
Exploring Careers	Sharf, Collings, et al.	4/81	10/81
What is Break-Even Point?	Di Antonio, Bizoe	5/81	4/82
Internal Force	Snyder	7/81	4/82
Benefits	Sharf, Collings, et al.	12/81	pending
Exploring Careers (revision and expansion)	Sharf, Collings, et al.	12/81	pending

Table 6

Lessons Published by the University of Delaware

Lesson Titles	Lesson Author(s)	Completed
GUIDO Ear-Training System	Hofstetter, Lynch	8/79
Lesson Catalog System	Anderer	12/81
Information System for Small Documents	Laubach	12/81
Turing Machine Simulator	Maia	5/82
Push-down Automata	Maia	5/82
GUIDO Ear-Training System Micro PLATO version	Hofstetter, Lynch Wiley	1/83
Beginning Drafting	L. Frank, L. Gil, Nichol	5/84
Drosophila Melanogaster	Sheppard, Bergey	5/84
Gene Mapping by Conjugation	Olsen	5/84
Human Karyotype Analysis	Olsen	6/84
Mitosis and Cell Division	Beyer	6/84
Positioning of Genes in Bacteria by Deletion Part I	Sheppard, Beyer	6/84
Positioning of Genes in Bacteria by Deletion Part II	Sheppard, Beyer	6/84
Somatic Cell Genetics Part I	Sheppard, Beyer	6/84
Somatic Cell Genetics Part II	Sheppard, Beyer	6/84
Activity Self-Assessment	B. Kelly, D. Richards Mattera, Bishop, Berrang	6/84
Fitness Part I: Types of Fitness	O'Neill, D. Richards errang, Galla	6/84
Fitness Part II: Ingredierts of Fitress	O'Neill, D. Richards Bayalis, Correll Berrang, Giniger	6/84
Volleyball Strategy Lessons	Viera, Markham, Balogh	6/84
Volleyball Strategy Lessons	Viera, Markham, Mattera	6/84

Table 6 (continued)

Lesson Titles	Lesson Author(s)	Completed
Basic Racquetball Strategies for Doubles Play	Kent, Bayalis, Berrang Balogh, Bishop	6/84
Artifex Verborum	G. Culley, Sine Newman, Oberem	6/84
Cursus Honorum	G. Culley, Sine Oberem	6/84
Mare Nostrum: A Game with Latin Nouns and Adjectives	G. Culley, Haughay Sine	6/84
Translat: Exercises in Translating	G. Culley, Skillman Sine, Oberem, M. Frank	6/84
Verb Factory	G. Culley, Sine Oberem	6/84
Expansion of an Ideal Gas	S. Sandler, D. Harrell	6/84
Modeling of Binary Mixtures	S. Sandler, A. Semprebon D. Harrell	6/84
Modeling the Draining of a Tank	S. Sandler, B. Schwartz	6/84
The Rankine Refrigeration Cycle	S. Sandler, A. Semprebon	6/84
Repressurizer	S. Sandler, D. Harrell A. Semprebon	6/84
Steam Turbine	S. Sandler, B. Schwartz D. Harrell	6/84
Chemical Equilibrium Calculation Program	S. Sandler, J. Davis	6/84
Chemical Equilibrium Problem 1	S. Sandler, J. Davis	6/84
Chemical Equilibrium Problem 2	S. Sandler, J. Davis	6/84
Corresponding States Principle, Lesson I: Introduction to the Compressibility Factor Diagram	S. Sandler, A. Semprebon	6/84

Table 6 (continued)

Lesson Titles	Lesson Author(s)	Completed
Corresponding States Principle, Lesson II: Use of the Compressibility Factor Diagram	S. Sandler, A. Semprebon	6/84
Corresponding States Principle, Lesson III: The Enthalpy Departure Diagram	S. Sandler, A. Semprebon	6/84
Desuperheater	S. Sandler, D. Williams D. Harrell	6/84

Instructor and Author Training

Since the installation of the first PLATO terminal at the University, a series of seminars has been offered four times a year in order to provide academic and corporate educators with an opportunity to learn about various aspects of computer-based education. Seminars that are not specific to a particular computer system include a general orientation, two courses in lesson design, and a lesson review seminar. For those who want to develop PLATO lessons, there is an orientation for instructors, a sequence of TUTOR programming courses, a programming review seminar, a seminar on special-purpose lesson packages and other topics of current interest, and a seminar on how to program the microcomputer that is part of the architecture of most PLATO terminals. For those who want to specialize in a microcomputer, there is an introduction to instructional microcomputing, two courses in BASIC programming, a course in PASCAL, a course in 6502 assembly programming, and a course in Apple lesson design.

Both PLATO and microcomputer seminars are offered free of charge to members of the University of Delaware community. Because of the success that these seminars have had in producing competent CBE authors, and in response to the need for a national training program for CBE authors, the Office of Computer-Based Instruction offers the same training curriculum in a revised, modular format of intensive workshops for those outside the University who are interested in this training. Participants may select a one-week or a two-week training period. One-week registration allows participants to choose three modules from the training curriculum. Two-week registration allows participants to study five modules. A brochure with more information regarding this training program is available from the Office of Computer-Based Instruction. Tables 7, 8, and 9 list the general CBE modules, the PLATO modules, and the microcomputer modules, respectively.

Table 7

Training Seminars on Computer-Based Education in General

1. Introduction to Instructional Programs on Microcomputers and the PLATO System. General purposes and uses of the PLATO system are presented, along with a look at CBE on the Apple and other microcomputers. Instructional materials are demonstrated to illustrate special features such as touch-sensitive screens, joysticks, music synthesizers, random-access audio, and speech synthesizers. This module helps participants establish comparisons and guidelines for the use of CBE in their respective fields.

2. Lesson Design. This module presents guidelines for designing computer-based educational materials. Emphasis is placed on the advantages and disadvantages of a variety of instructional styles, plus work on basic display techniques, response handling, and individualized instruction.

3. Review and Critique of CBE Lessons. This module, designed to help authors improve the instructional materials they are developing, involves informal review and critique of one another's lessons, and the sharing of design techniques.

4. Advanced Lesson Design. This module addresses four specific problem areas in the design of computer-based educational materials: appropriate use of light pens and touch screens; improving student interaction; creating simulations; and making full use of alternate design formats.

Table 8

Training Seminars for PLATO Users and Authors

1. Orientation for PLATO Instructors. Guidelines for integrating PLATO lessons into the participant's learning environment are detailed. Topics include viewing the library of instructional materials on the PLATO system, organizing these materials into a curriculum, setting up student rosters, collecting student-usage data, and using the system's communication features. This module provides a valuable opportunity to learn how to individualize instruction.

2. Beginning TUTOR Programming. For those with little or no background in computer usage, this module offers the fundamentals of TUTOR, the language of the PLATO system, and includes guided practice at a PLATO terminal.

3. Advanced TUTOR Programming. For those with some prior knowledge of TUTOR, this module covers advanced topics in programming on the PLATO system, tailored to participants' individual programming needs.

4. TUTOR Programming Review and Critique. This module involves informal review and critique of TUTOR programming techniques used by participants. Lessons are reviewed for readability, documentation, and efficiency.

5. Site Management Training. Designed for those who manage a site on the PLATO system, this workshop emphasizes how to use "site director options" to run an efficient site. Topics include PLATO system hardware components; system resources such as extended memory, disk space, and computer time; and how to allocate resources among users.

6. Computer-Managed Instruction (CMI) on the PLATO system. Designed to teach participants how to use the PLATO Learning Management (PLM) package, this workshop demonstrates the use of the PLATO system for computer-managed instruction. PLATO Learning Management incorporates instructor-specified objectives, test items, mastery criteria and multimedia instructional materials. Topics include the use of PLM to individualize instructional programs, to create competency-based courses, and to set up study/review materials.

7. MicroTUTOR Programming. This module introduces participants to MicroTUTOR, the language of the microprocessor in programmable PLATO terminals. Topics include judging, dual processing, conversions and floppy disks.

Table 9

Training Curriculum for Microcomputer Users and Authors

1. Introduction to Instructional Microcomputers. Components and uses of a typical instructional microcomputer are outlined. Topics include discussion of terminology, operating systems, start-up procedures, and trouble-shooting. Sessions compare the Apple system to other microcomputer systems and peripherals. Hands-on experience is included in all sessions.

2. Introduction to BASIC. Participants develop skills in utilizing BASIC statements to produce instructional materials. This seminar is for those with interest and/or experience in programming who wish to develop programming skills on a microcomputer. Familiarity with the introductory terminology of microcomputers is assumed.

3. Advanced BASIC Programming. Emphasizing programming techniques in the BASIC programming language, this module is intended for those who have mastered beginning BASIC and covers such topics as graphics, color, and the creation of files for data collection.

4. Instructional Programming in PASCAL. Emphasis is placed on the use of the editor, modes of display, and the formulation of typical PASCAL programming structures. Participants learn how to obtain information on specific commands from reference manuals, and they program a small practice lesson of their choice.

5. Introduction to Assembly Language Programming. Participants learn the assembly language instructions and addressing modes of the 6502 microprocessor. Hexadecimal arithmetic, logical operators, and the functions of hardware gates are covered.

6. Apple Lesson Design. Techniques of instructional design are applied to the development of programs for the Apple microcomputer. Topics include making the design fit the sophistication of the programming language and capabilities of the Apple system, simplifying difficult student input situations, using color wisely, and choosing appropriate function key conventions. The critique of existing Apple lessons is included.

A growing number of teachers from Delaware's public schools have become interested in using instructional computers in the classroom. In response to their requests for an opportunity to learn more about computer-based education, a Summer Institute in Computer-Based Education was held during July of 1976. Jointly funded by the University and the Delaware School Auxiliary Association, the Institute offered instruction on the PLATO system and on Project DELTA, a minicomputer-based system with terminals in many of Delaware's high schools. In addition, all participants attended a seminar to discuss issues raised in the book by Hunter et al., Learning Alternatives in U.S. Education: Where Student and Computer Meet (Englewood Cliffs: Educational Technology Publications, 1975).

A second Summer Institute in Computer-Based Education was held from July 24 through August 11, 1978, jointly funded by the National Science Foundation and the Delaware School Auxiliary Association. Ninety-six teachers from the tri-state area attended this Institute and studied the history of computer-based education, programming of the DELTA system and the PLATO system, and instructional design of computer-based learning materials, as well as instructional applications of computers in art, chemistry, mathematics, music, physics, and social science.

A similar Summer Institute was funded by the National Science Foundation and was held July 23 through August 10, 1979. In addition, the Delaware School Auxiliary Association provided funds for a second 1979 Summer Institute to serve computer-based training needs of teachers of agriculture, biology, business, and economics.

In 1980, a fifth Summer Institute was funded by the National Science Foundation. In recognition of the growing use of personal computers in elementary and secondary schools, presentations on the Apple II, TRS-80, PET, and TERAK personal computers were added to the 1980 Summer Institute. Also added were faculty lectures on the instructional applications of computers to biology and psychology.

In 1981, the National Science Foundation funded a sixth Summer Institute for ninety-six teachers of fifth through twelfth grade biology, chemistry, economics, mathematics, physics, and psychology from the states of Virginia, Maryland, Ohio, Delaware, Pennsylvania, New Jersey, New York, Connecticut, and Rhode Island. Recognizing the widespread use of microcomputers in schools, the University installed a microcomputer classroom. Teachers had their choice of learning BASIC on the Apple II microcomputer or of learning TUTOR on PLATO. All of the participants had access to both PLATO and Apple systems during this three-week Institute.

In the fall of 1981, the Information and Dissemination in Science (IDSE) program of the National Science Foundation provided funding for an Institute on microcomputers for school administrators and decision-makers. Forty-eight participants spent two days attending sessions which included "An Overview of Educational Microcomputers," "Choosing a Computer," "Evaluation and Development of Courseware," "Initiating and Administering CBE Programs," and "Seeking Funding for CBE." Ample time was allotted for hands-on experience and consultation.

The National Endowment for the Humanities sponsored a Summer Institue in Computer-Based Education for secondary-school foreign language teachers during the summer of 1982. This Institute, modeled on the highly successful SICBE institutes for science teachers, brought thirty high-school teachers from six states to the University for a program jointly administered by the Office of Computer-Based Instruction and the Department of Languages and Literature. Instruction took place in the Apple microcomputer classroom. Three teachers have since successfully marketed their work. Participating teachers discussed design criteria for language-teaching materials, reviewed a broad selection of existing programs on microcomputers and mainframes, and developed their own materials on Apple microcomputers.

The University funded an eighth Summer Institute in Computer-Based Education for seventy-five teachers in the first summer session of 1983. This four-week Institute consisted of three main areas of study, namely, a survey of the applications of microcomputers to education, identification of instructional goals and their attainment through computer-based learning materials, and an introduction to instructional programming on the Apple or Atari microcomputers.

Participation in the Summer Institutes has reaped several benefits for area teachers and school administrators. Many have gone on to evaluate, develop, test, and implement computer-based instructional materials in their respective schools. Some have been motivated to pursue advanced degree programs with concentrations in computer-based education. A few have taken part-time jobs in order to obtain on-site training in the methods and uses of computer-based education. Four of those originally employed part-time have become full-time professionals in the Office of Computer-Based Instruction. In turn, the University has learned much about what instructional needs in middle school and high school environments may be met through computer-based techniques.

Orientation to Computer-Based Instructional Systems

New users usually begin their orientation to computer-based instructional systems by attending the Office of Computer-Based Instruction's introductory seminars on PLATO and microcomputers. These seminars are followed up by a review of lesson materials.

Potential users may review lessons in their field to consider them for use by their students and/or to provide ideas for new lessons. Ideas for applications in one's own subject can be conceived as a result of looking at lessons in other subjects.

Another early step in becoming acquainted with the features of CBI systems involves trying various accessories such as the random-access audio device, which presents pre-recorded messages; the University of Delaware Sound Synthesizer; the Votrax digital speech devices; the random-access slide projector; different types of printers; and input devices such as joysticks, game paddles, light pens, and graphics tablets.

The microcomputer classroom, located in room 203-1 Willard Hall Education Building, has a growing library of diskettes and manuals that are cataloged according to subject matter and grade level. To see microcomputer lessons, reviewers can search through the card catalog in the microcomputer classroom and give the catalog number to the classroom assistant. The assistant will then locate the appropriate diskette and instruct the reviewer in its use.

More than 8000 hours of lessons reside on the Delaware PLATO system. The ever-increasing PLATO lesson library is organized into twenty-seven subject matter catalogs and is accessible from any PLATO terminal. In addition, comprehensive written guides to lesson materials are available from the Office of Computer-Based Instruction.

In order to facilitate the review of PLATO lessons by faculty, staff, students, and visitors, a special "demonstration" signon has been created which gives all users immediate and easy access to lessons on the PLATO system. Instructions for using this signon are illustrated in figures 7 and 8. First, when you are asked for your name, type "demo" as shown in figure 7, then press the NEXT key. Second, when you are asked for your group, type "demo," as shown in figure 8, then hold down the the SHIFT key while pressing the STOP key. You will then see an index that will let you access most of the instructional materials on the PLATO system. This index is shown in figure 9. Reviewers may try a lesson by typing the appropriate letter from the index.

Four PLATO lessons have been written specifically for the purpose of orienting new users to the Delaware PLATO system. They include "How to Use PLATO," which teaches new users how to operate the terminal; "Seminars Offered by the Office of Computer-Based Instruction," which describes the seminar series offered four times a year by OCBI; "Information About OCBI," which displays tables and graphs on monthly terminal use, projected costs, and departmental involvement; and "Delaware PLATO System Hardware Configuration," which describes the PLATO system, communications equipment, and terminals. These four lessons are accessible from the demonstration index.

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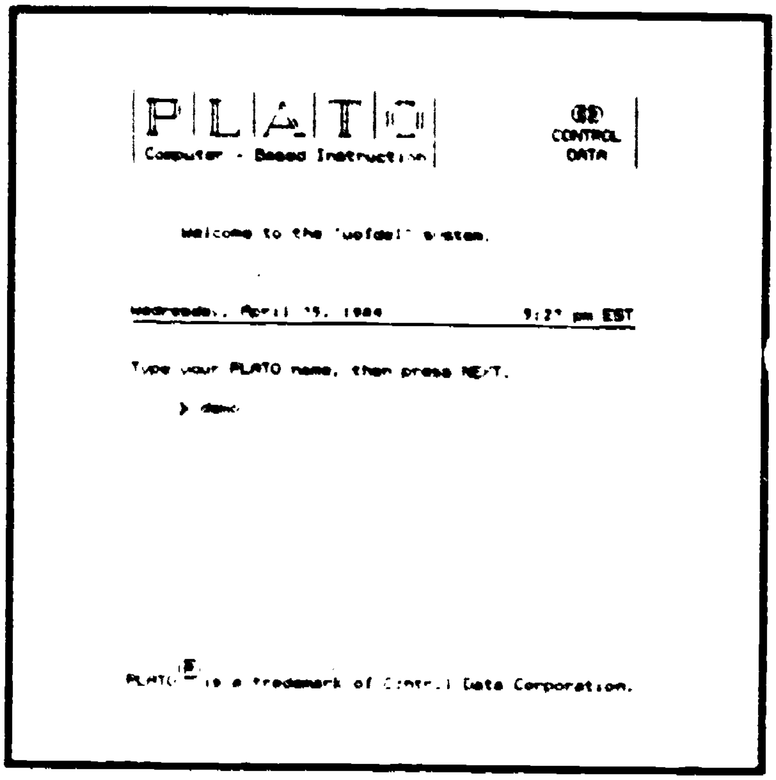

Figure 7. Signing on for Lesson Review: The Name.

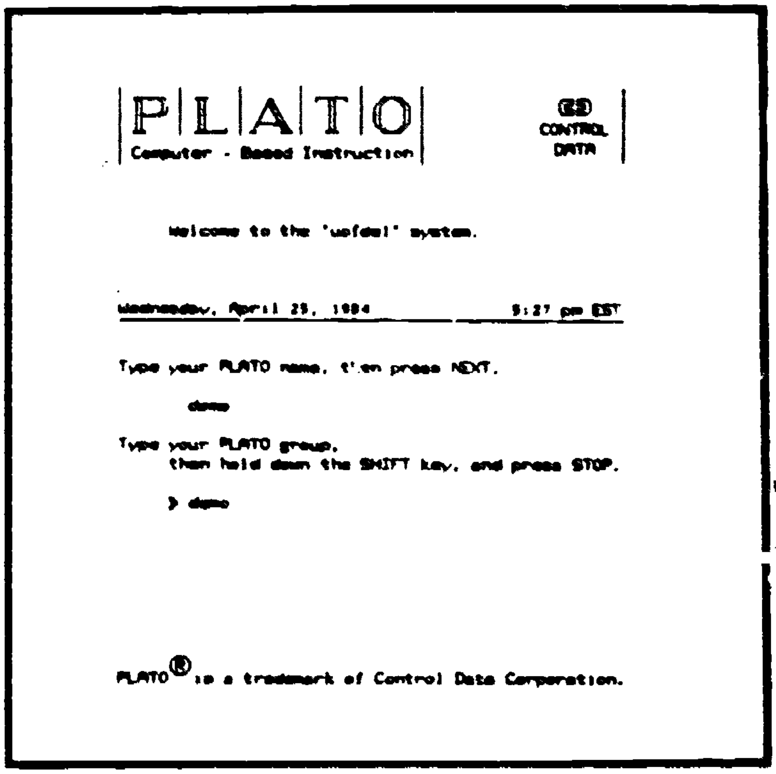

Figure 8. Signing on for Lesson Review: The Group.

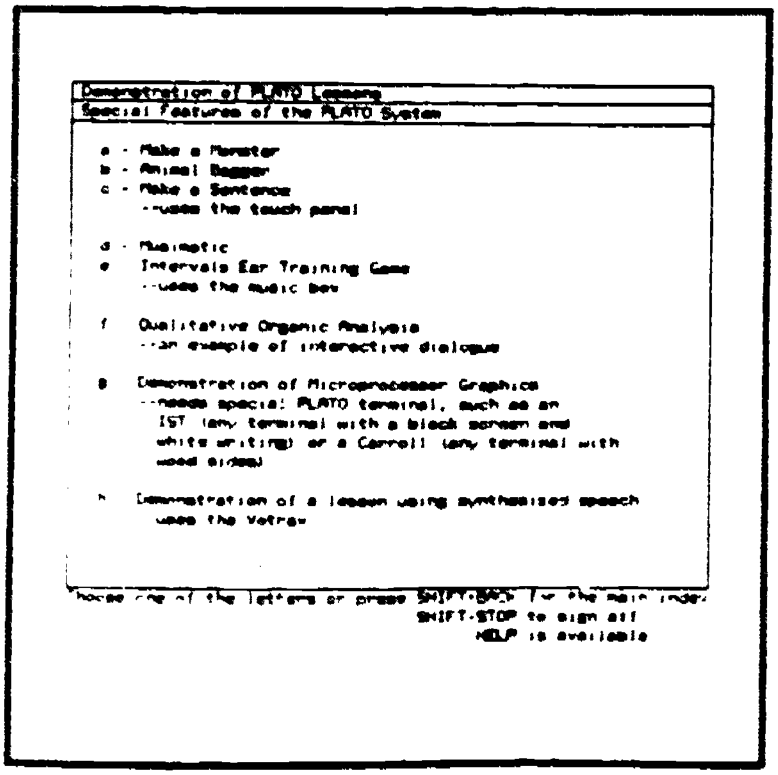

Figure 9 (a). Index of Programs for Lesson Review.

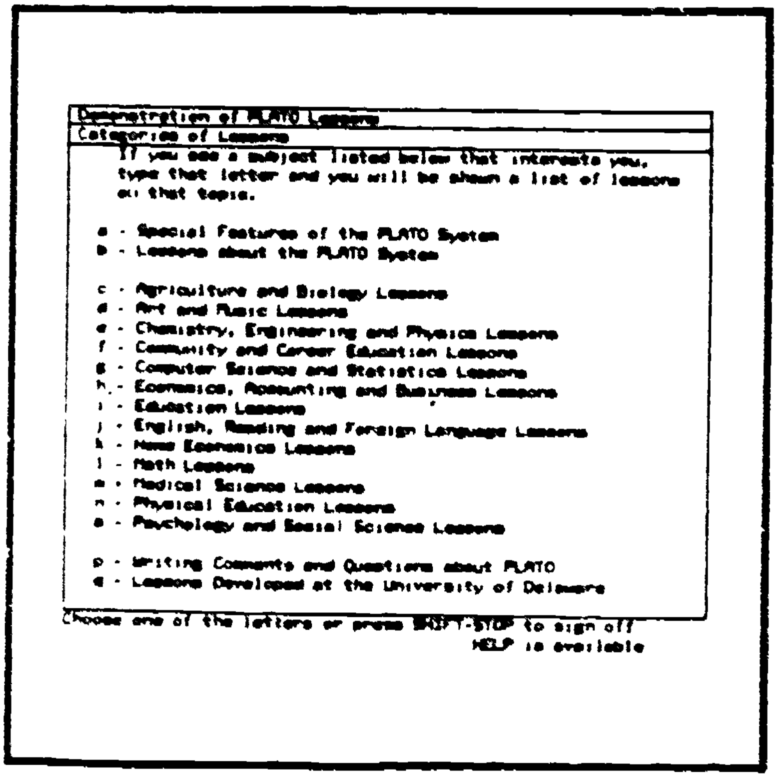

Figure 9 (b). Index of Programs for Lesson Review.

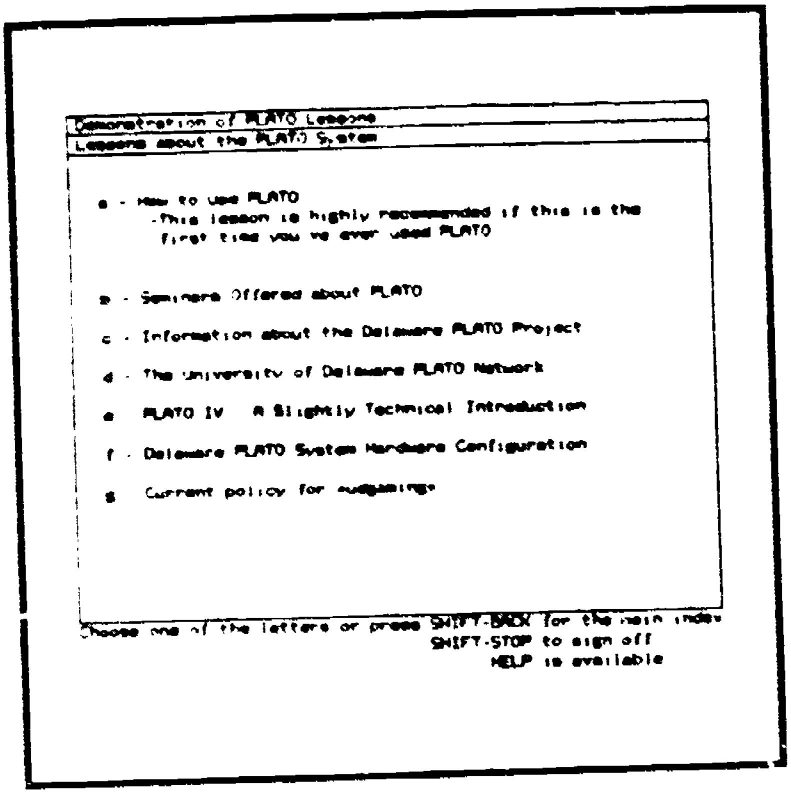

Figure 9 (c). Index of Programs for Lesson Review.

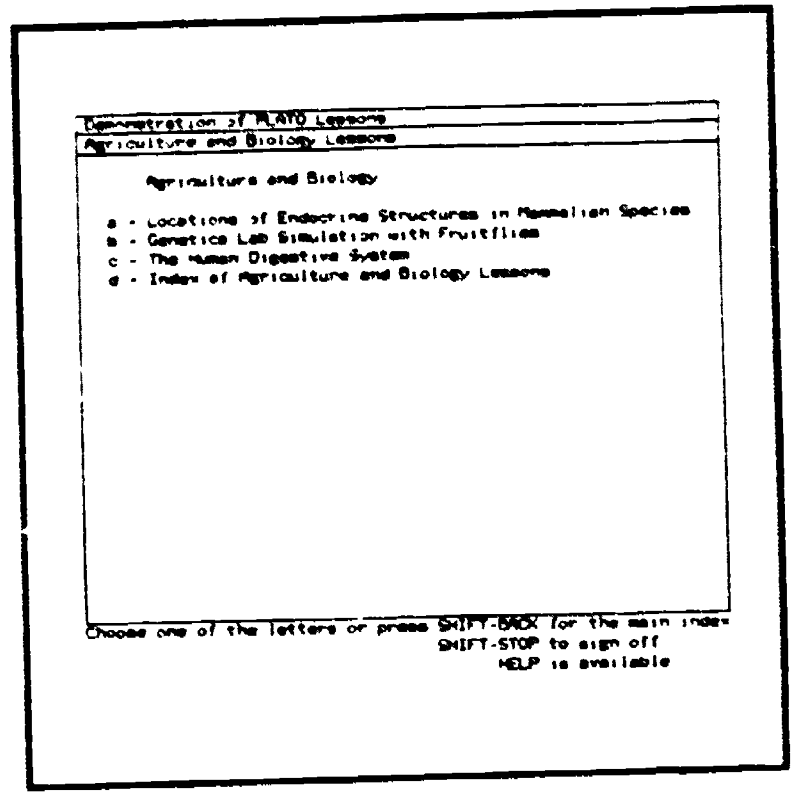

Figure 9 (d). Index of Programs for Lesson Review.

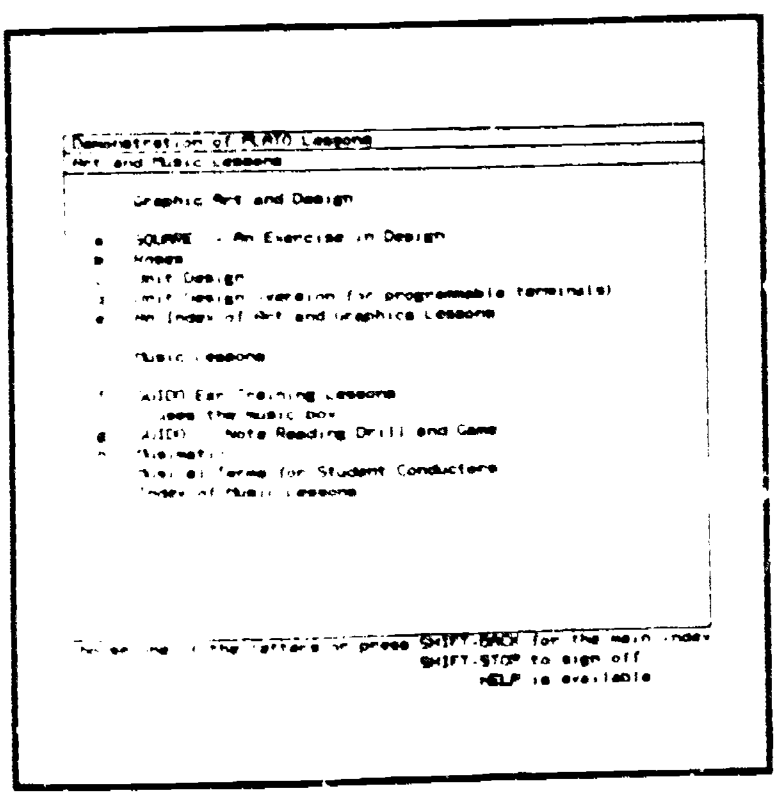

Figure 9 (e). Index of Programs for Lesson Review.

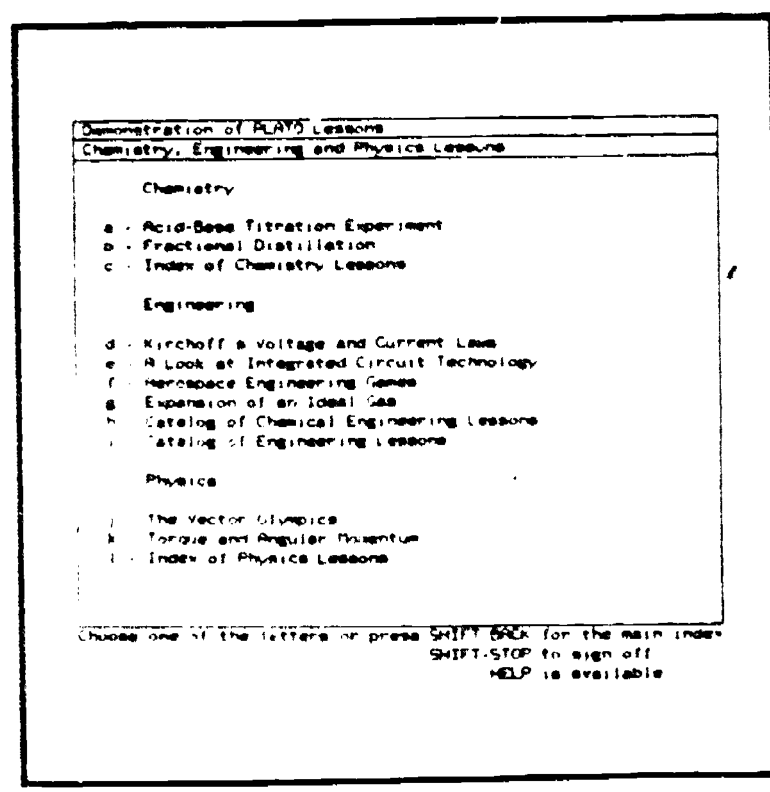

Figure 9 (f). Index of Programs for Lesson Review.

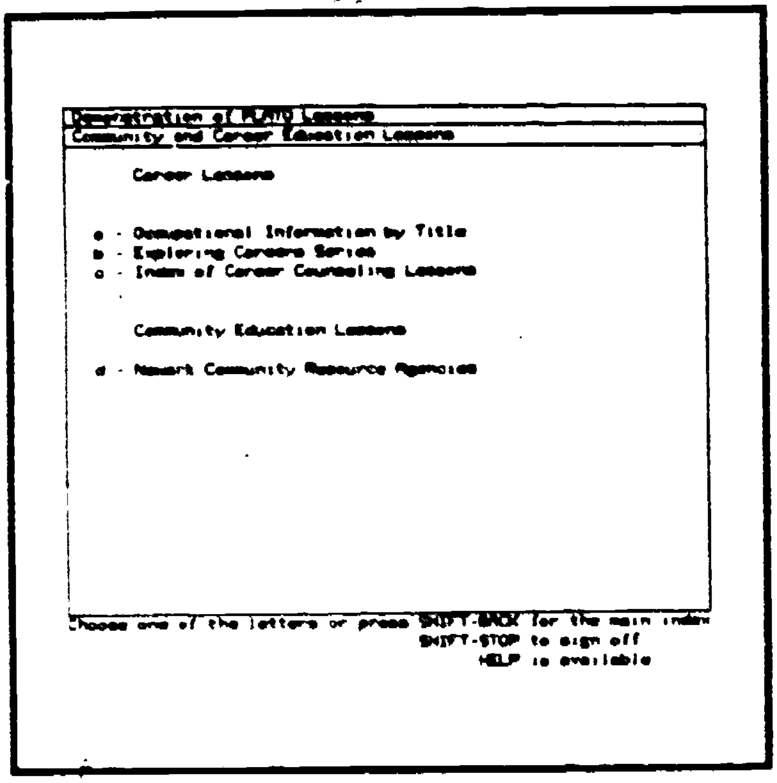

Figure 9 (g). Index of Programs for Lesson Review.

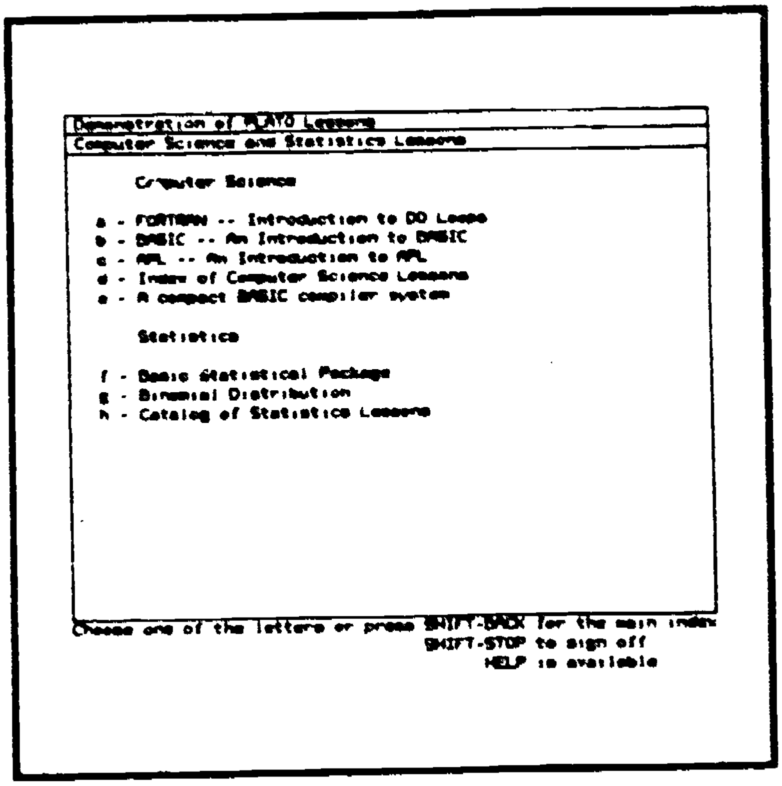

Figure 9 (h). Index of Programs for Lesson Review.

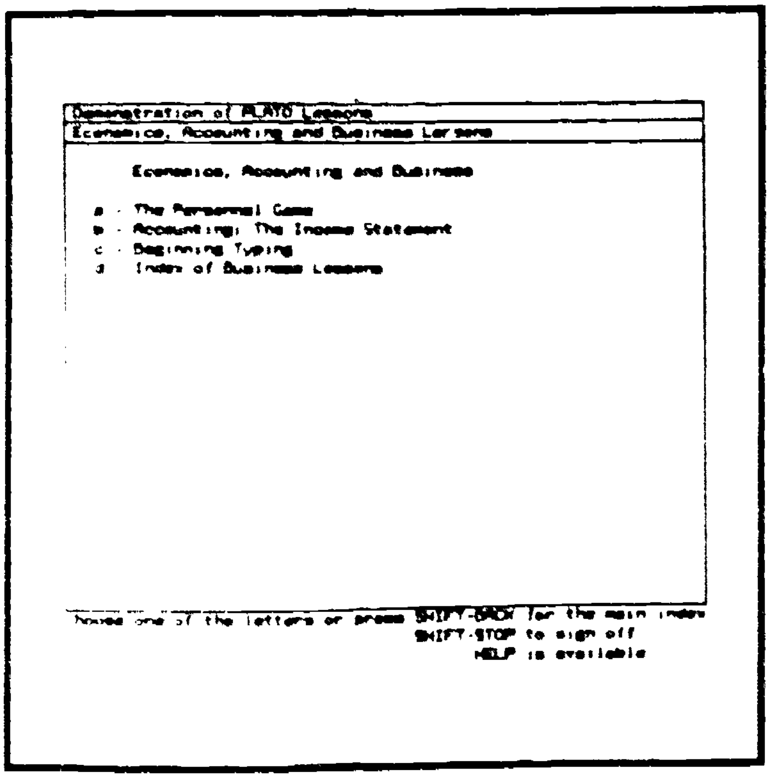

Figure 9 (i). Index of Programs for Lesson Review.

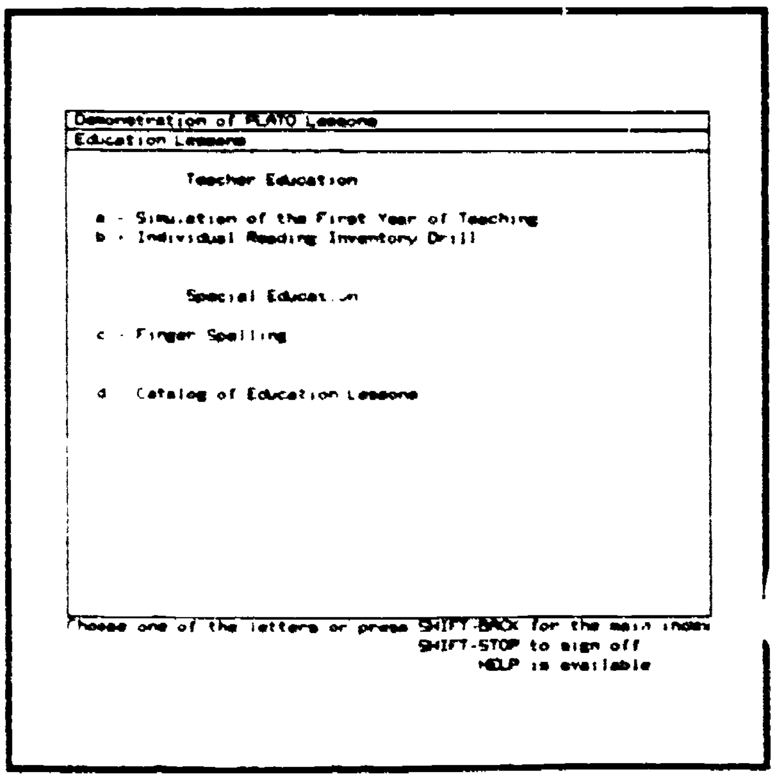

Figure 9 (j). Index of Programs for Lesson Review.

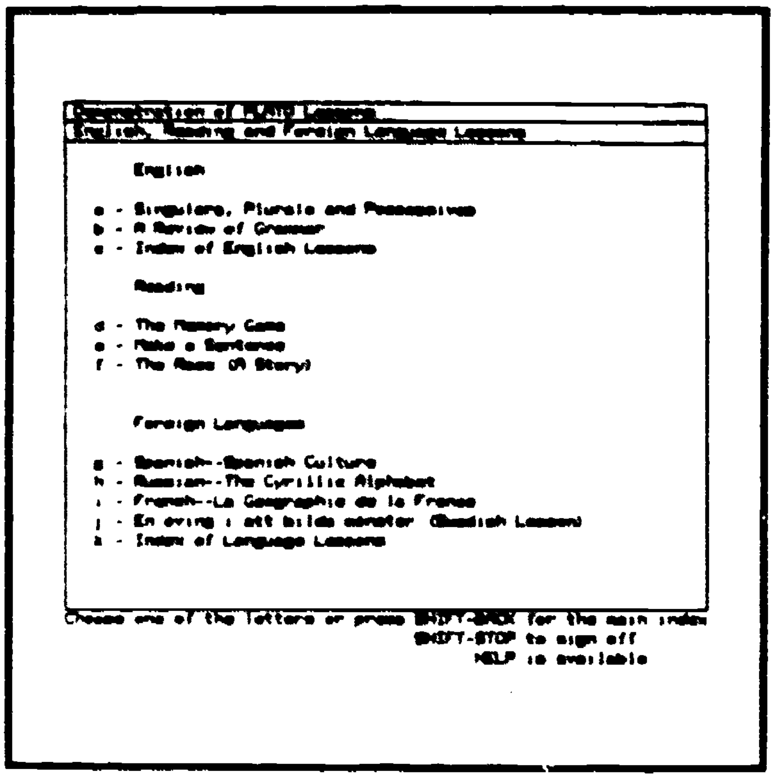

Figure 9 (k). Index of Programs for Lesson Review.

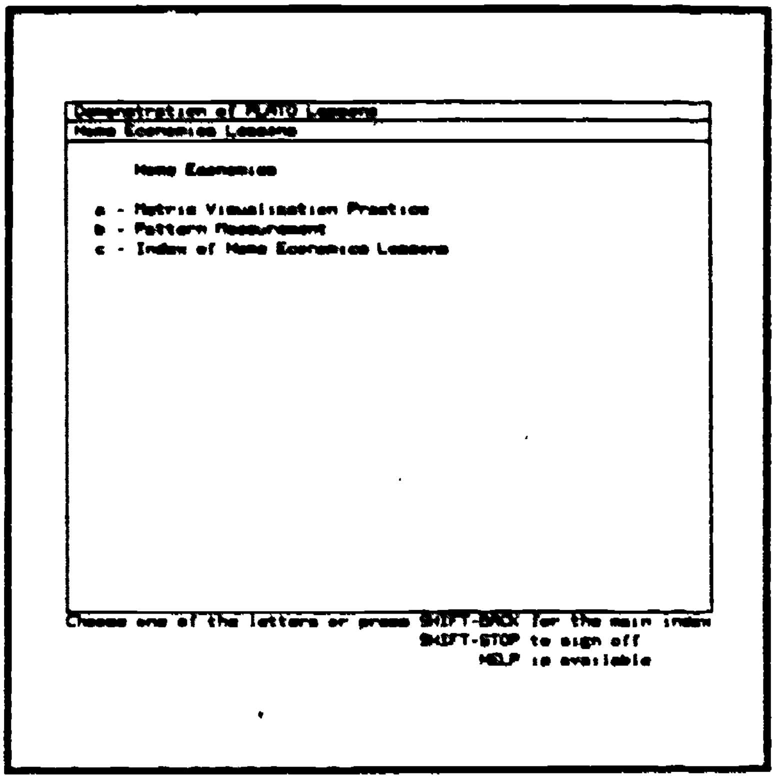

Figure 9 (l). Index of Programs for Lesson Review.

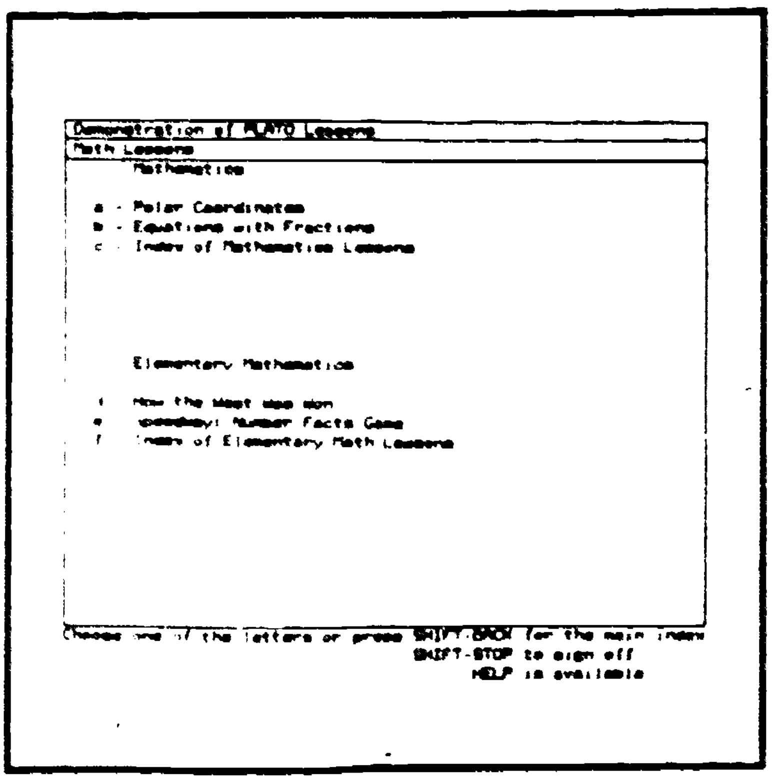

Figure 9 (m). Index of Programs for Lesson Review.

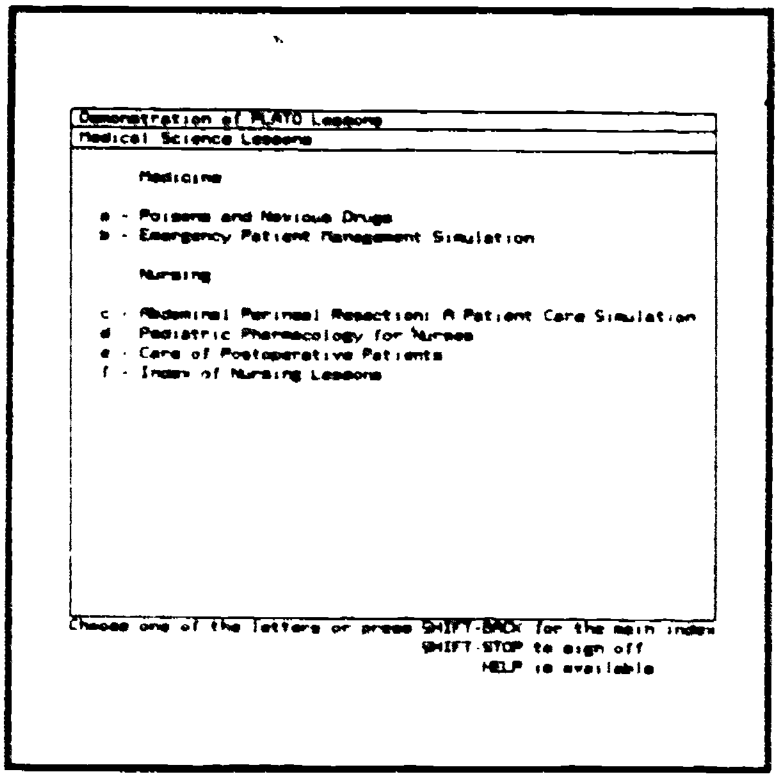

Figure 9 (n). Index of Programs for Lesson Review.

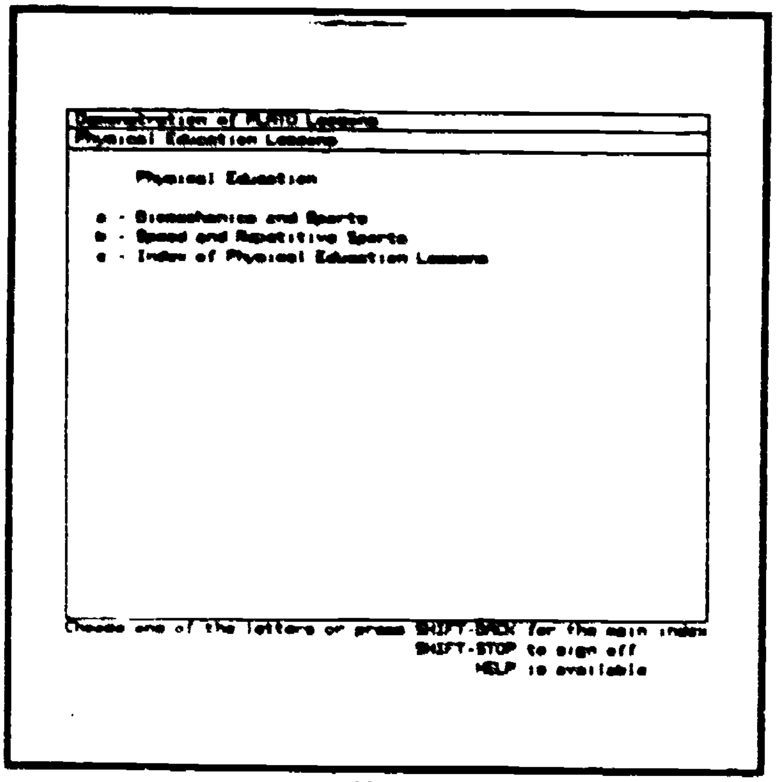

Figure 9 (o). Index of Programs for Lesson Review.

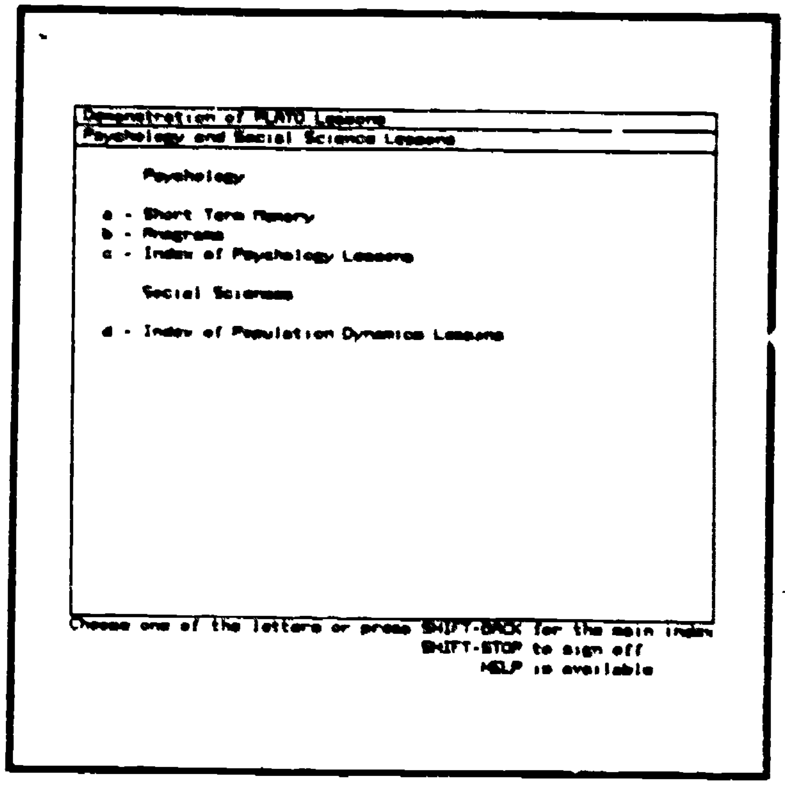

Figure 9 (p). Index of Programs for Lesson Review.

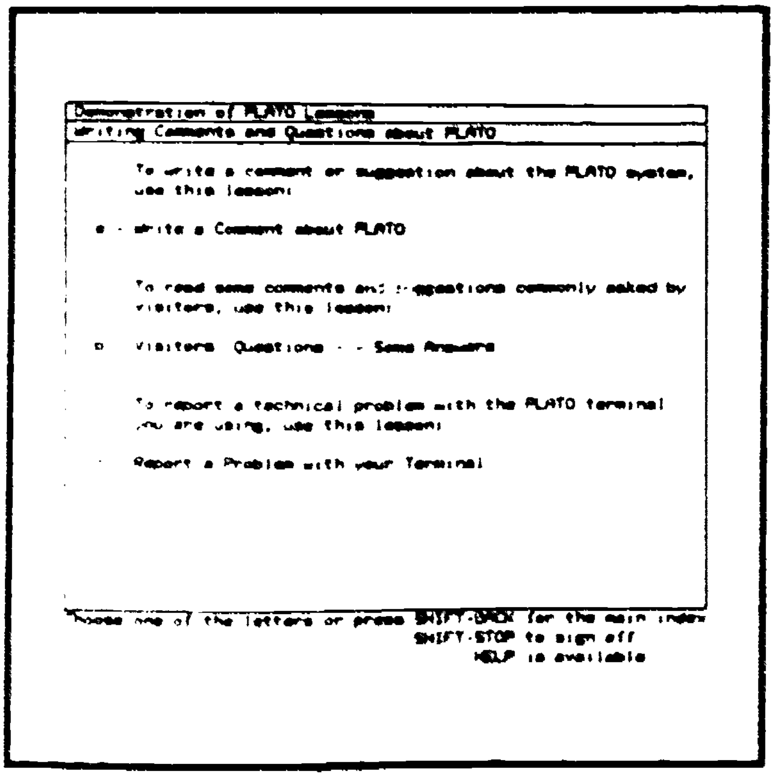

Figure 9 (q). Index of Programs for Lesson Review.

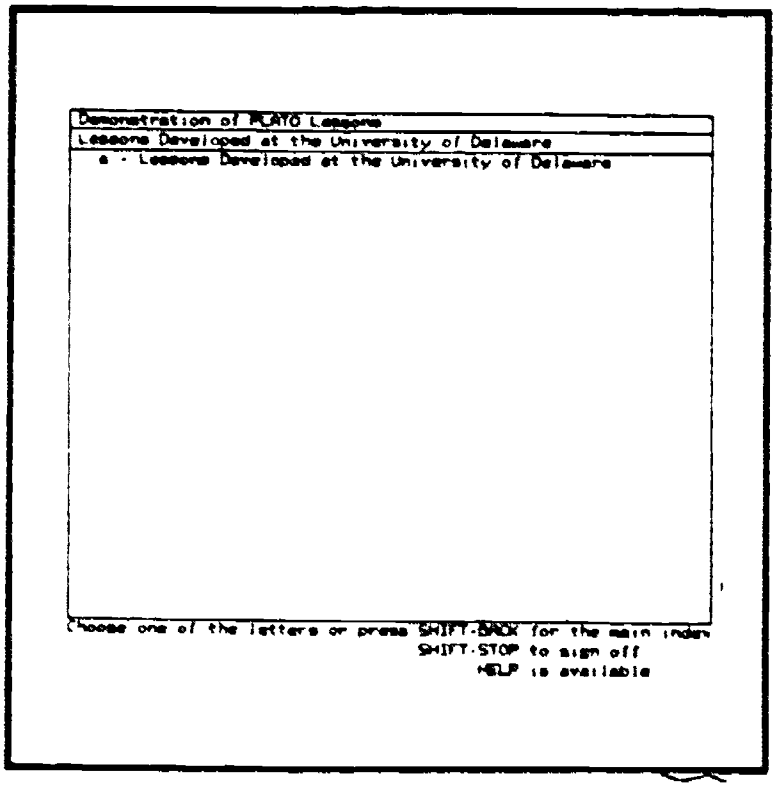

Figure 9 (r). Index of Programs for Lesson Review.

Participation in Conferences

The University of Delaware is an active participant in ADCIS, the principal national forum for the scholarly exchange of ideas regarding computer-based education. OCBI regularly delivers progress reports at the Association's annual meetings. Papers have also been presented at ADCIS special interest group meetings. Delaware faculty members organized special interest groups in music in 1976, home economics in 1979, mathematics in 1981, and theory and research in 1981.

The 1984 ADCIS Cconvention was held in Columbus, Ohio. Fred T. Hofstetter gave the Dean Lecture. Named after Peter Dean, a pioneer in the field of CBE, this lecture is the featured presentation at each ADCIS conference. The speaker is chosen by a ballot sent to all ADCIS members. Louisa Frank, Bonnie A. Seiler, and Lynn H. Smith participated in panel discussions on the topic of converting PLATO software to microcomputers. Ms. Seiler also moderated a panel discussion entitled "Marketing Micro Materials." Mary Jac Reed conducted workshop presentations. Dr. Michael A. Arenson was re-elected chairperson of the music special interest group, and Dr. Ronald Wenger continued as chairperson of the math special interest group.

Many OCBI staff helped found a Greater Delaware chapter of the Association for Educational Data Systems (AEDS). This chapter serves Delaware and Southeastern Pennsylvania by providing an exchange of ideas among educational computing users and by offering further training in the field. The name of the chapter is GDAEDS, which stands for Greater Delaware Association for Educational Data Systems. A monthly GDAEDS newsletter is published with support from OCBI.

In the fall of 1983, GDAEDS held a workshop called "Educational Computing -- Decisions, Applications, and Sharing Expertise." Dr. Sylvia Charp, President of the International Federation for Information Processing, delivered the keynote address. The first annual Spring Conference was held on March 17 in conjunction with the Delaware State Computer Faire. The conference theme was "Educational Computing into the Twenty-First Century." Dr. Robert Taylor, director of the educational technology program at Teachers College in New York City, delivered the keynote address. Twenty-five vendors displayed products in the exhibit hall. GDAEDS donated a Commodore 64 as a prize for a programming contest held in conjunction with the Faire. Fred T. Hofstetter, Roland Garton, and James K. Hadlock were elected past president, president, and president-elect, respectively.

In addition to ADCIS and AEDS, Delaware faculty and OCBI staff members have been quite active in presenting papers and workshops before several forums. Table 10 lists presentations given during 1983-84.

Table 10

Conference And Workshop Presentations
by Delaware Faculty and Staff
During 1983-84

Arnott, Patricia. 1984. Computer-Assisted Instruction: Considerations for Libraries. Banquet speech at the Fifth Southeastern Bibliographic Instruction Conference, Gainesville, Florida, May 10.

Arnott, Patricia and Richards, Deborah. 1984. CAI Design Workshop for Bibliographic Instruction for Librarians. Workshop given at the Fifth Southeastern Bibliographic Instruction Conference, Gainesville, Florida, May 10-11.

Arnott, Patricia and Richards, Deborah. 1983. Some Considerations of a Computer-Assisted Instruction Program: The University of Delaware Library Experience. Paper presented at the Library and Information Technology Association Annual Conference, Baltimore, Maryland, September 30.

Barlow, David and Payalis, Patricia. 1984. Computer Applications for Teaching and Learning in Physical Education. Paper presented at the Second National Symposium on Teaching Kinesiology and Biomechanics in Sports, Colorado Springs, Colorado, January 13.

Feurer, Gary A. 1984. "Intelligent" Computer-Assisted Instruction. Presented at the GDAEDS Conference, Delaware State College, Dover, Delaware, March 17.

Frank, Louisa and Smith, Lynn H. 1984. The Conversion of PLATO Courseware to the Apple Microcomputer. Presented at the ADCIS conference, Columbus, Ohio, May 14-17.

Garton, Roland; Reed, Mary Jac; Reed, George; and Stevens, Evelyn V. 1984. Developing a CBI Course: The Process. Presented at the ADCIS conference, Columbus, Ohio, May 14-17.

Garton, Roland; Reed, Mary Jac; Reed, George; and Stevens, Evelyn V. 1984. Programming a CBI Course: A Case Study. Presented at the ADCIS conference, Columbus, Ohio, May 14-17.

Garton, Roland. 1983. Computers in Education. Presented at the Continuing Education Computer Faire, University of Delaware, Newark, Delaware, March 13.

Garton, Roland. 1983. The AEDS Organization--How Would You Like Your Chapter? Presented at the GDAEDS Workshop, University of Delaware, Newark, Delaware, October 29.

Table 10 (continued)

Hadlock, James K. 1984. Introduction to Computer Hardware. Presented at the GDAEDS Conference, Delaware State College, Dover, Delaware, March 17.

Hadlock, James K. 1984. Introduction to Computer Software. Presented at the GDAEDS Conference. Delaware State College, Dover, Delaware, March 17.

Hofstetter, Fred T. 1984. Perspectives on a Decade of Computer-Based Instruction. Dean Lecture. Presented at the ADCIS Conference, Columbus, Ohio, May 15-18.

Hofstetter, Fred T. 1984. Keynote Speech and Music Clinic, Educational Computing Consortium of Ohio, Cleveland, Ohio, May 3-4.

Hofstetter, Fred T. 1984. Technology and the Arts. Presented at the University System Executive Seminar, Control Data Corporation, Minneapolis, Minnesota, May 2-3. Also presented at Control Data on March 7, 1984 and November 16, 1983.

Hofstetter, Fred T. 1984. The Micro GUIDO Music Learning System. Day-Long Clinic at St. Thomas Choir School in New York City, New York, April 11.

Hofstetter, Fred T. 1984. Computer-Based Instruction: What Difference Can It Make? Presented at the National Conference on Computers and Young Children, University of Delaware, April 5-6.

Hofstetter, Fred T. 1984. Computer-Based Instruction: Using Computer Active Toys Presented at the National Conference on Computers and Young Children, University of Delaware, April 5-6.

Hofstetter, Fred T. 1984. The NEH Videodisc Music Series. Presented at the Music Educators National Conference, Chicago, Illinois, March 21-24.

Hofstetter, Fred T. 1984. Day-long Clinic on Computer-Based Music Instruction for the Christina School District, Newark, Delaware, February 17.

Hofstetter, Fred T. 1984. Teacher Preparation for Computer Education. Invited presentation for the State Computer Planning Task Force, Greater Wilmington Development Council, Wilmington, Delaware, February 4.

Hofstetter, Fred T. 1984. Taking the First Byte: Computer-Based Instruction. Presented at the University of Delaware Computer Center, Newark, Delaware, January 19.

Table 10 (continued)

Hofstetter, Fred T. 1983. Learning With Computers. Presented at the Seaford School District Computer Night, Seaford, Delaware, November 14.

Hofstetter, Fred T. 1983. Hand-Held Educational Microcomputers. Presented at the GDAEDS Workshop, University of Delaware, Newark, Delaware, October 29.

Hofstetter, Fred T. 1983. Panel Discussion--Dealing with New Challenges of Technology. Presented at the GDAEDS Workshop, University of Delaware, Newark, Delaware, October 29.

Hofstetter, Fred T. 1983. Teacher Training for K-12 Computeracy: Music and Tutorial Computing. United States Department of Education, Teacher's College, Columbia University, New York City, New York, October 20.

Hofstetter, Fred T. 1983. Computer-Based Instruction in Mathematics and English. Keynote Address, Delaware Council of Mathematics and English, Wilmington, Delaware, October 14.

Hofstetter, Fred T. 1983. A word processing tutorial. Department of Music, University of Delaware, Newark, Delaware, September 14.

Hofstetter, Fred T. 1983. Computers in Engineering Education. Keynote Address, Faculty In-Service Program at the Milwaukee School of Engineering, Milwaukee, Wisconsin, September 1.

Hofstetter, Fred T. 1983. The Past, Present and Future of Computer-Based Learning. Keynote Address, Faculty In-Service Program at Johnson County Community College, Overland Park, Kansas, August 12.

Hofstetter, Fred T. 1983. Clinic on the GUIDO Music Learning System at the Summer Institute of the Delaware State Music Teacher's Association, University of Delaware, August 9.

Hofstetter, Fred T. 1983. Seminars on the design of computer-based learning materials, Teacher's College, Columbia University, New York City, New York, July 18-22.

Hofstetter, Fred T. 1983. The Societal Impact of Home Computing. Presented at the University by the Sea, Lewes, Delaware, July 13.

Table 10 (continued)

McBride, Suzanne R. 1984. Children's Computer Programming: An Analysis of the Learning Process. Paper presented at the Annual Meeting of the American Educational Research Association, New Orleans, Louisiana, April 23-27.

McBride, Suzanne R. 1983. Logo: A Language for Learning. Paper presented at the DATE/DCTM Conference, Wilmington, Delaware, October 14.

McBride, Suzanne R. 1983. The Use of Logo in the Classroom. Presented at the GDAEDS Workshop, University of Delaware, October 29.

McBride, Suzanne R. 1983. Logo for Parents and Kids. Presented at the GDAEDS Conference, Delaware State College, Dover, Delaware, March 17.

Mayhew, Frances W., and Gardner, Vickie. 1983. The Alterlab Lesson: A Simulation Program to Teach the Principles of Pattern Alteration. Paper presented at the National Meeting of the Association of College Professors of Textiles and Clothing, Honolulu, July 7-8.

Mayhew, Frances W. 1984. The Alterlab Lesson: A Simulation Package to Teach the Principles of Pattern Alteration. Presented at the ADCIS conference, Columbus, Ohio, May 14-17.

Morris, Sandra, and Hadlock, James K. 1983. Computers and Classrooms: Physical Considerations. Paper Presented at the National Conference on Computers and Young Children, University of Delaware, Newark, Delaware, April 5-6.

Mulford, George W. 1984. The Use of Computers in Foreign-Language Instruction. Presented at the Lehigh Valley Association of Independent Colleges, Lafayette College, Easton, Pennsylvania, April 7.

Mulford, George W. 1983. L'Ordinateur: Un Outil pour le Professeur, Une Aide pour l'Etudiant. Presented at the Philadelphia Area Association of Teachers of French, Philadelphia, Pennsylvania, November 15.

Mulford, George W. 1983. College-Level Use of Computing in Instruction. Presented at Salisbury State College, Salisbury, Maryland, March 3.

Peterson, Larry and Schwartz, Ed. 1983. The Applications of Laser Videodiscs to the Teaching of Music Theory, Music Literature, and Music Appreciation. Paper presented at the National Association of Schools of Music Conference, Dearborn, Michigan, November 21.

Table 10 (continued)

Reed, Mary Jac. 1984. Lesson Design for the VAX. Paper presented at the DECUS Conference, Cincinnati, Ohio, June 3.

Reed, Mary Jac. 1984. Designing CAI Lessons. Paper presented at the CALICO Symposium for Brigham Young University's Consortium on Language Learning, Baltimore, Maryland, January 22.

Schwartz, Ed. 1983. The Interactive Videodisc in the Future of Education. Presented at the GDAEDS Conference, Delaware State College, Dover, Delaware, March 17.

Sharf, Richard; Frank, Louisa; and Frank, Michael. 1983. Teaching Vocational Counseling Skills Using Computer Simulation. Paper presented at the American College Personnel Association Renewal '84, Baltimore, Maryland, April 9.

Sine, Pat and Garton, Roland. 1983. Comparison of Popular Microcomputers. Presented at the GDAEDS Workshop, University of Delaware, Newark, Delaware, October 29.

Sloyer, Clifford and Smith, Lynn H. 1983. Using Computer Graphics to Teach Applied Mathematics. Paper presented at the DATE/DCTM Conference, Wilmington, Delaware, October 14.

Stabosz, Rae D., and Weissman, Jessica. 1984. A Model for PSO Consulting in a Large, Multi-System CBE Envirnoment. Presented at the ADCIS conference, Columbus, Ohio, May 14-17.

Williams, Dennis, and Schwartz, Ed. 1984. Interactive Videodiscs as Educational Resource Media: A Case for the Generic Disc. Paper presented at the Society for Applied Learning Technology Conference, Orlando, Florida, February 15.

Williams, Dennis; Hearn, Lonnie; and Schwartz, Ed. 1984. Producing Optical Videodiscs for Interactive Music Instruction. Paper presented at the Association for Educational Communications and Technology Conference, Dallas, Texas, January 21.

Peripheral Development

During 1979, OCBI added to its staff the position of peripheral design engineer. This position was created in order to help the Office meet some hardware needs for research being done on the PLATO system and to facilitate the design of new equipment not currently available for the system. In 1982, an Ithaca Intersystems microcomputer development system was put into use to aid in hardware development activities. Some examples of how research problems have been solved and of how new equipment is being developed are provided for projects in psychology, physical education, music, art, and Latin.

Psychology needed a real-time clock accurate to 1/1000 second for measuring human response times to visual stimuli presented through microprocessor-programs in the PLATO terminal. In order to meet this need, a timer was constructed out of MOS LSI integrated circuits. The design allows the researcher to make certain key connections which make the timer both versatile and easy to use.

Physical education needed a digitizer so that key points in films of human movements in competitive sports could be read by PLATO lessons in making accurate stick figures that could in turn be used to analyze and to correct errors in sports movements. This need was fulfilled by purchasing a Bit Pad from Summagraphics Incorporated and interfacing it to the PLATO terminal in physical education's Biomechanics Laboratory.

A long-standing need of the music project had been a music synthesizer which could provide control over timbre, envelope, and special effects, in addition to time and frequency. A new music synthesizer, in production since the spring of 1981, was designed to contain fully programmable wave shapes and envelopes, plus control of glissando, tremolo, and vibrato. Based on a Z-80 microprocessor, the University of Delaware Sound Synthesizer (UDSS) can be used not only with the PLATO system but with any system that can send 8-bit parallel data. A Kay Elemetrics Pitch detector has also been interfaced to link with PLATO and the UDSS for the teaching of sight-singing.

The departments of art, physical education, and psychology are using an interface to a random-access Kodak slide projector whereby pictures are shown in instructional lessons. And for the optical input of pictures, a videoprocessor has been developed. This videoprocessor converts images placed before a video camera to digital pictures that can be displayed on screens of intelligent terminals. The storage capacity of Micro PLATO stations allows quick retrieval of these pictures in instructional lessons. Already useful for simple pictures and as an aid to creating characters, the videoprocessing package is being enhanced by the implementation of additional image processing algorithms.

A low-cost light pen was developed for the Apple microcomputer. For its conversion of PLATO lessons to Apple, the Latin project needed a way of simulating PLATO's touch-sensitive screen. A light pen was developed that allows touch to be simulated at a very low cost.

In addition to designing new peripherals, OCBI is also making use of peripherals that have been developed elsewhere. Interfaces for the use of videodisc players with PLATO terminals and with microcomputers have been acquired. Two kinds of audio devices are being tested by the languages project. And support hardware for using ASCII terminals with the PLATO system has been purchased and integrated into the PLATO communications system.

CHAPTER II. UNIVERSITY APPLICATIONS

This chapter contains a summary of activities in the departments using computer-based instruction at the University of Delaware. Sample lessons have been described with accompanying photographs in order to give the reader a general idea of the kinds of applications being pursued in the Office. Study of these descriptions gives not only an overview of the wide range of activities which are being supported, but it also provides a source of ideas from which new applications can arise.

Accounting

In the past year, the Office of Computer-Based Instruction has provided 744 accounting students with a total of 1856 lesson hours. These students are using drill and practice lessons to reinforce basic accounting concepts and to prepare for written practice examinations.

Figure 10 shows a sample display from a lesson on cost accounting and the break-even point. This lesson provides a graph of the break-even equation and asks the student to choose a point on the graph. Then the student is asked whether that point will result in a profit or a loss. As this process is repeated, students are guided to fill in a chart that shows how much profit or loss is obtained from the various sales amounts.

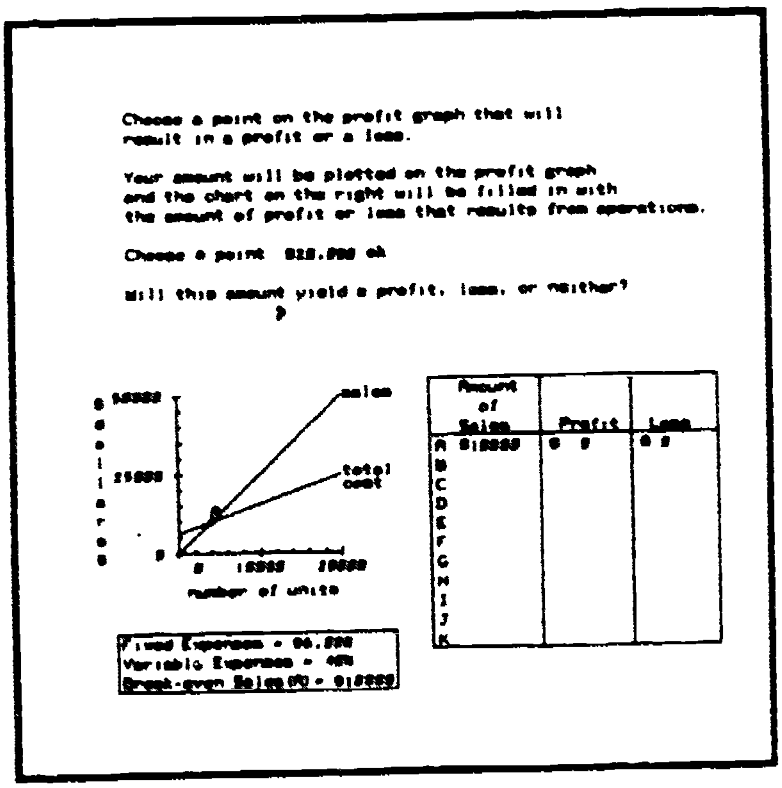

Figure 10. What is Break-Even Point?, by Angelo Di Antonio and Louisa Bizoe. Copyright © 1979, 1980 by the University of Delaware.

Figure 11 shows the computation of the cost to manufacture one unit of product. The student is asked to compute the dollar values of the ending inventory of finished goods using absorption costing. Absorption costing along with direct costing are two types of cost accounting methods explained in this lesson.

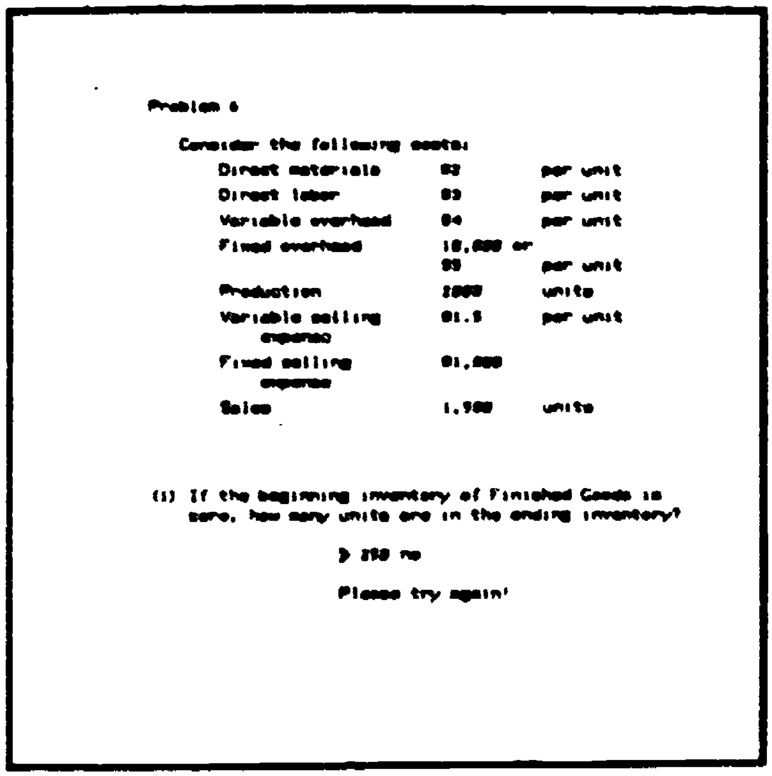

Figure 11. Costing Methods, by Jeffrey Gillespie and William Childs. Copyright © 1979 by the University of Delaware.

Advisement Center

Since September of 1982, the College of Arts and Science Advisement Center has been designing and implementing a computer-assisted advisement program. This project is funded by a grant from the Fund for the Improvement of Post-Secondary Education to the Office of the Dean, College of Arts and Science. The principal investigator is Dr. Peter W. Rees, Associate Dean.

The purpose of this project is to develop a series of five PLATO lesson modules containing academic advisement information. The lessons are intended for use by undergraduate students to enhance the quality of curriculum choice and learning.

The five modules are listed as follows:

1) Exploring Individualized Curriculum Options
2) General Academic Information
3) Student-Advisor Message System
4) Introductory Tutorial
5) Evaluation and Feedback

Module 1, "Exploring Individualized Curriculum Options," uses a database developed by members of the advisement staff. It suggests majors, minors, and areas of specialization that are related to students' current majors, interests, or career objectives.

In figure 12, a communications major has expressed an interest in speech pathology, and the lesson lists academic subject areas related to this field. The student may

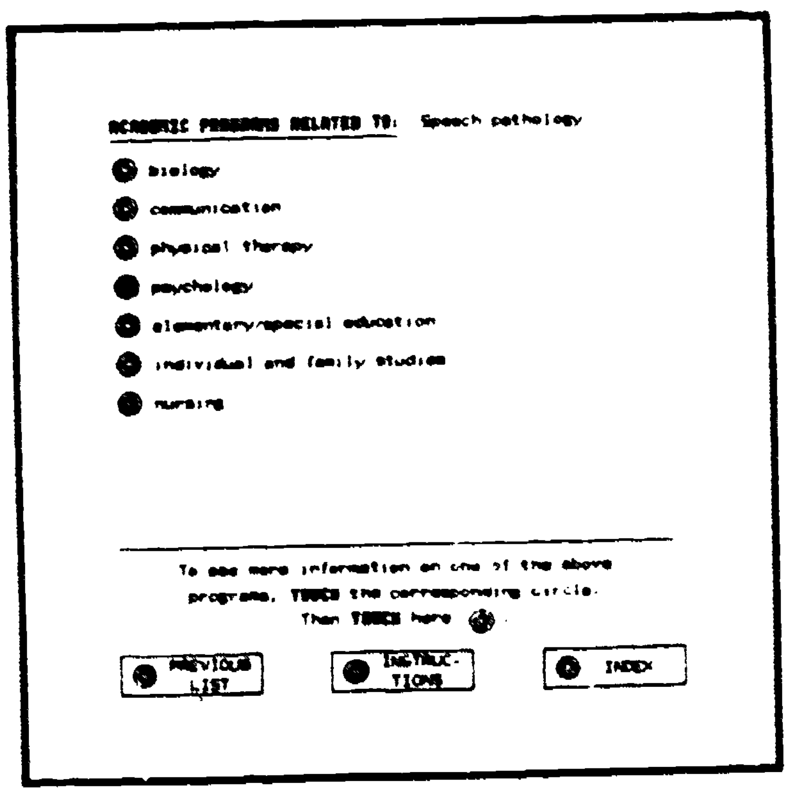

Figure 12. Exploring Individualized Curriculum Options, by Peter W. Rees, Anita O. Crowley, and Sharon Correll. Copyright © 1984 by the University of Delaware.

choose to see detailed information on any of the majors, minors, and special programs offerred in these areas.

The purpose of Module 2, "General Academic Information," is to provide students with quick access to information on any topic relating to the University's policies and requirements, from a description of the various types of degrees that are offered, to an explanation of drop/add policies, or a lesson on how to compute your G.P.A., as shown in figure 13. This module provides the information contained in the University's Academic Regulations and Policies Catalog, but in a more practical, easy-to-use format that will allow students to see relationships between requirements and policies. This also frees advisors from answering routine policy questions and allows them to concentrate their efforts on more individualized advisement issues. Figure 14 shows the main index page of this module. In addition to accessing information through a series of index pages, students may also enter a keyword describing the type of information they would like to see, and the lesson will move directly to the display containing that information.

Module 3, the "Student-Advisor Message System," consists of a group of notesfiles in which a student may ask advisement-related questions and receive an individualized response from the advisement staff. This provides students with greater access to the Advisement Center, since they can use the PLATO Message System even when the advisors are not available for personal appointments. Students also benefit from being able to read other students' questions and advisors' responses to them, thereby gaining a broader awareness of University policies and academic opportunities. Also included in Module 3 is access to an on-line copy of each advisor's schedule. This module is currently being tested with students.

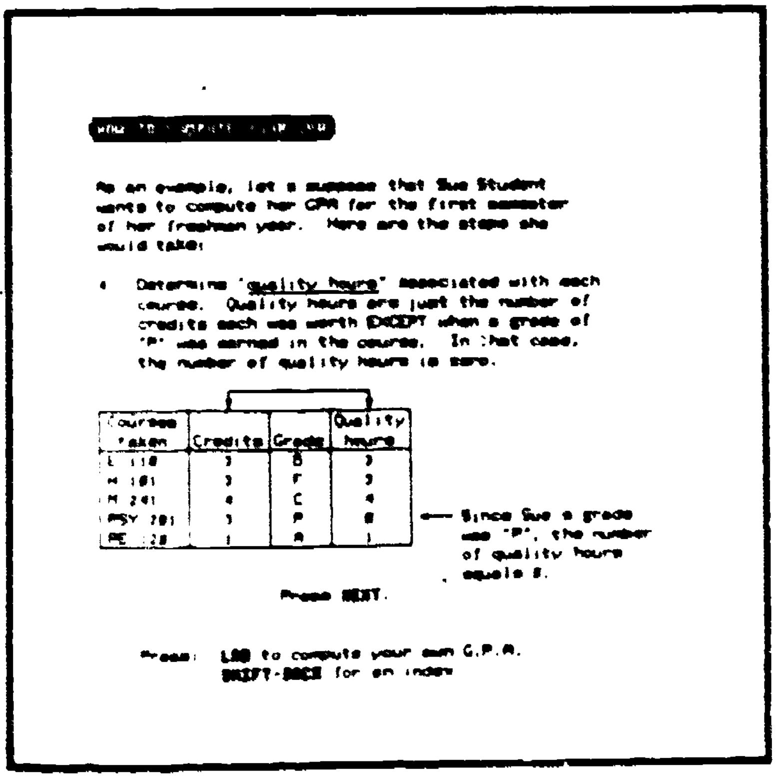

Figure 13. General Academic Information, by Peter W. Rees, Sharon Correll, and the Staff of the College of Arts and Science Advisement Center. Copyright © 1982, 1983, 1984 by the University of Delaware.

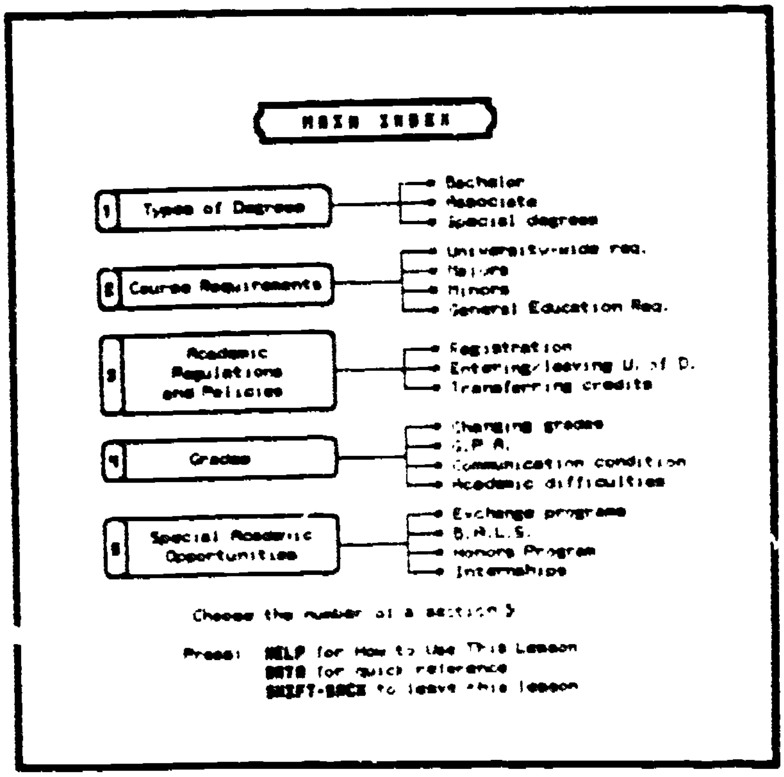

Figure 14. General Academic Information, by Peter W. Rees, Sharon Correll, and the Staff of the College of Arts and Science Advisement Center. Copyright © 1982, 1983, 1984 by the University of Delaware.

In order to evaluate the effectiveness of the Advisement System, statistics will be kept as to the amount and the type of use it receives. This will be done by Module 5, "Evaluation and Feedback," which will collect information on how many students use the system in any given period of days, how long each student spends using the system, where and at what time of the day it is used, and which lessons are used by each student. This will assist the advisement staff in determining the helpfulness of each module and the factors that contribute to student use.

An on-line questionnaire has also been developed to acquire information such as the classification, college, and major of each student who uses the Advisement System. With this data, advisors will not only be able to determine who is using the system, but also what lessons each type of user finds helpful.

Agriculture

Faculty members from the Departments of Animal Science and Plant Science are using PLATO to provide students with simulated laboratory experiments and field experience that would be very costly to provide by other means. A number of the programs were originally developed by the College of Veterinary Medicine and by the Community College Biology Group at the University of Illinois. The successful implementation of these programs at the University of Delaware shows how through "courseware sharing" one institution can take advantage of PLATO programs written elsewhere.

In Animal Science, beginning students are using the PLATO system to study veterinary terminology, principles of digestion, muscular movement, mechanics of breathing, neuron structures and functions, spinal reflex loops, eye anatomy, and elementary psychophysiology of audition. Advanced undergraduates study mitotic cell division, probability and heredity, drosophilia genetics, natural selection, mitosis, gene mapping in diploid organisms, blood typing, population dynamics, pedigrees, karyotyping, and DNA, RNA, and protein synthesis. Graduate students concentrate on meiosis and the anatomy and physiology of reproduction.

In Plant Science, undergraduates can run PLATO programs in cellular structure and function, water relations, diffusion, osmosis, genetics and the spectrophotometer. Graduate students study plant pathology, enzyme experiments, respiration, biogeochemical cycles, enzyme hormone interactions, photosynthesis, seed germination, apical dominance, flowering and photoperiod, fruiting and leaf senescence, gas chromatography, and gene mapping in diploid organisms.

One kind of experience that agriculture students obtain from using the PLATO terminal is illustrated in the following example. Figure 15 shows a sample display from the neuron structure and function program. This PLATO lesson simulates neurons with

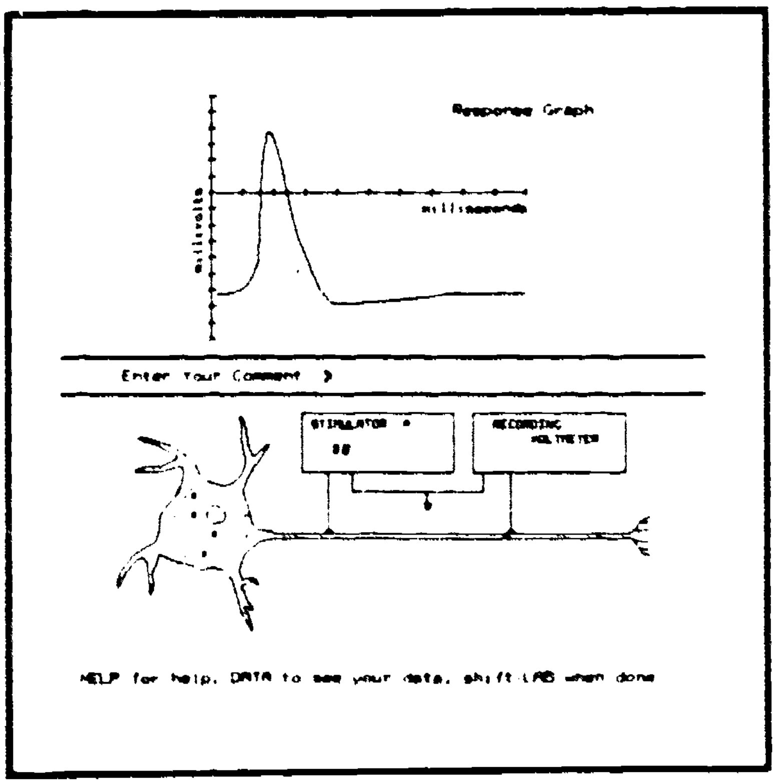

Figure 15. Neuron Structure and Function by S. H. Boggs. Copyright © 1976 by the Board of Trustees of the University of Illinois.

various internal structures. The student stimulates the neurons by pressing keys at the terminal and observes the effects of the stimulations as read by a recording voltmeter. The student can experiment with different rates and patterns of stimulation. The PLATO system keeps track of what the student does and provides the student with reports in the form of response graphs.

The College of Agriculture's Department of Animal Science has developed a package of five PLATO lessons that deal with the endocrine system. These lessons cover the following topics:

1. Terminology and Definitions
2. Listing and Classification of Endocrine Structures
3. Location of Endocrine Structures in Mammalian Species
4. Location of Endocrine Structures in Avian Species
5. Hormones Secreted by Endocrine Structures

After teaching terminology, definitions, and classifications of endocrine structures in the first two lessons, the third lesson presents the students with an outline of the human body. Students are asked what endocrine structure they would like to see. Figure 16 shows how one student has asked to see the kidney, and PLATO has responded by drawing the kidney in the proper locations. Later on in the lesson, the body outline is drawn again with all of the structures drawn in their proper locations, and the student is required to correctly identify each structure. Figure 17 shows how this way of teaching locations of endocrine structures was expanded to include avian species in the fourth lesson.

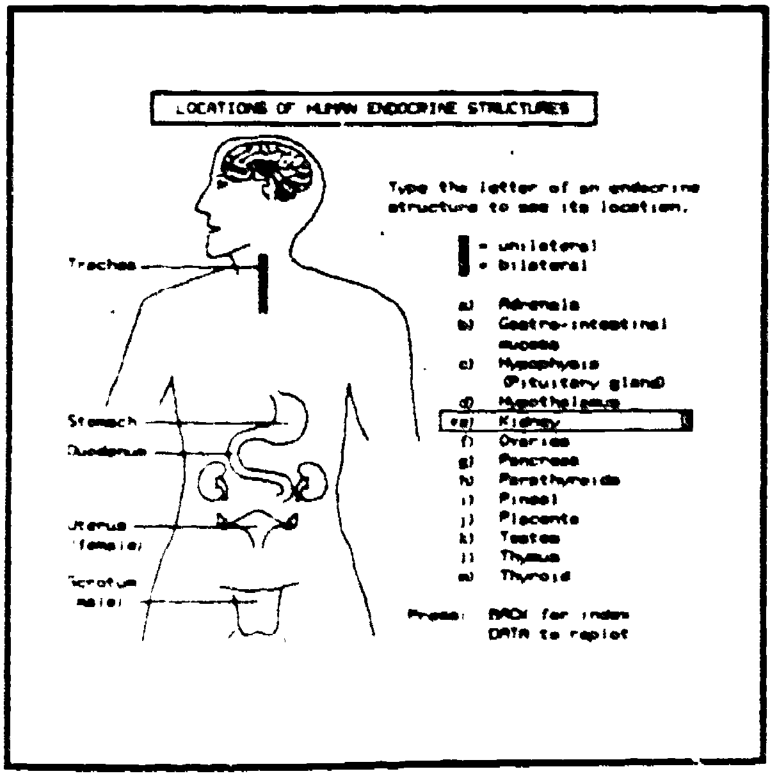

Figure 16. Endocrine System, by Paul Sammelwitz, Daniel Tripp, and Michael Larkin. Copyright © 1978, 1979, 1980, 1981 by the University of Delaware.

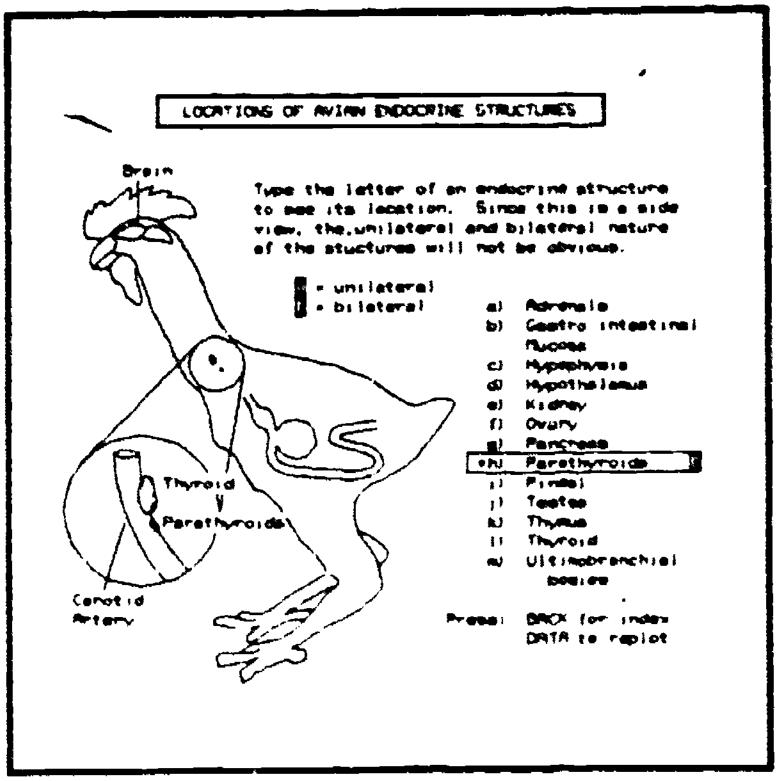

Figure 17. Endocrine System, by Paul Sammelwitz, Daniel Tripp and Michael Larkin. Copyright © 1978, 1979, 1980, 1981 by the University of Delaware.

Another package that has been developed deals with animal nutrition. Figure 18 shows how students are introduced to the concepts of "as fed" versus dry matter feedstuff nutrient content. Graphics and an animation help students visualize the relationship between these two concepts. Figure 19 shows how this package teaches students to prepare a balanced animal ration for monogastric animals. The students choose an animal to feed, and they select up to four feedstuffs to be used in the ration. The students can either perform step-by-step calculations on their own, or they can ask to be shown the balanced ration formulation. Students can repeat this process as often as they wish in order to create a balanced ration using the most desirable proportion of available feedstuffs.

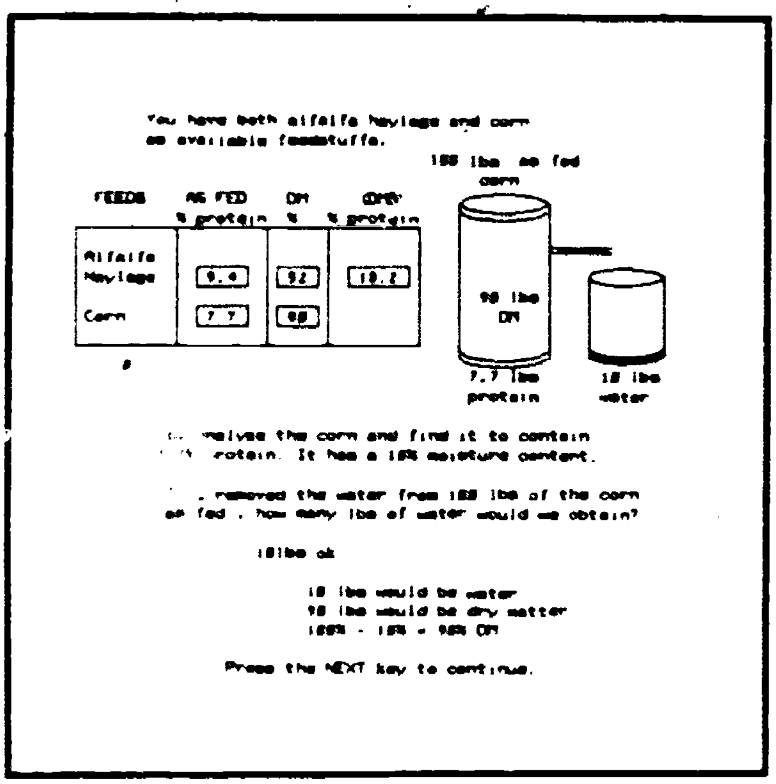

Figure 18. Preparing a Balanced Animal Ration, by William Saylor and Gladys Sharnoff. Copyright © 1980, 1981 by the University of Delaware.

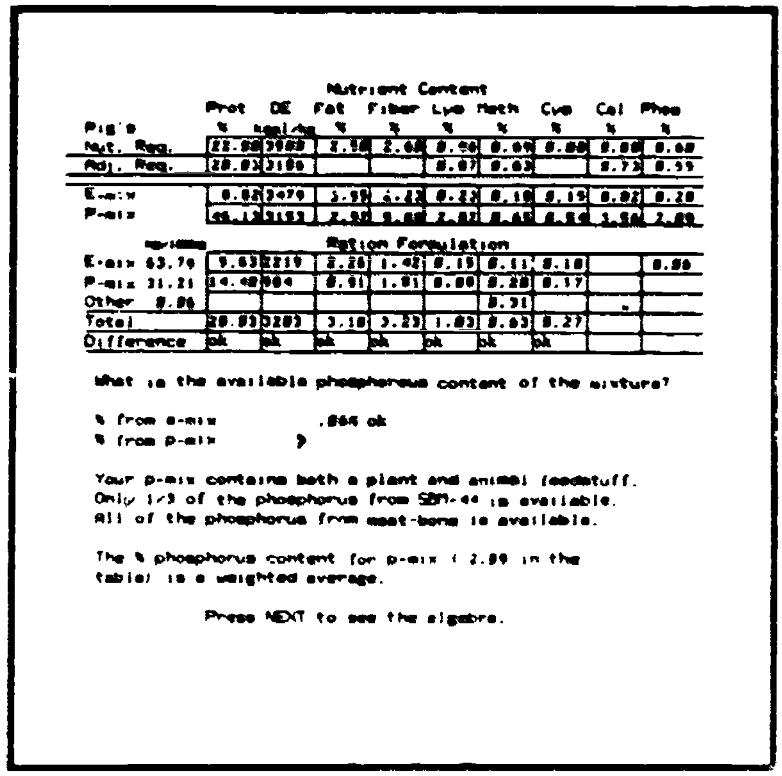

Figure 19. Preparing a Balanced Animal Ration Laboratory, by William Saylor and Gladys Sharnoff. Copyright © 1980, 1981 by the University of Delaware.

In 1983, a three-lesson series on the senses was developed. The objectives of the first lesson, "Identifying the Senses," are to help the student become familiar with the anatomy and physiology of the senses and their receptors, and to increase the awareness of the practical applications of that knowledge to the care and management of domestic animals. The student is asked to relate the senses to animal behavior and management practices. The second lesson offers a drill in relating the senses to their receptor organs and a tutorial in the classification systems used for the senses. In figure 20, the student has just indicated the receptor organs for the sense of equilibrium and is now asked to locate them on a diagram of a domestic animal. The third lesson deals with the anatomy of the ear. In figure 21, the student has asked for information about an inner ear structure, the semicircular canals. The structure is highlighted, and its function is described.

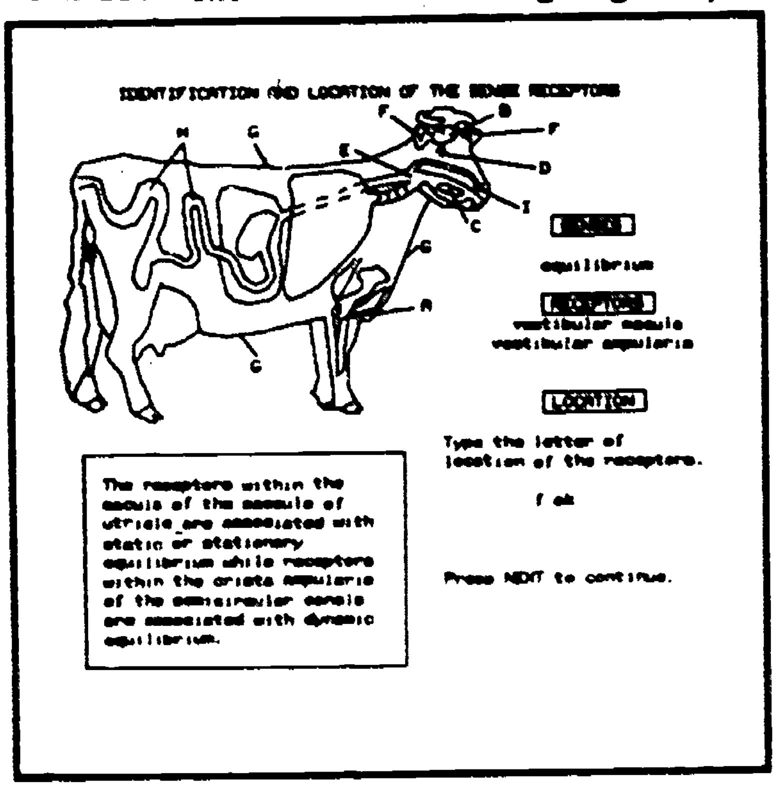

Figure 20. Senses: Identification of Sense Receptors and Classification of the Senses, by Paul Sammelwitz, Gladys Sharnoff, and Clella Murray. Copyright © 1982, 1983 by the University of Delaware.

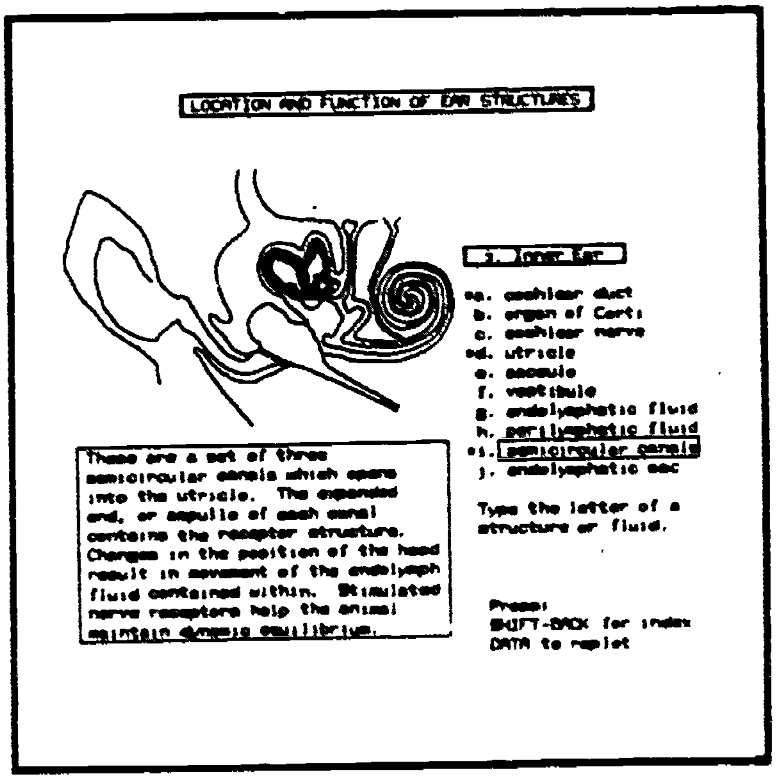

Figure 21. Senses: Structures of the Ear, by Paul Sammelwitz, Gladys Sharnoff, and Michael Larkin. Copyright © 1982, 1983 by the University of Delaware.

The Department of Entomology and Applied Ecology has developed a lesson that deals with dance language in honey bees. Bee dance language is an example of the precision and diversity of animal communication. This lesson combines animation with high-resolution graphics to teach the information that is transmitted by bee dance behavior. Figure 22 shows one situation that a bee might encounter in its field foraging. The bee will translate this information into a wag-tail dance pattern in the hive. After presenting tutorials, simulations, and graphs of many bee dance behavior patterns, this lesson concludes by presenting a series of practice problems that test the student's knowledge of bee dance language.

Another lesson completed in 1983 is an insect order identification game called "What's My Kind?" Designed for use in introductory entomology courses, this game asks the student to identify an insect order described by a set of insect characteristics. Maximium points are earned if the order is identified with the least number of characteristics that can uniquely identify it. In figure 23, the student has just identified the order hemiptera and has asked to see a diagram of an order member. An entomology Hall of Fame is included which lists the five highest game scorers. Students are expected to play the game several times to improve their scores and their abilities to recognize the unique characteristics of each insect order.

Presently under development is an entomology lesson entitled "All in the Family, an Insect Family Identification Game." This lesson uses the gaming strategy developed in "What's My Kind" but deals with insect families rather than orders. It will test the student's knowledge of the families of ten orders and will last ten times as long as "What's My Kind." As in the first lesson, a hall of fame will include the five highest scoring students.

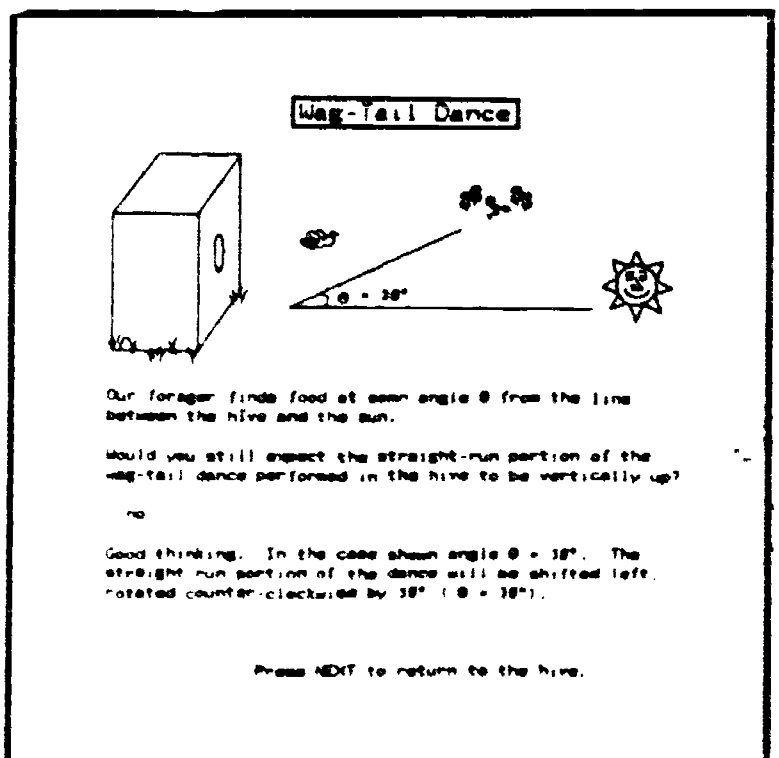

Figure 22. Dance Language in Honey Bees, by Dewey Caron, Charles Mason, and Gladys Sharnoff. Copyright © 1980, 1981 by the University of Delaware.

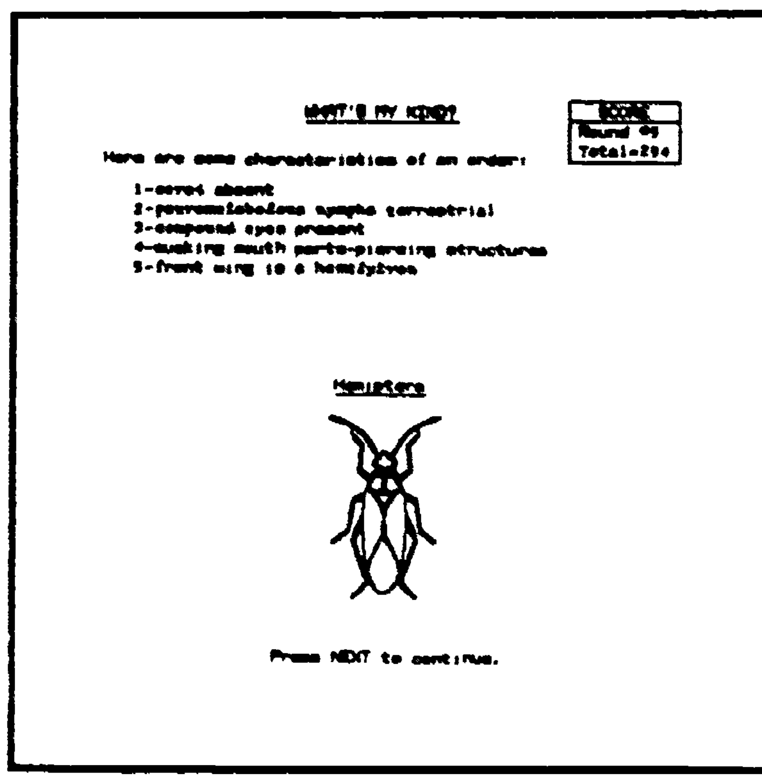

Figure 23. What's My Kind? An Insect Order Identification Game, by Charles Mason, Gladys Sharnoff, Robert Charles, and Art Brymer. Copyright © 1982, 1983 by the University of Delaware.

The College is also using PLATO Learning Management to make available practice tests for beginning animal science students. These tests present questions to students, record and grade their responses, analyze their errors, and suggest learning activities to improve their scores on future practice tests which they may repeat as often as they wish.

The Department of Agricultural Economics has developed a program where students learn basic managerial skills through the use of an agribusiness simulation. This lesson contains actual data obtained from Southern States Cooperative, an agricultural business supply store. Students in agricultural marketing and management courses gain experience in solving typical problems faced by a manager in the areas of personnel, advertising, inventory and merchandising. Figure 24 shows a typical display.

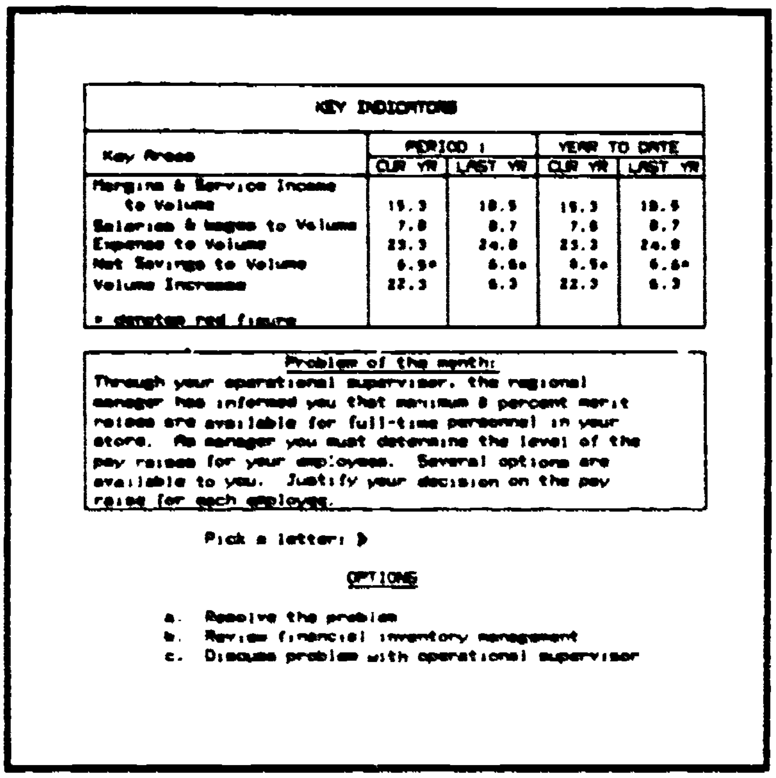

Figure 24. An Agribusiness Management Simulation, by Michael Hudson, Ulrich Toensmeyer, and Carol A. Leefeldt. Copyright © 1980, 1981 by the University of Delaware.

<u>Anthropology</u>

The Department of Anthropology has developed tutorial and drill lessons to use with its introductory courses in biological and socio-cultural anthropology.

An evolutionary perspective is important in the field of biological anthropology, which is the study of the biological aspects of man's culture. PLATO lessons that emphasize this perspective have been written about cellular structure and the genetic laws of inheritance.

Socio-cultural anthropologists are interested in the interrelationships among the many aspects of the cultures of the peoples they study. For instance, particular rules and obligations are associated with a group of people whose members live near one another or are related by blood. Examples of such rules include restrictions on permissible marriage partners and the manner in which two individuals address and communicate with one another. Socio-cultural anthropologists interested in studying the rules operating within a particular population group might include in an initial study the residence and descent patterns characteristic of the group.

Figure 25 shows a display from a lesson on anthropological residence theory in which a student has chosen a particular individual on a genealogical chart and then identified every member of the matrilocal residence group to which that individual belongs. Students learn that matrilocal residence groups exist in a population where unmarried children live with their parents, and married couples settle with or near the wife's parents.

In a lesson on anthropological descent theory, students must similarly identify descent relationships for a given individual in a population group. Later in the lesson, students are presented with an ethnographic description and are asked to identify the descent rule which applies to the population group described. As depicted in figure 26, a student has correctly identified the patrilineal descent

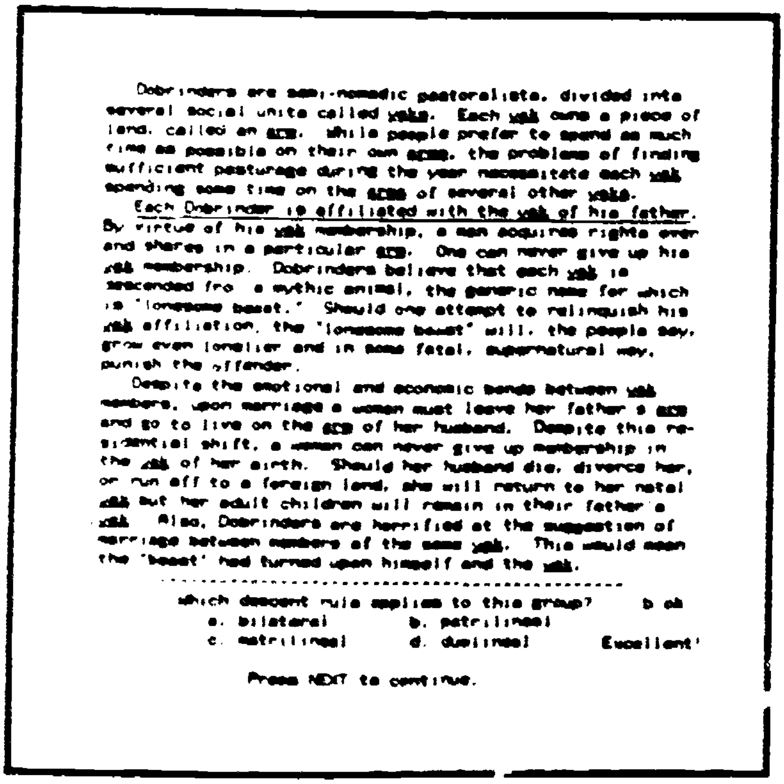

Figure 25. <u>Anthrolopogical Residence Theory</u>, by Norman Schwartz, Monica Fortner, Charles Collings, and Karen Sims. Copyright © 1978, 1979 by the University of Delaware.

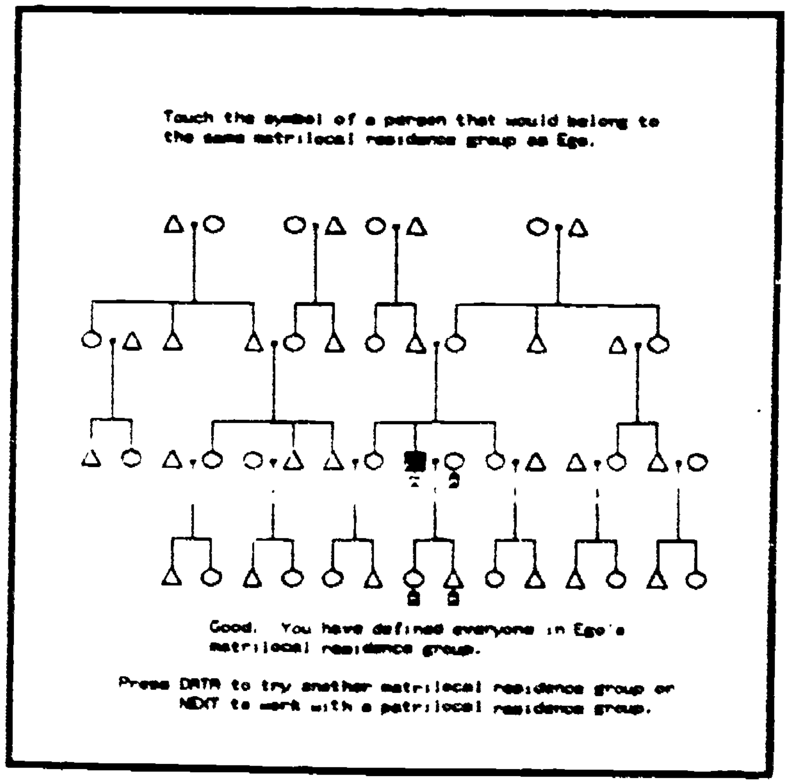

Figure 26. <u>Anthropological Descent Theory</u>, by Norman Schwartz, Monica Fortner, Charles Collings, and Karen Sims. Copyright © 1978, 1979 by the University of Delaware.

rule that a ,lies to a population group called the Dobrinders. The underlining in the text indicates to the student the portion of the description which should have made clear the descent rule that applies.

Professor Peter G. Roe was awarded a Local Course Improvement grant by the National Science Foundation to use the PLATO system in introductory and advanced anthropology courses to show how artistic style can be understood as a process, both as a formal system of visual logic and as a vehicle to convey symbolic information about the culture that produces it. Two lessons were developed and evaluated, one which introduces the concepts of aesthetic syntactics and gives examples of their application, and a second which requires students to utilize these concepts to create designs according to a specified set of rules. The first lesson illustrates the principle of Rule Replication Behavior on a graphic display. Figure 27 shows how students are asked to replicate a particular vessel by touching component parts reproduced on the screen, starting, as would a potter, with the base. In illustrating Rule Creation Behavior, students are asked to touch on a similar display any parts that they wish to use in creating their own unique pots. Figure 28 shows an example of how the art style of the Cumencaya Indians can be analyzed using an art grammar. The rule of grammar appears in the box, and students can see how the rule is applied in the design that appears at the top of the screen.

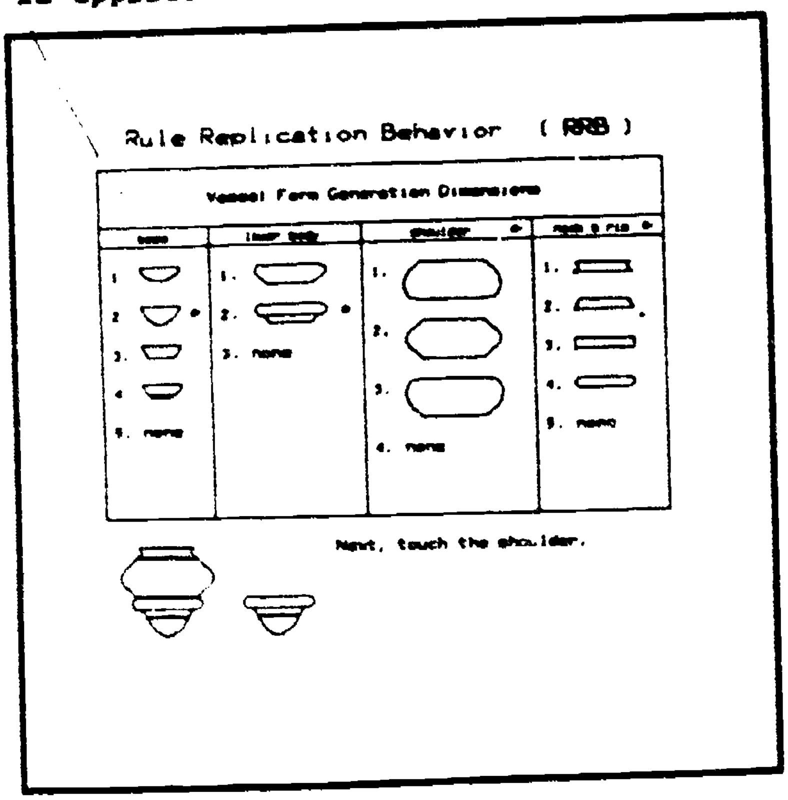

Figure 27. The Anthropological Study of Art Style, by Peter G. Roe, Christine M. Brooks, and Karen Sims. Copyright © 1980, 1981 by the University of Delaware.

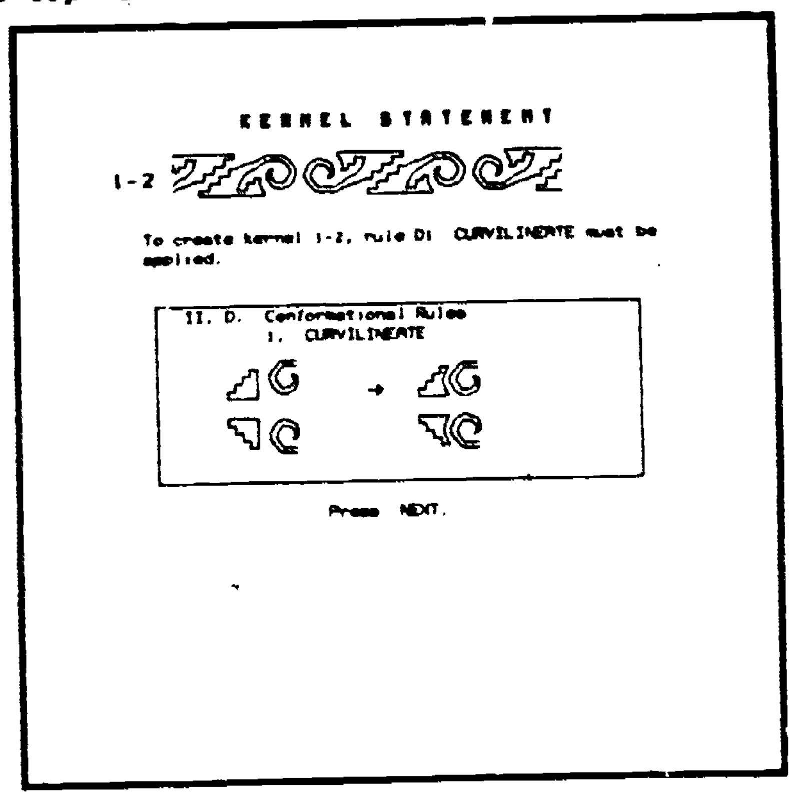

Figure 28. The Anthropological Study of Art Style, by Peter G. Roe, Christine M. Brooks, Karen Sims, and Samuel Lamphier. Copyright © 1980, 1981, 1982 by the University of Delaware.

Art

The Department of Art is developing its own package of PLATO programs for the purpose of improving instruction in basic design and graphic design, including courses in typography, basic illustration, advertising design, and portfolio preparation. Using the highly sophisticated graphics features of the PLATO system, students are interactively able to create and alter designs on the terminal screen. Work which used to take fifteen hours to complete on paper can be done in three hours on the PLATO terminal, giving students the opportunity to work many more problems than they could before. The students are also developing a better aesthetic judgment, because the lessons make it very easy for them to alter their designs. If the students do not like part of a design, they can change that part while retaining the remainder of the design. Thus students are encouraged to make what they like rather than like what they make.

The main applications of the PLATO system in art can best be explained by looking at how students use four programs, namely, "Unit Design," "Grey Scale Practice in Tonal Recognition," "Optical Letterspacing," and "Logodesign." In the unit design program, the student enters a shape into the computer by either turning on or turning off points on a 96 x 96 dot matrix. Figure 29 shows how the student creates the image by selecting options like "move," "delete point," "store," and "draw line." Next, the student uses the basic shape to form a composite image by performing graphic transformations of the basic shape. Figure 30 shows how the student creates the composite image by rotating, mirroring, and inverting the positive/negative relationships of each element.

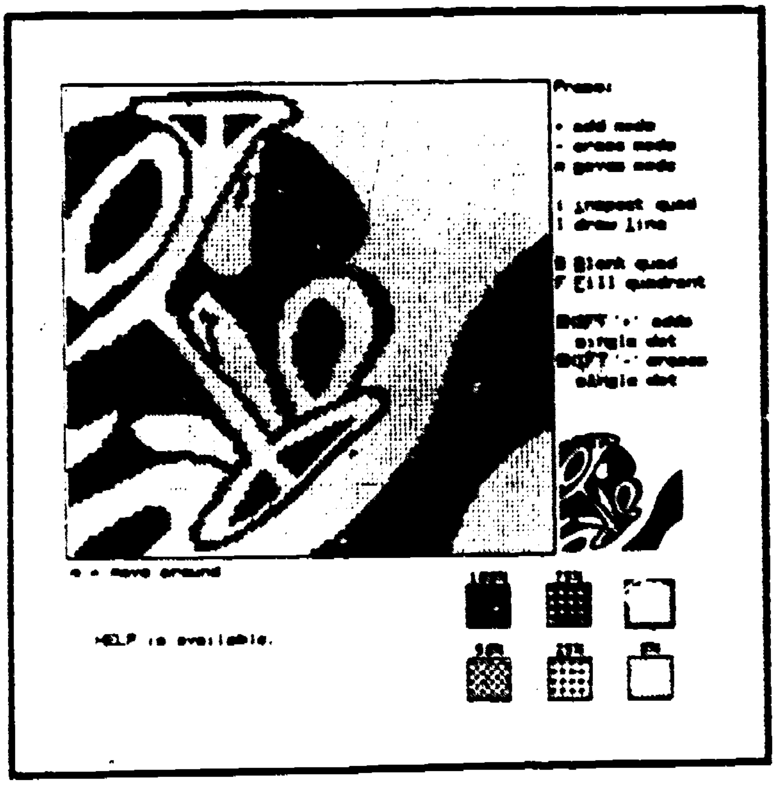

Figure 29. Unit Design: Creating the Basic Image, by Raymond Nichols. Copyright © 1977, 1980, 1982, 1983 by the University of Delaware.

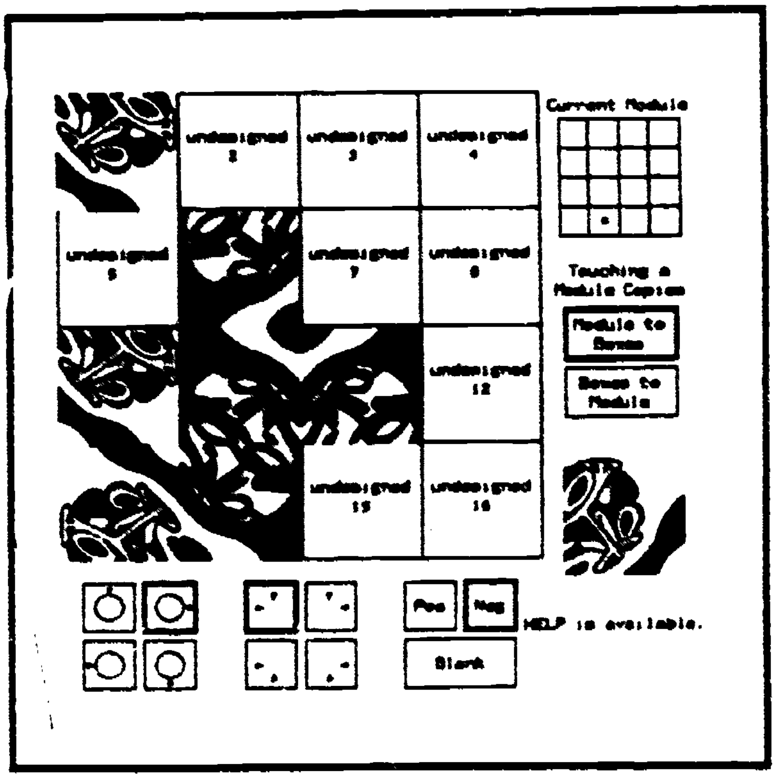

Figure 30. Unit Design: Creating the Composite, by Raymond Nichols. Copyright © 1977, 1980, 1982, 1983 by the University of Delaware.

Through successive tries at designing basic shapes and performing graphic transformations, the student learns how to create clever and intricate designs as the one shown in figure 31.

The grey scale program gives art students practice in recognizing the tonal values of the many shades of grey. This lesson presents the students with a grid of 20 x 30 squares. The student can then set the shade of grey for each square by indicating the percentage of grey that should be in the square. Some students have become so adept at recognizing values of grey that they can use the grey scale program to create facial images, such as the one shown in figure 32.

Since typography plays such an important role in advertising, it is extremely important for the art student to be able to space letters so that the printed word is both aesthetically pleasing and readable. The letter spacing program gives the students interactive practice in spacing letters without requiring them to go through the time-consuming process of drawing and inking a word every time they want to change the placement of a letter. Using the PLATO system, students can do many more assignments than were possible before, and the instructor is able to offer greater help to the students because he gets to see much more of their work.

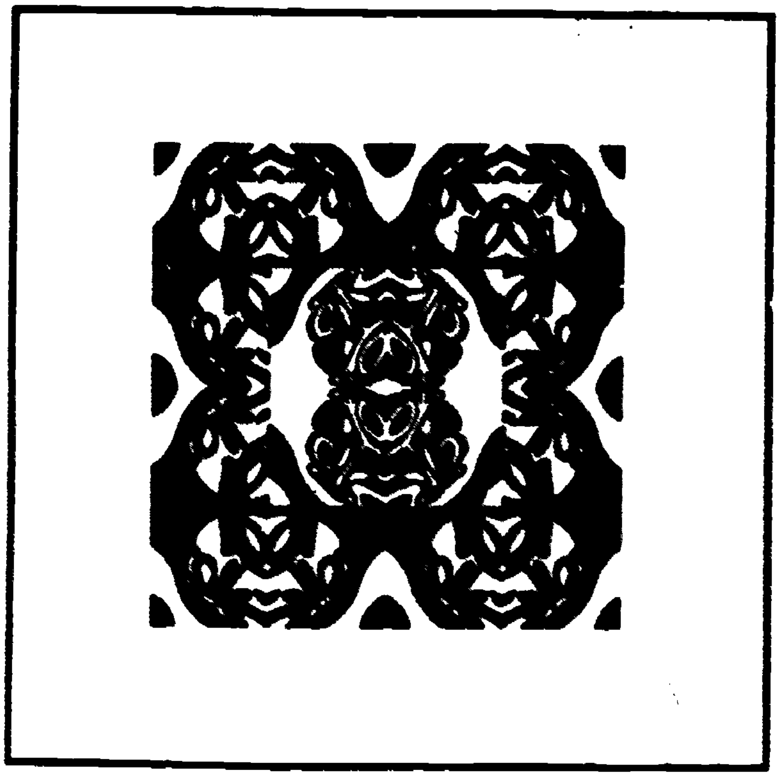

Figure 31. Unit Design: The Finished Product, by Raymond Nichols. Copyright © 1977, 1980, 1982, 1983 by the University of Delaware.

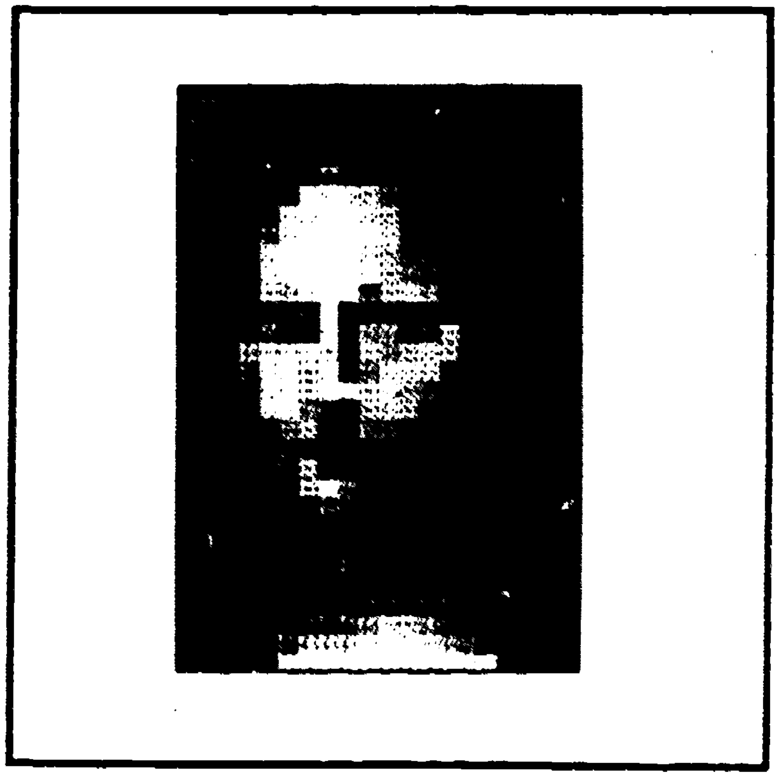

Figure 32. Grey Scale, by Raymond Nichols. Copyright © 1977, 1980, 1981, 1982 by the University of Delaware.

Students can use words containing up to nine letters from each of five typefaces: Helvetica, Baskerville, Garamond, Century Expanded, and Bodoni. Figure 33 shows a sample display from the letter spacing program; the student is just about to move the "T" further over to the right.

An instructor version of "Optical Letterspacing" has been developed to interface with the student version of this lesson. The instructor version enables the teacher to inspect a student's work and compare it with that of every other student in the class. Using standard deviations, statistical data indicates the significance of any errors made. This comparison of data provides the teacher with useful information about the performance of the class as a whole. The data can indicate certain areas where the majority of students are having problems and areas that are mainly error free. The instructor can then concentrate teaching efforts on the areas where most students need improvement.

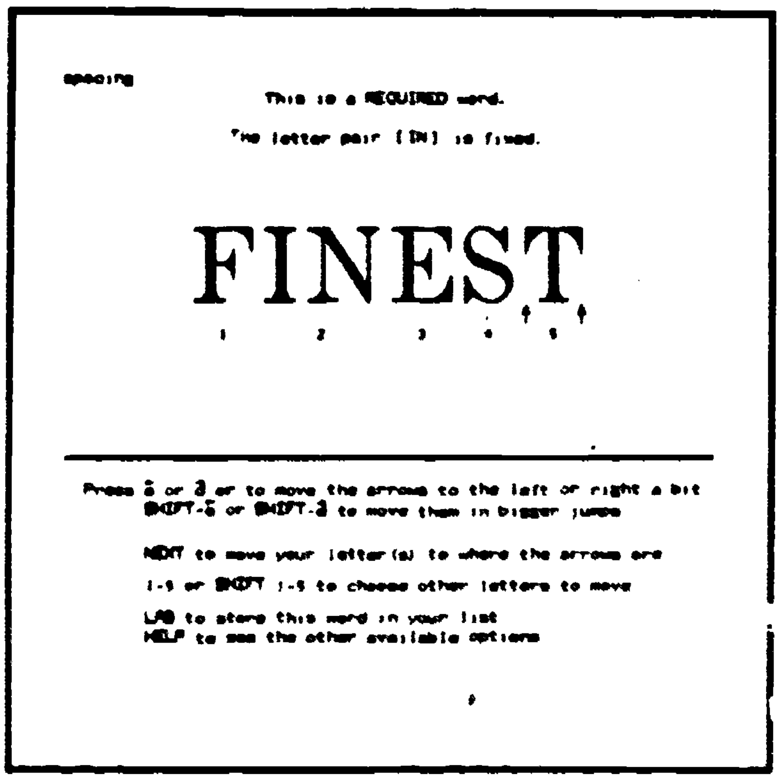

Figure 33. Optical Letterspacing, by Raymond Nichols. Copyright © 1980, 1981, 1982, 1983 by the University of Delaware.

"Logodesign" was written to provide the graphic design student with a format for the development of designs that would be used for trademarks and corporate identity work. Figure 34 shows the basic drawing for such a design. The lesson allows the student to draw lines and circles in any configuration, setting the borders for a series of shapes that will eventually form the final design. After finishing the drawing, any of the shapes which are bordered by a line or a circle may be filled in. Figure 35 is the completed logo.

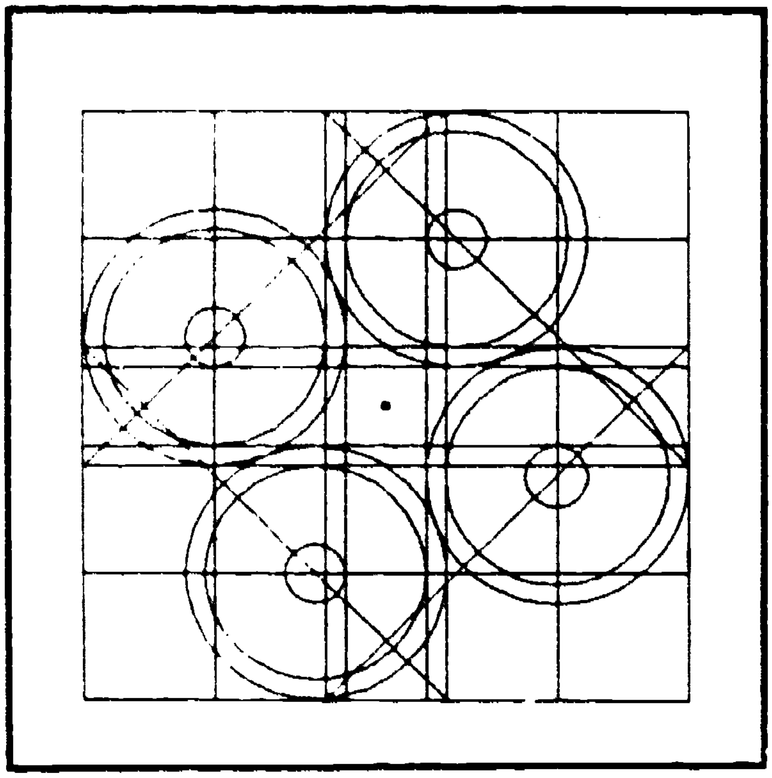

Figure 34. Logodesign: Creating the Basic Design, by Raymond Nichols. Copyright © 1980 by the University of Delaware.

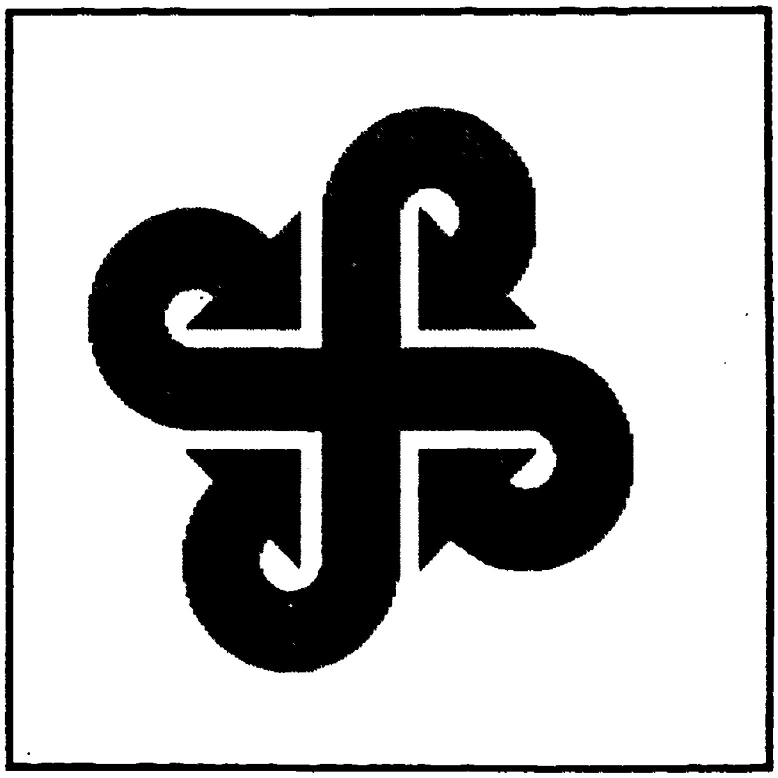

Figure 35. Logodesign: The Finished Design, by Raymond Nichols. Copyright © 1980 by the University of Delaware.

Art Conservation

Because few microscopists skilled in project identification are available to art conservators, art historians, or curators, there is a need for conservation students and practicing conservators to be able to readily identify pigment samples taken from paintings and other works of art. Toward this end, a set of tutorials and drills called "Pigment Identification" has been developed for the Winterthur art conservation program.

Pigment identification is an important aid to attribution, spotting of fakes and forgeries, and decision making regarding conservation treatments. The lesson familiarizes students with distinguishing characteristics of pigments, cogent dates, X-ray fluorescence spectra, and the advantages and disadvantages of various identification methods. An example of X-ray fluorescence spectra can be seen in figure 36. Figure 37 shows a reaction occurring during microchemical testing.

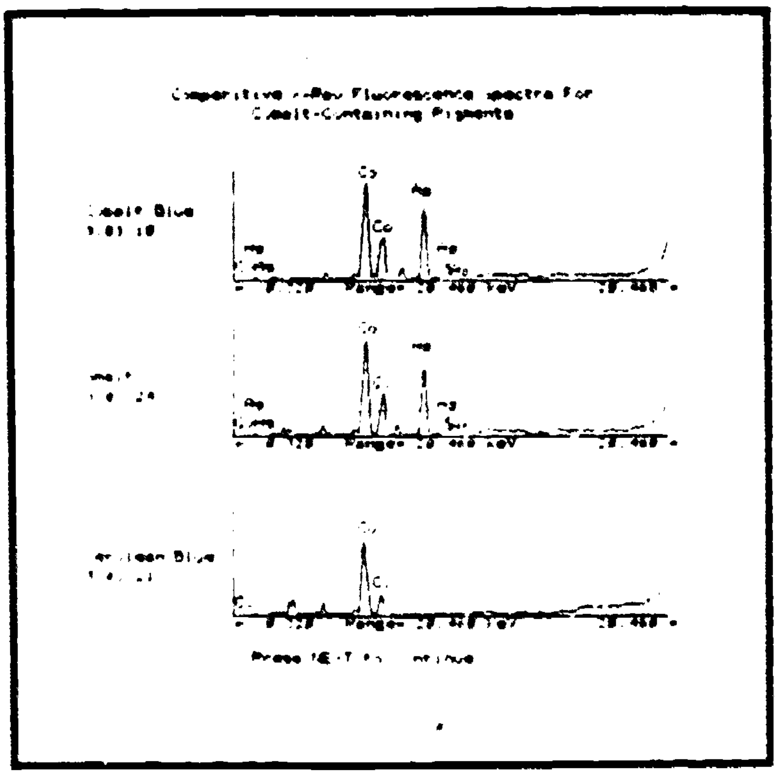

Figure 36. Pigment Identification, by Joyce Hill Stoner, Brian Listman, Louisa Frank, and Chris Patchel. Copyright © 1983, 1984 by the University of Delaware.

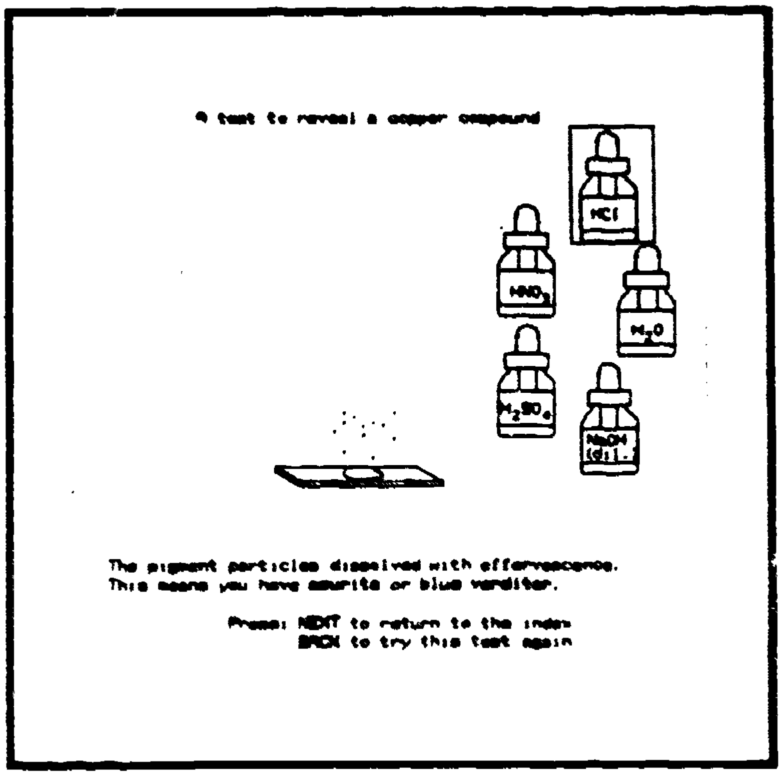

Figure 37. Pigment Identification, by Joyce Hill Stoner, Brian Listman, Louisa Frank, and Chris Patchel. Copyright © 1983, 1984 by the University of Delaware.

Biology

The School of Life and Health Sciences uses the PLATO system to supplement laboratory exercises in genetics. Genetics exercises traditionally require students to learn time-consuming and mechanically difficult procedures. In an actual laboratory situation, students often overlook the important concepts under study in their efforts to complete complicated manual procedures within the time allotted. The flexible, interactive nature of the PLATO genetics lessons permits students to design experiments, obtain data, graph and analyze results, and draw conclusions without having to first master expensive and time-consuming procedures that do not contribute to their understanding of the concepts. Using a PLATO lesson as a tool, students unskilled in laboratory procedures can learn much more from complex and information-rich experimental designs. Through simulation, beginning students can obtain data from sources that are normally not available to them.

Professor David E. Sheppard is developing a complete genetics curriculum funded by a Local Course Improvement grant from the National Science Foundation. Three lessons were completed during 1982, namely, "Somatic Cell Structures," "The Molecular Nature of the LAC Operon," and "Positioning Genes in Bacteria by Deletion Mapping." Two additional lessons were completed this year, namely, "Recombinant DNA: Techniques and Applications," and "The Molecular Basis of Mutation." Two new lessons are now under development, including, "Crossing Over in Drosophila 4" and "The Histidine Operon."

Figure 38 shows a display from the lesson "Somatic Cell Genetics." In a simulated experiment, students learn the current techniques used to locate genes on

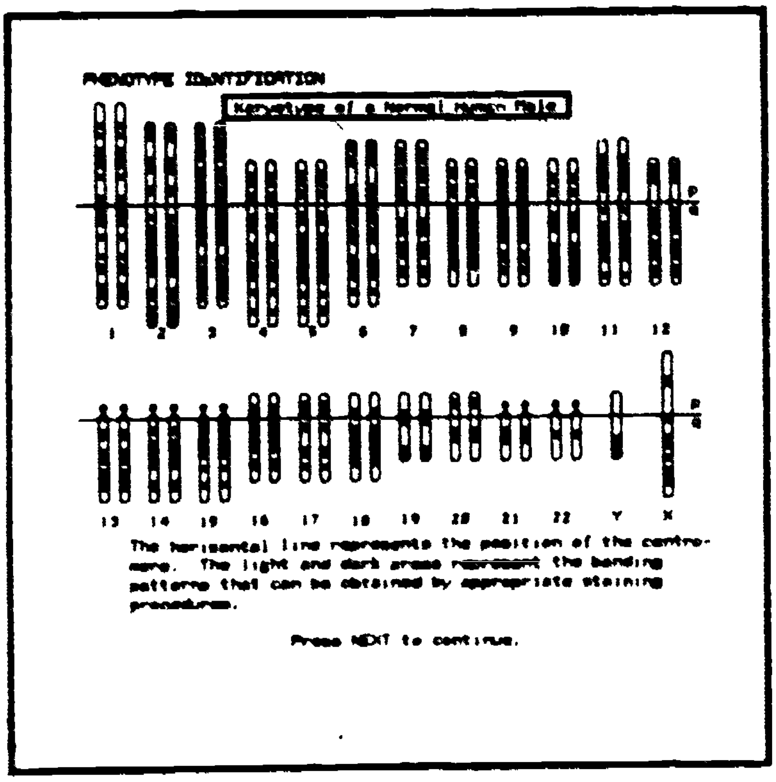

Figure 38. Somatic Cell Genetics, by David E. Sheppard. Copyright © 1980, 1981, 1983 by the University of Delaware.

chromosomes. The student must isolate cells that exhibit an abnormal trait and then determine which genes govern this trait and on which chromosome they are located. First, the student simulates the growth of cells on various culture media. Then, by correlating the absence or presence of the trait with the presence of a certain chromosome, the student can eventually pinpoint the exact location of the controlling gene.

Figure 39 shows a genetic map from the deletion mapping lesson. Students are presented with a matrix of deletion mutation crosses and are asked to determine which deletion mutations overlap and what are the relative orders of the deletions on the genetic map. With the aid of interactive instructic s, students are able to complete a difficult laboratory exercise much more easily th . in a conventional laboratory situation. Upon completion of the exercise, student work is evaluated immediately. Students receive informative feedback to point out incorrect positioning, and they are asked to make changes to obtain a correct mapping.

Figure 40, from "Recombinant DNA: Techniques and Applications," shows how the plasmid DNA of E. coli can be introduced into other E. coli cells. Plasmids often ex ibit resistance to antibiotics (in this case, to tetracycline). When plasmids are placed in other cells of the same species, these other cells also gain the ability to tolerate the growth of antibiotics. Growing these cells in the presence of tetracycline inhibits the growth of cells that do not contain the plasmid. In this way one can select for cells that have undergone transformation and now contain the plasmid. Using the PLATO system, students can observe all of the steps involved in this process of transformation.

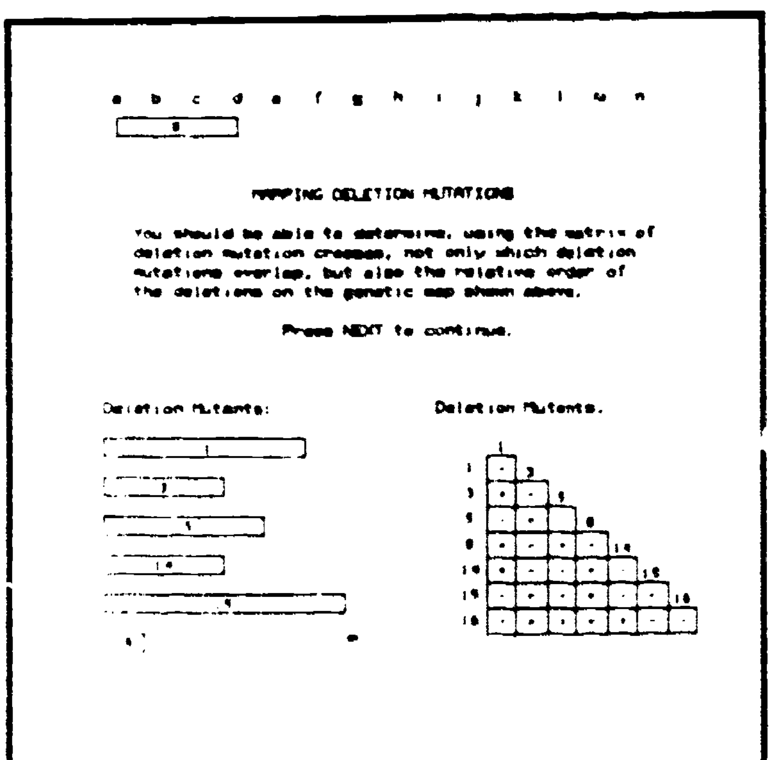

Figure 39. Positioning of Genes in Bacteria by Deletion Mapping, by David E. Sheppard. Copyright © 1980, 1983 by the University of Delaware.

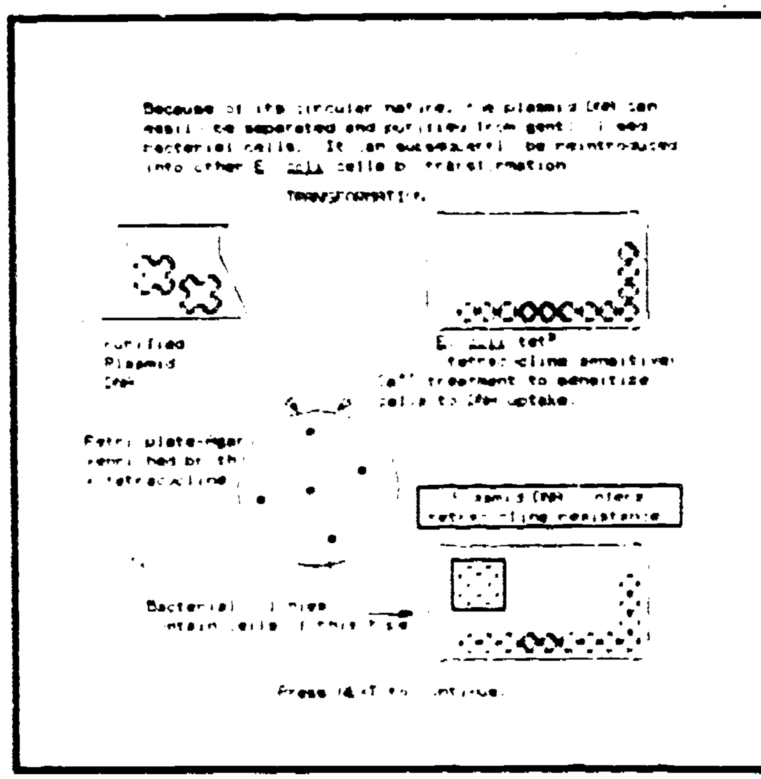

Figure 40. Recombinant DNA: Techniques and Applications, by David E. Sheppard. Copyright © 1981, 1982, 1983 by the University of Delaware.

Business Administration

There are three kinds of CBI usage in the Department of Business Administration. First, students learning marketing research methods are using the computer to deliver and analyze a marketing survey of local restaurants. Students respond to the survey and study statistical analyses of the results.

Second, students in information systems are using lessons that teach FORTRAN. Figure 41 shows a sample screen display from one of these lessons in which the student is being asked to analyze an arithmetic IF statement.

Third, general use is being made of tutorials and simulations of business situations. Figure 42 shows a simulation of an individual applying for a loan. The student acts as a federal loan officer interviewing an applicant.

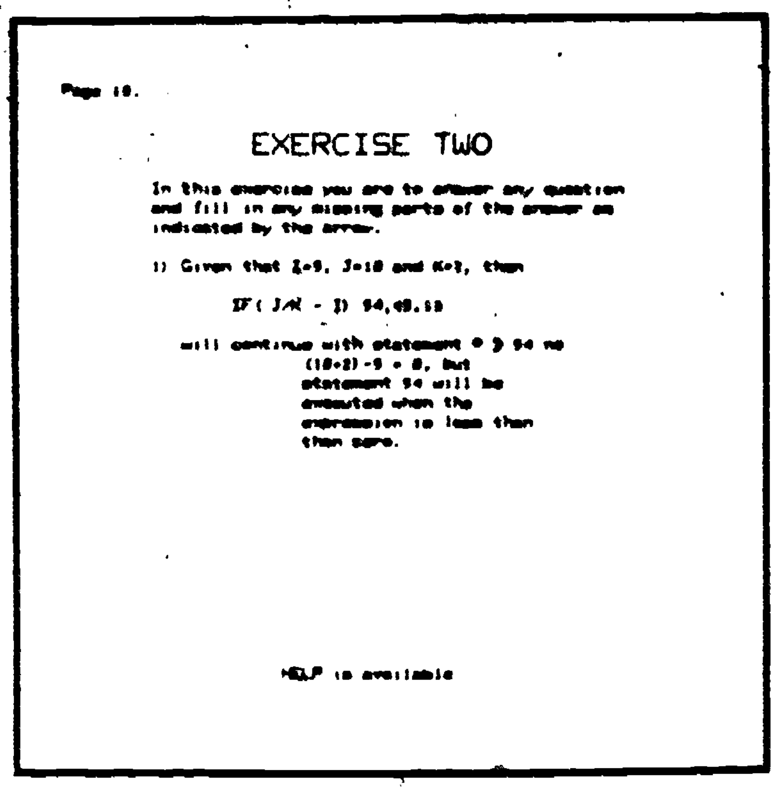

Figure 41. FORTRAN IF Statements, by Greg Strass. Copyright © 1975 by the University of Illinois.

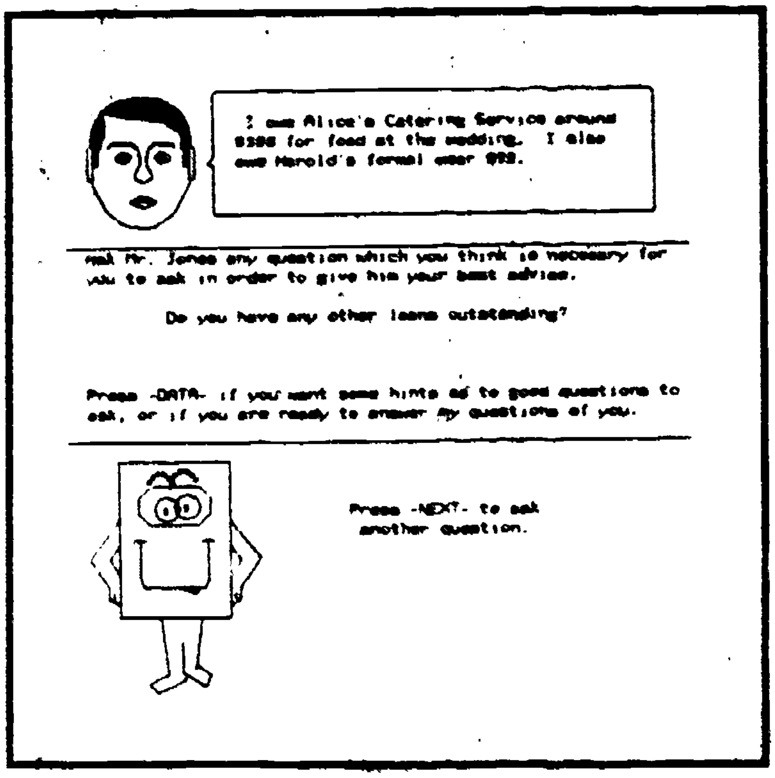

Figure 42. The Loan Arranger, by Steve Dirks. Copyright © 1976 by the Control Data Corporation.

Chemical Engineering

An important aspect in engineering education is the development of problem-solving skills. Since large numbers of students are now choosing to major in chemical engineering, and since engineering students are avid computer users, the chemical engineering department has chosen to develop PLATO lessons to provide additional problem-solving experiences and tutoring to its students. This work was supported by a two-year grant awarded in 1979 by the National Science Foundation to Professor Stanley Sandler.

Of the fifteen lessons that have been brought to the final stages of testing, review, and student use, thirteen are intended for the two-semester upper-level course sequence in chemical engineering thermodynamics. The other two were written for freshman and sophomore courses. Figure 43 is part of a lesson that instructs the students on the use of an Othmer still to get vapor-liquid equilibrium data and then tests their abilities to analyze the data and to extract activity coefficients to determine if the data are thermodynamically consistent, and to compare the activity coefficients with various theoretical models.

Figure 44 shows a sample display from a lesson on the Rankine refrigeration cycle, which instructs and tests undergraduate chemical engineering students on their understanding of thermodynamic cycles and the reading of thermodynamic diagrams. Following an idealized Rankine refrigeration cycle on a pressure-enthalpy diagram, students learn how to calculate the coefficient of performance.

Two lessons written for the Chemical Engineering project on the PLATO system have recently been translated into Pascal to run on the IBM Personal Computer. There are plans to convert the other thirteen lessons as well. Except for the use of the touch panel, both versions of the lessons are nearly identical.

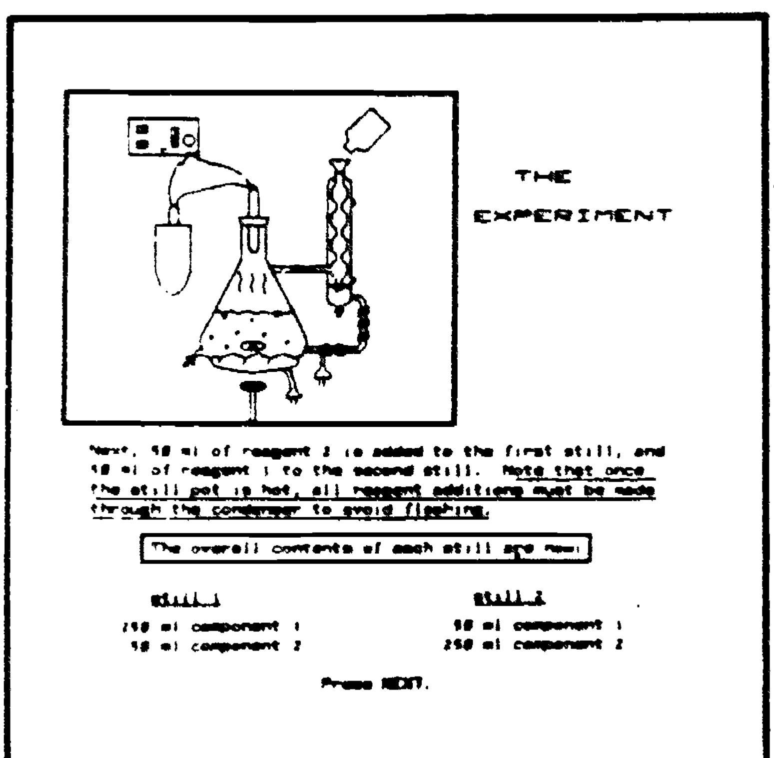

Figure 43. Modeling of Binary Mixtures, by Stanley Sandler, Douglas Harrell, and Andrew Paul Semprebon. Copyright © 1976, 1977, 1978, 1979, 1980, 1981, 1983 by the University of Delaware.

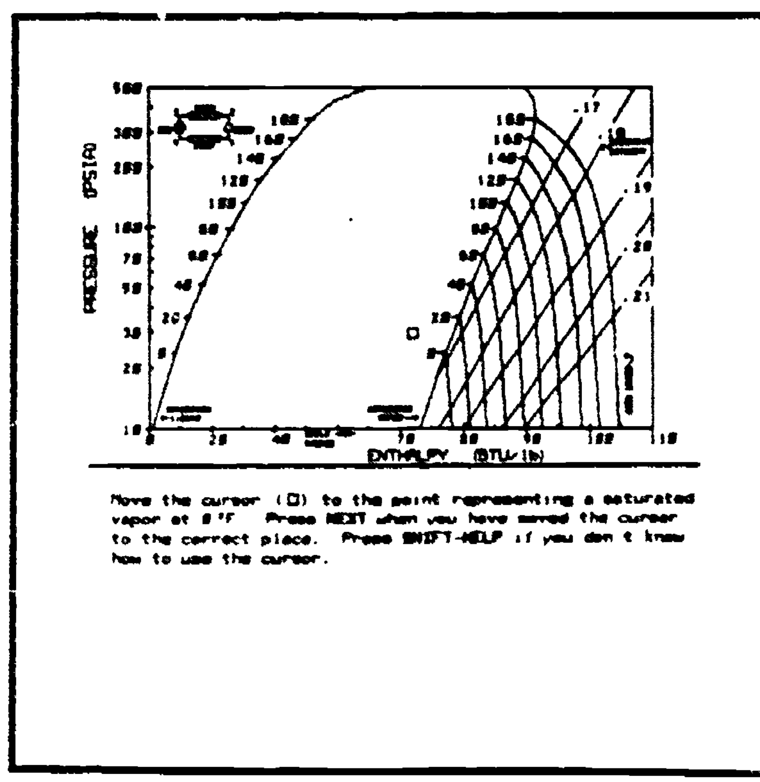

Figure 44. The Rankine Refrigeration Cycle, by Stanley Sandler, Robert Lamb, and Andrew Paul Semprebon. Copyright © 1978, 1979, 1980, 1981, 1982, 1983 by the University of Delaware.

Chemistry

In the fall of 1979, the Drake Hall PLATO classroom was established. Since that time, use of the PLATO system by chemistry students has continued to increase. In response to the growing number of chemistry students using PLATO lessons, PLATO terminals have been added to the classroom bringing the total to twenty-four. In addition to these terminals, the classroom has also been equipped with four stand-alone Micro PLATO stations with floppy disk drives. These micro stations allow students to use chemistry lessons on the PLATO microcomputer without being connected to a central computer.

Taking advantage of the large package of chemistry lessons written under NSF funding at the University of Illinois, the Department of Chemistry has enjoyed much success helping students learn and reinforce a good basic knowledge of the principles of chemistry. Students can see simulations of chemical reactions in three dimensions. Drill-and-practice lessons offer students the opportunity to review sections and problems as much as is needed for firm comprehension. Diagnostic lessons help check achievement levels and progress. By using the computer to simulate chemical reactions, students get to work with many more samples than is possible in the traditional chemistry lab. In problem-solving, students have the freedom to experiment with many methods of finding a solution.

Figure 45 shows how students are checked on their knowledge of the energy levels of electron shells in a lesson on the Aufbau Principle. Each orbital is represented by a circle in order of increasing energy, and when each one is touched, a symbol representing an electron with spin direction is placed in it. The student must place the correct number of electrons in each orbital before getting credit for that element, proceeding to the next section in the lesson after eight elements have been correctly displayed.

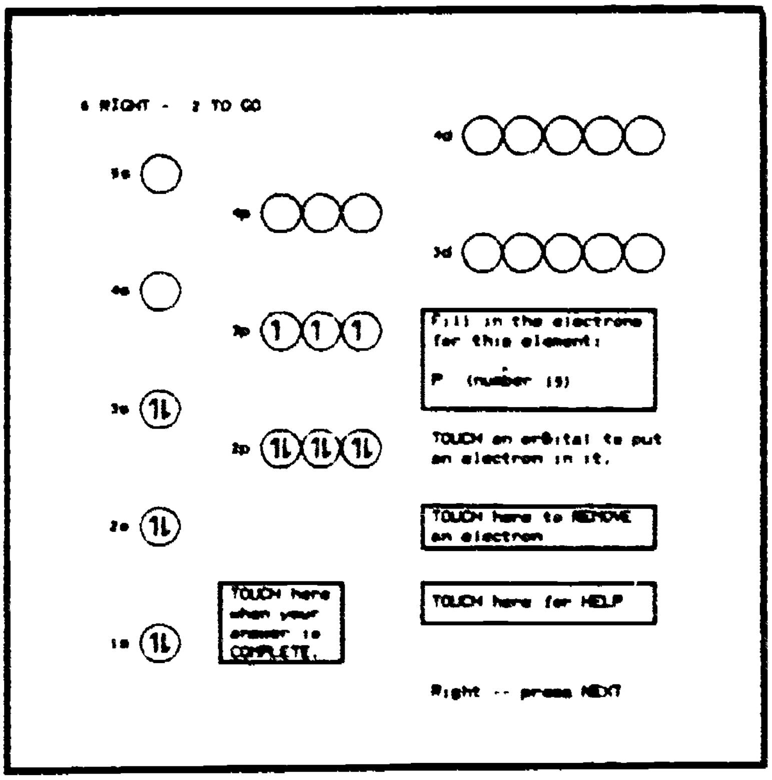

Figure 45. Electronic Structure of Atoms, by Ruth Chabay.

Figure 46 shows how the PLATO system teaches the standardization of an aqueous NaOH solution by simulating acid-base titrations. The student must perform every step in the simulation from filling the buret to observing the change of color at the end of the experiment. The lesson makes sure that the student follows correct laboratory procedures, helping out with suggestions when necessary.

Lessons were developed at the University of Delaware to fill instructional needs in chemistry. Figure 47 shows a chart that the student builds while learning the meaning of the pH factor and how logarithms are used in determining pH.

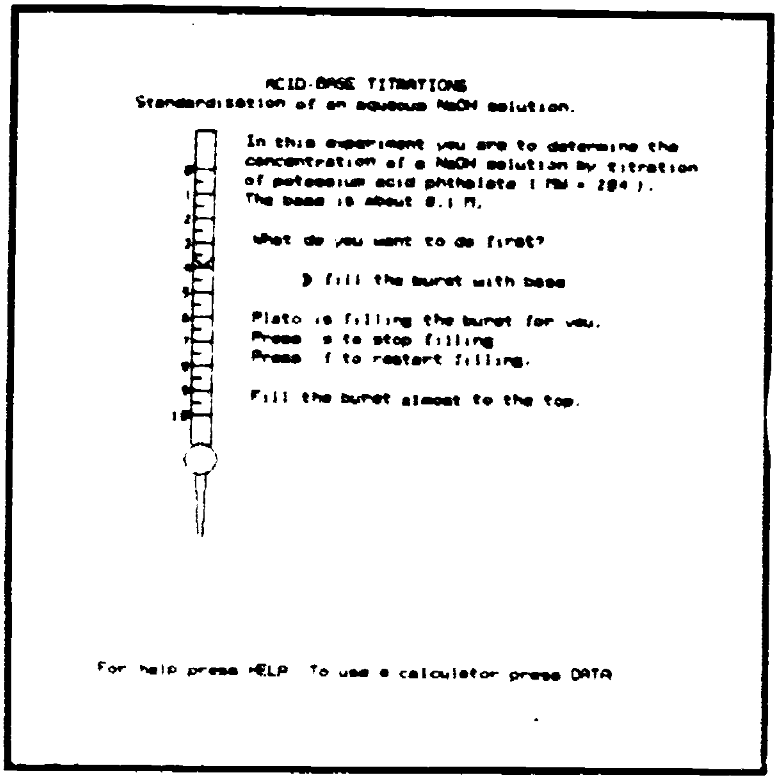

Figure 46. Acid-Base Titrations, by Stanley Smith. Copyright © 1976 by the Board of Trustees of the University of Illinois.

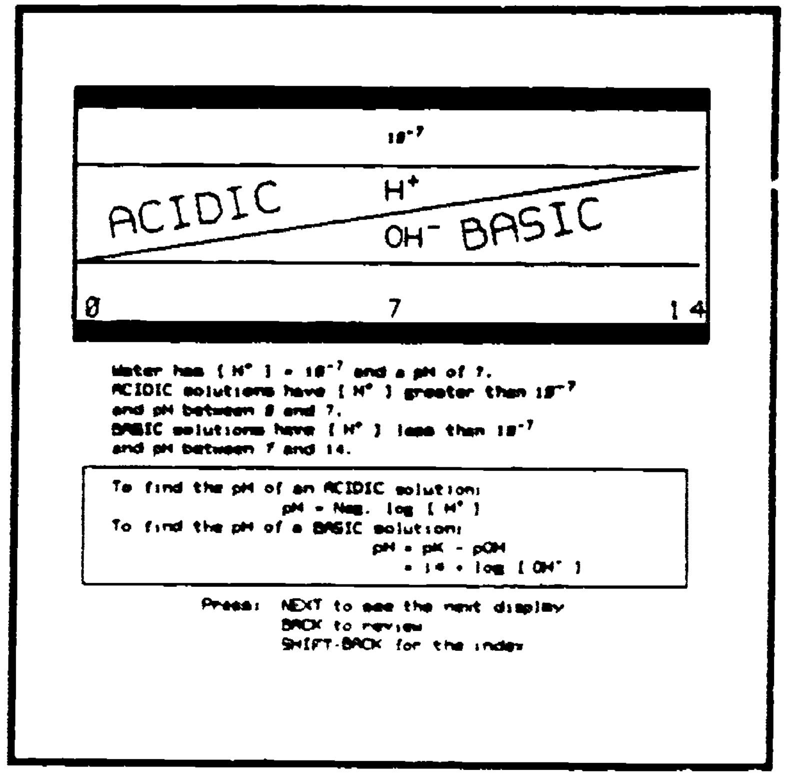

Figure 47. Application of Logs: pH, by Bernard Russiello. Copyright © 1980, 1981, 1982 by the University of Delaware.

In another lesson, high-resolution graphics help convey the concept of the spatial arrangement of molecules as shown in figure 48. The molecule in the picture is composed of a central atom, A, and six surrounding atoms, X. The picture shows how the surrounding atoms arrange themselves as far apart as possible on the surface of an imaginary sphere with the central atom as the center. In figure 49, the sphere is removed, and the octahedral framework of this molecule is drawn in dotted lines.

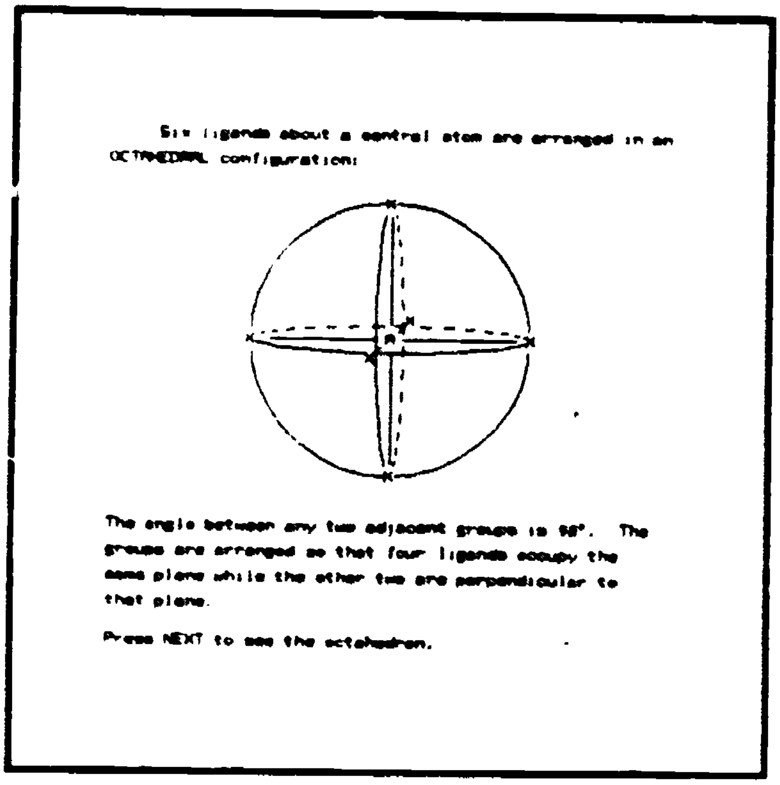

Figure 48. Determining Shapes of Molecules: VSEPR, by Edward R. Davis, Roland Garton, Leonid Vishnevetsky, and Seth Digel. Copyright © 1980, 1981, 1982, 1983, 1984 by the University of Delaware.

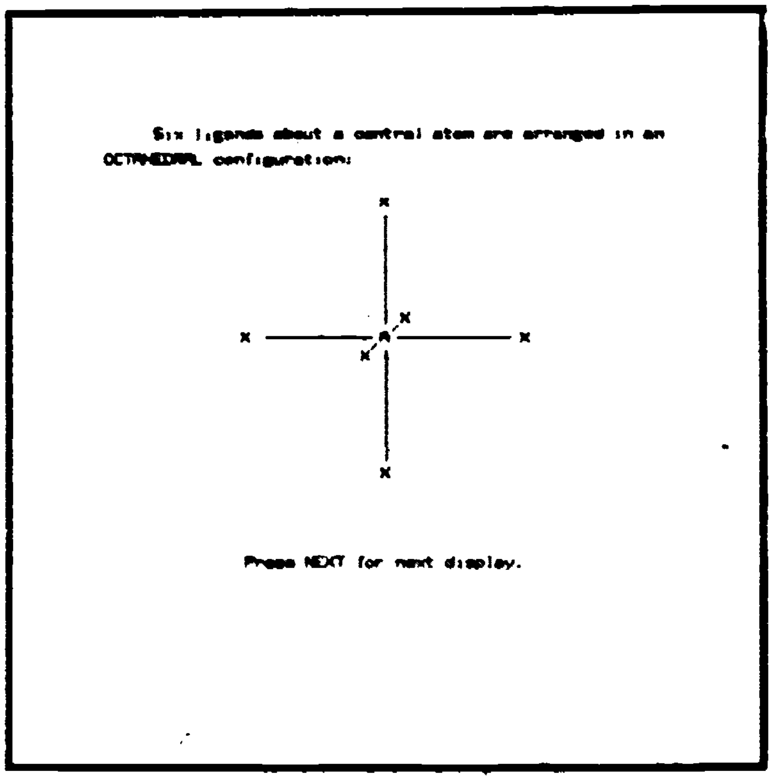

Figure 49. Determining Shapes of Molecules: VSEPR, by Edward R. Davis, Roland Garton, Leonid Vishnevetsky, and Seth Digel. Copyright © 1980, 1981, 1982, 1983, 1984 by the University of Delaware.

Civil Engineering

The civil engineering faculty has developed and implemented a PLATO lesson that is being used in Statics and Structural Analysis courses. Covering the topics of axial force, shear and moment, this lesson teaches students the concepts of internal force and definitions and methods of calculating internal axial force, shear and moment. It also provides practice in calculating these forces.

Figure 50 shows a part of the lesson which explains the concept of internal force. The student is shown a rod that is used to suspend a clock from a ceiling. It is explained that internal forces inside the rod hold it together and enable it to support the weight of the clock.

In figure 51, the student has just completed a section that explains the method of calculating axial force, shear and moment. The student is now being asked to use this method to calculate these internal forces at point B. If the student answers correctly, the lesson continues on to the next topic. If not, the student is given helpful hints, depending on the nature of the error.

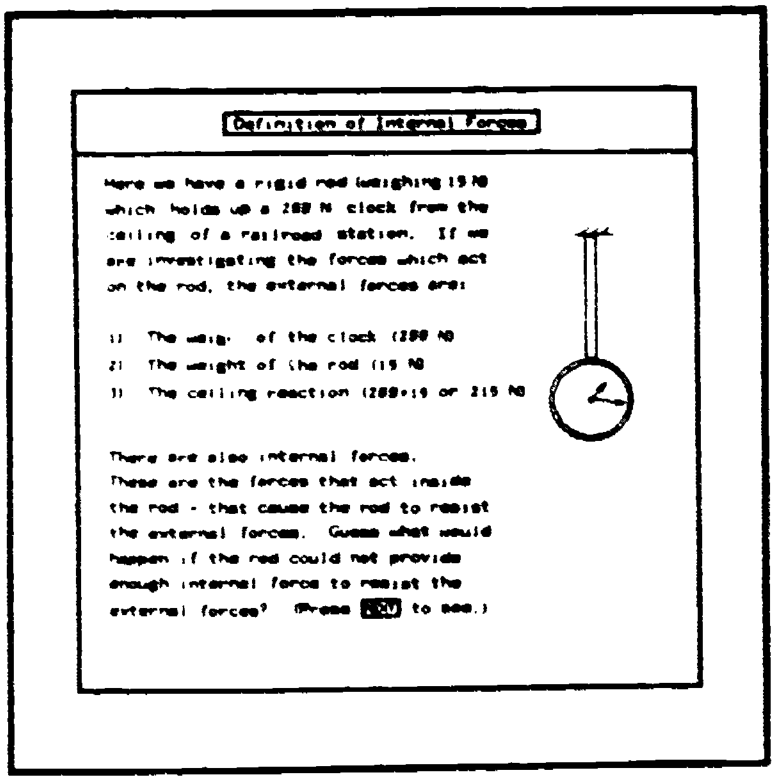

Figure 50. Internal Force, by Eugene Chesson, Jr. and Jeffrey Snyder. Copyright © 1979, 1980 by the University of Delaware.

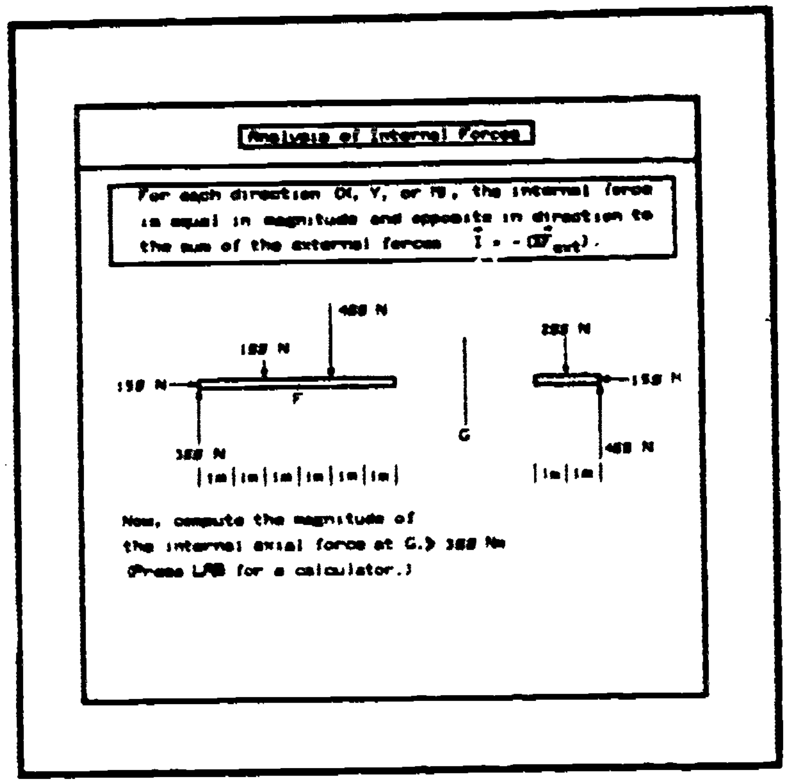

Figure 51. Internal Force, by Eugene Chesson, Jr. and Jeffrey Snyder. Copyright © 1979, 1980 by the University of Delaware.

Figure 52 is from a tutorial section where the student learns how to solve more complicated problems using the method of summation. The student is being shown how to make a load diagram for a beam that is being acted on by various loads. The student has already been shown how to do the calculations at two points along the beam and is now being asked to calculate the load at other points. Helpful hints are given if the student encounters difficulty.

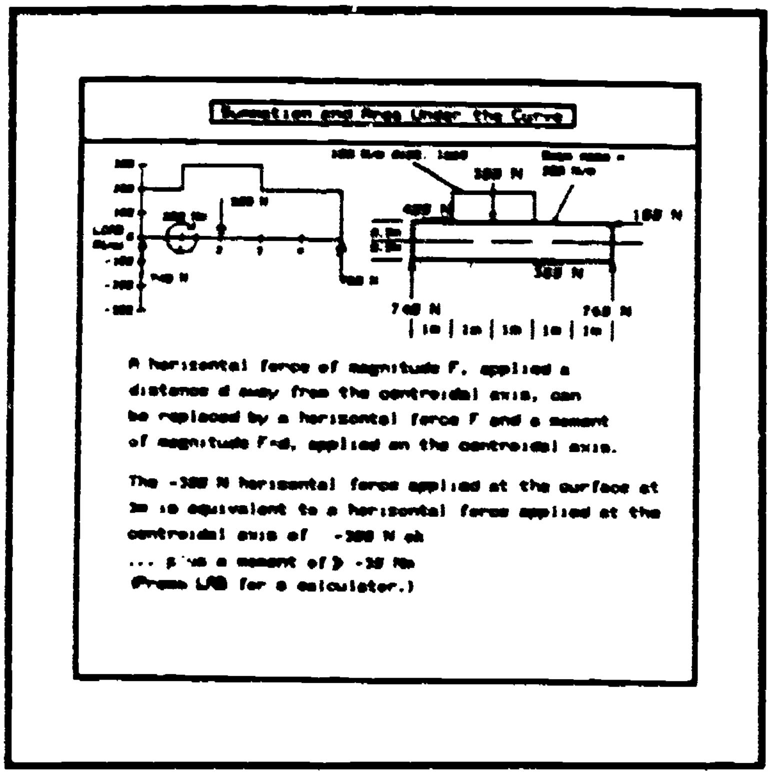

Figure 52. <u>Internal Force</u>, by E'gene Chesson, Jr. and Jeffrey Snyder. Copyright © 1979, 1980 by the University of Delaware.

Continuing Education

In the 1980-81 academic year, the Division of Continuing Education began offering courses comprised of lessons from Control Data's published courseware libraries and lessons developed at the University of Delaware. Five courses were offered with a total enrollment of thirty-eight students. In 1981-82, eighty-four students enrolled in eight PLATO courses. These courses included an introduction to computers, an introduction to data processing for managers, investing and the consumer, money management and the consumer, laboratory tests and procedures, chemical instrumentation/laboratory skills, a math review for chemical/physical/life sciences, and heat and thermodynamics. In 1982-83, seventeen students enrolled in the same eight classes. In 1983-84, three PLATO classes were offered: an introduction to computers, an introduction to programming in BASIC, and BASIC programming techniques. Sixty-three students enrolled in these classes. The computer-based format has proven to be especially appropriate for continuing education students because sessions on the PLATO system can be arranged around work and family obligations.

The Division has continued its on-going program of career counseling using lessons developed jointly with the Counseling Center. Sitting at a PLATO terminal located in Clayton Hall, students may obtain career information and guidance. The counseling programs include an on-line version of John Holland's "Self-Directed Search," an occupational information by title lesson that allows students to explore career information on 510 different occupations, and the "Exploring Careers" series that was developed by Dr. Richard Sharf with funding from the Center for Counseling, the Division of Continuing Education, and the Control Data Corporation. These programs are explained in depth in the counseling section of this report.

In addition to the above, the Division continued offering four popular non-credit microcomputer seminars for professional and personal development. These seminars provide training to the general public on using and evaluating microcomputers. "Introduction to Personal Computers" was offered twelve times with a total enrollment of 240 students. Topics included a discussion of terminology, architecture and features of microcomputers, issues to consider when purchasing hardware and software, a comparison of programming languages, demonstrations of software packages, and demonstrations of microcomputers and peripherals. "Introduction to BASIC Language Programming" was offered seven times with a total enrollment of 140 students. Topics included a discussion of variables, manipulating the flow of execution, evaluating input, arrays, and string processing. "Introduction to Popular Application Software" was offered three times with a total enrollment of fifty-one students. Topics included electronic spreadsheets, word processing, home budget programs, educational programs, and recreational programs. Students had ample time for hands-on experience with each type of program. "Introduction to Pascal Programming on Personal Computers" was offered once and had a total enrollment of ten students. Topics included variables, declarations, assignment statements, expressions, functions, operators, repetition, and procedures. Each seminar consists of four three-hour sessions. Part of each session includes laboratory work in the OCBI Microlab during which students have access to microcomputers.

Counseling

In July of 1980, Senior Psychologist Richard Sharf received a grant of $50,000 from the Control Data Corporation to complete the Exploring Careers Series and to modify it for the urban/underprivileged population that CDC addresses through its Fair Break program. A second grant of $175,000 was awarded in January of 1981 to continue work on the Exploring Careers Series as well as several other lessons on career development and education. These grants culminated in 1982 with the conversion of many lessons to run on Micro PLATO stations in a low-cost format.

The Exploring Careers Series is similar to its predecessor, the Career Search. One of the major differences is that the Exploring Careers Series is designed not only to help students explore occupational alternatives, but also to narrow down their choices. Students are guided through this process, which may take two to three hours, by the two cartoon characters shown in figure 53.

The Exploring Careers Series has three main parts. Part 1 introduces students to a wide range of careers by asking them to indicate their interest in each of sixty-two different careers. Unlike other career interest inventories that rely on career stereotypes, this one allows students to look at information about each occupation before making their ratings. Figure 54 shows one of the four pages of ratings that students are asked to complete. Using John Holland's typology, students are given scores in six areas -- Realistic, Investigative, Artistic, Social, Enterprising, and Conventional. On the basis of these scores, students are presented with an ordered

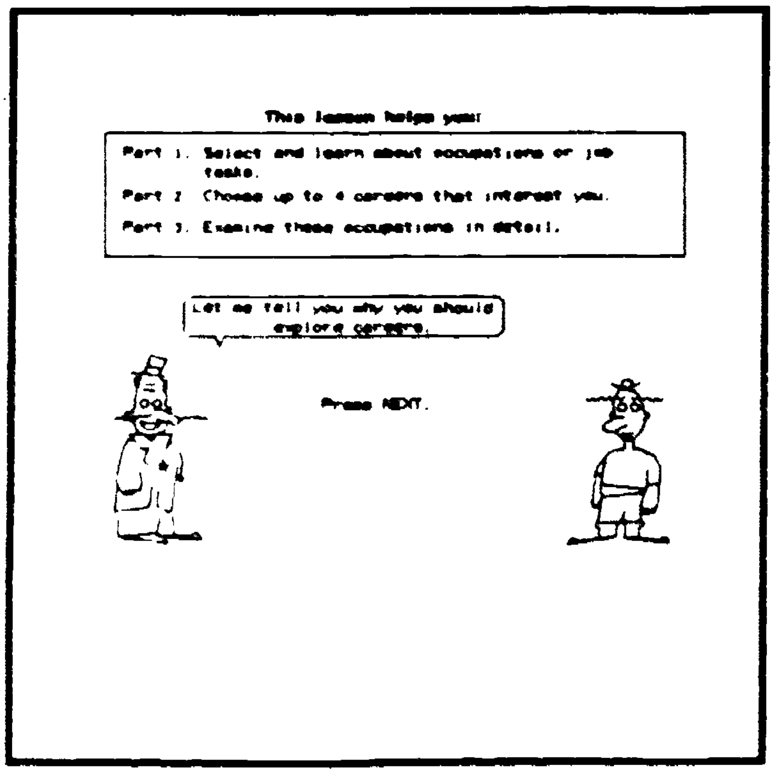

Figure 53. Exploring Careers: Introduction, by Richard Sharf. Copyright © 1979, 1980, 1981 by the University of Delaware.

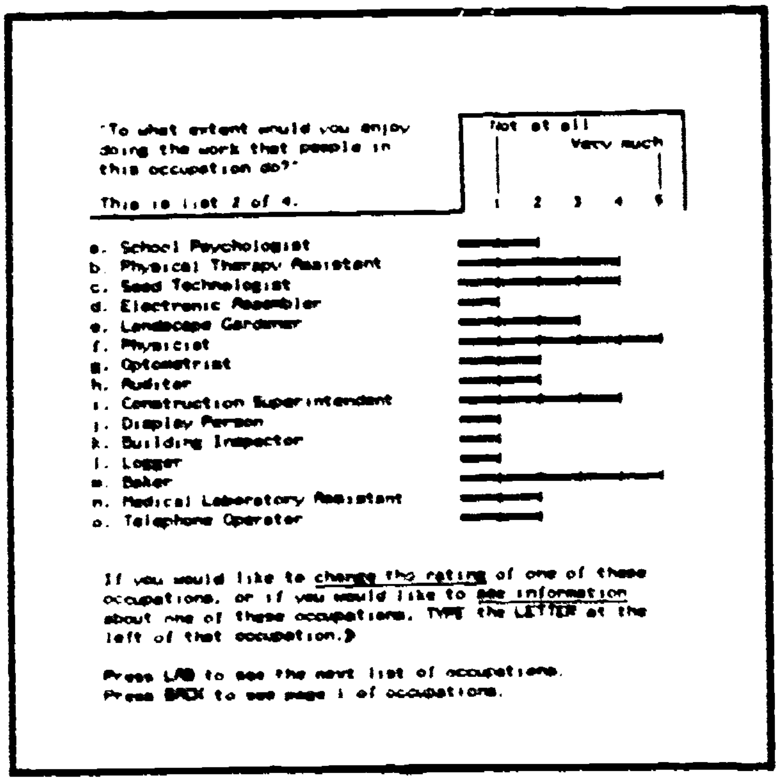

Figure 54. Exploring Careers: Part 1, by Richard Sharf. Copyright © 1979, 1980, 1981 by the University of Delaware.

list of occupations from which to choose in Part 2. If the students have already chosen an occupation, they can go directly to Part 2 without completing the ratings.

Part 2 of the Exploring Careers Series contains 510 jobs from which students can choose two, three, or four that they wish to save and examine further. Figure 55 shows the options available to students interested in learning more about listed occupations. When students have decided which occupations to investigate further, they proceed to Part 3.

Part 3 of the Exploring Careers Series was designed to help high school students and high school drop-outs be realistic about their career choices. Students are asked to rate each of the two, three, or four occupations on six characteristics: interest in the occupation; attainability of education level; ability to meet qualifications; acceptability of salary; acceptability of working conditions; and the riskiness of the job market. Figure 56 gives an example of the occupational information and the rating instructions.

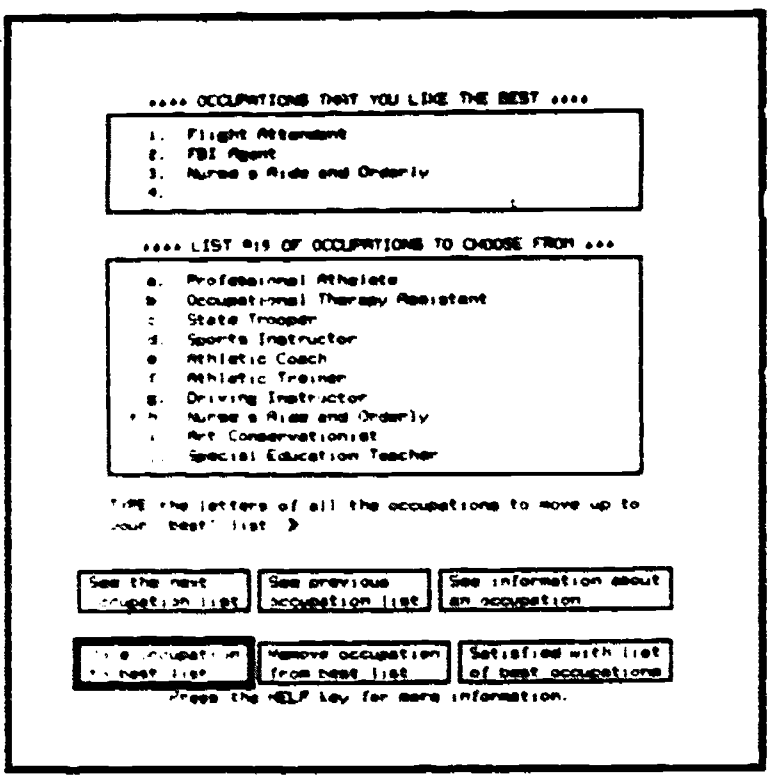

Figure 55. Exploring Careers: Part 2, by Richard Sharf. Copyright © 1979, 1980, 1981 by the University of Delaware.

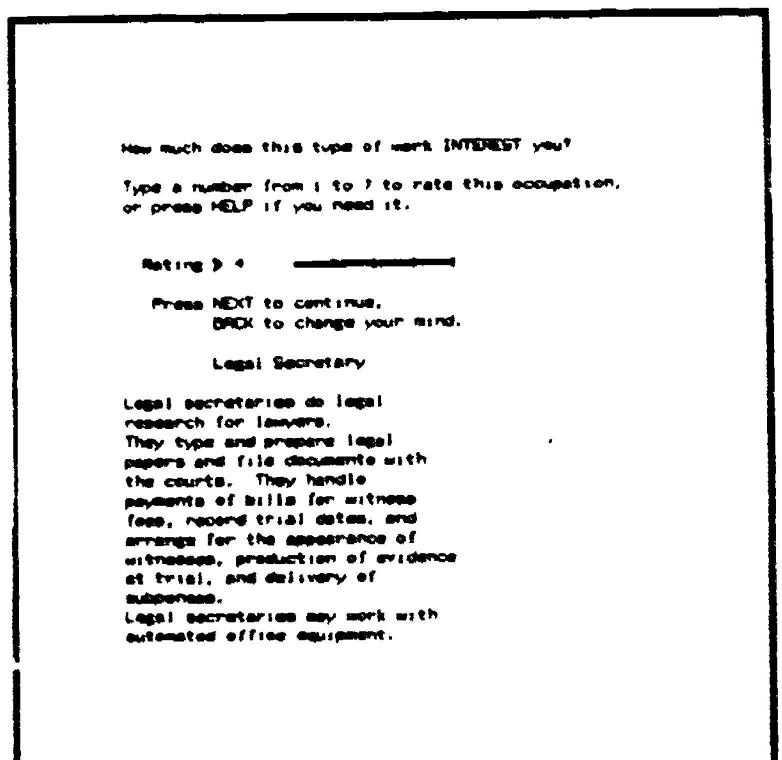

Figure 56. Exploring Careers: Part 3, by Richard Sharf. Copyright © 1979, 1980, 1981 by the University of Delaware.

The occupation database of the Exploring Careers Series contains summary information on 510 jobs. Occupational vignettes provide students both with opportunities to learn the nature of the work involved in particular occupations and with ways to receive occupational training. To date, two occupational vignettes have been completed, and a third is under development. The first vignette, "Secretary: Skills and Careers," allows the student to study secretarial tasks, secretarial career paths, pay scales, promotional ladders, and job requirements. Figure 57 shows how this vignette illustrates the relationship between a dictated letter taken in shorthand by a secretary and the corresponding typed transcription. The second vignette deals with the occupation of custodian, and the third deals with the retail sales clerk.

The counseling project is also developing lessons that help students learn about general occupational concerns. "Job Benefits" introduces students to wage deductions and the range of benefits offered by many companies. This lesson simulates working at a job where benefits accrue. A sample pay stub is displayed, and students learn how deductions such as social security and federal taxes reduce the amount of pay they receive. Figure 58 shows a check stub that has typical deductions. This lesson also shows how job benefits function. For example, students learn how a company dental benefit may pay all or most of the cost of a trip to the dentist.

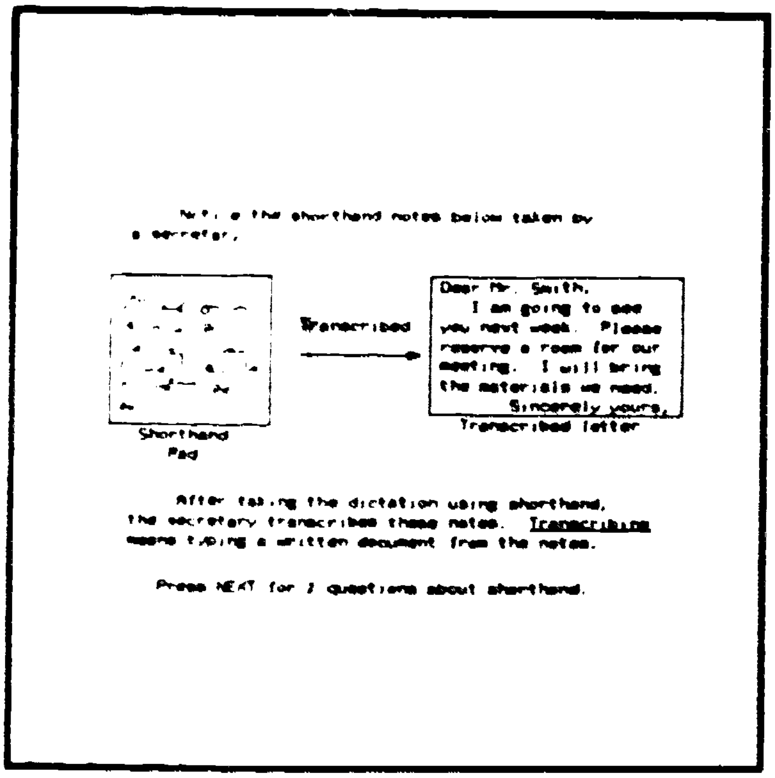

Figure 57. Secretary: Skills and Careers, by James Morrison and Richard Sharf. Copyright © 1981, 1982 by the University of Delaware.

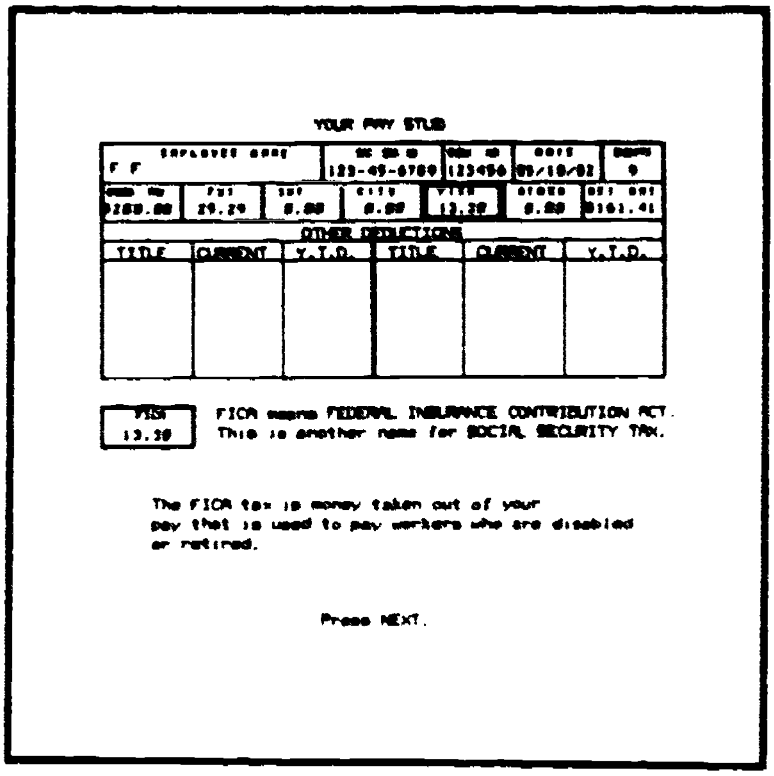

Figure 58. Job Benefits, by Richard Sharf and Kathy Jones. Copyright © 1981 by the University of Delaware.

Also under development is a lesson dealing with career counseling. "Counseling for Career Decisions" allows students, training as counselors, to practice and learn appropriate vocational counseling techniques. Students are shown how to use specific counseling skills by responding to client situations in the lesson. Figure 59 shows a sample client statement and the choice of responses.

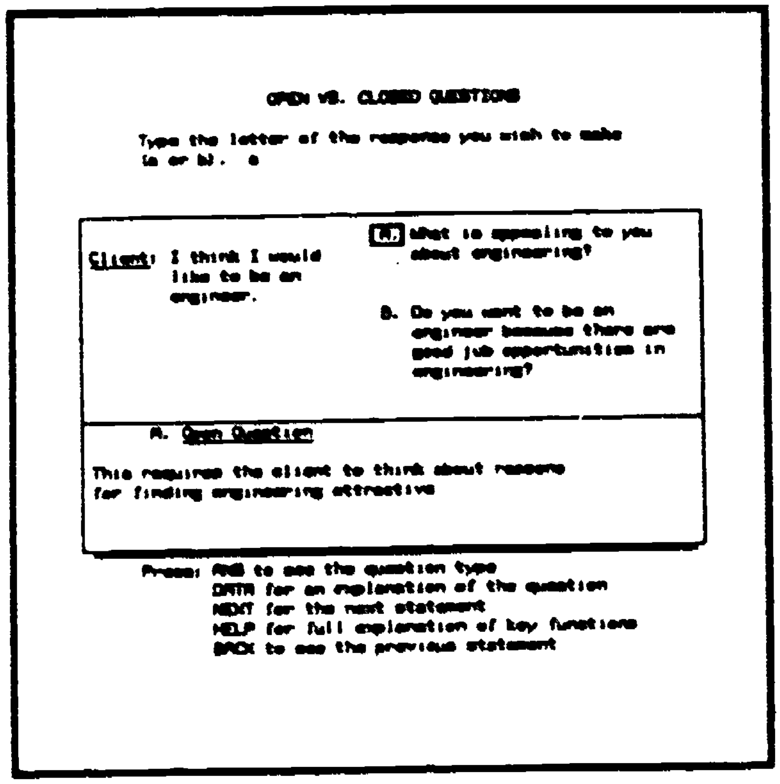

Figure 59. Counseling for Career Decisions, by Richard Sharf and Louisa Frank. Copyright © 1982, 1983 by the University of Delaware.

Economics

Students in the Department of Economics are using two sets of PLATO lessons. The first set, developed at the University of Illinois, is a series of instructional lessons in basic macroeconomics and microeconomics. Under a joint agreement with the original authors, these lessons have been adapted so that they are better suited to the University of Delaware curriculum. Discrepancies in terminology have been resolved, topics have been reordered or omitted, and the explanations and graphs have been made easier to read. Figure 60 shows how graphs and questions are used together in a lesson on profit maximization under conditions of imperfect competition to improve student comprehension of a complicated economic relationship. To reach the point shown in this lesson, the student has answered a series of questions about total cost, total revenue, average total cost, and demand. Each of these functions has been plotted at an appropriate place in the discussion. In response to the series of questions the student has answered, the total profit curve is about to be plotted on the top graph. This in turn will allow the student to read the point of profit maximization from the graph.

The second set of lessons is being developed by the Department of Economics at the University of Delaware. These lesson include over 400 multiple-choice practice problems related to basic macroeconomics and microeconomics. Figure 61 is taken from one of these problems. The student has responded incorrectly and is being shown an explanation of the problem. Explanations are provided for all possible answers to each problem; students see only the explanations that are appropriate to their

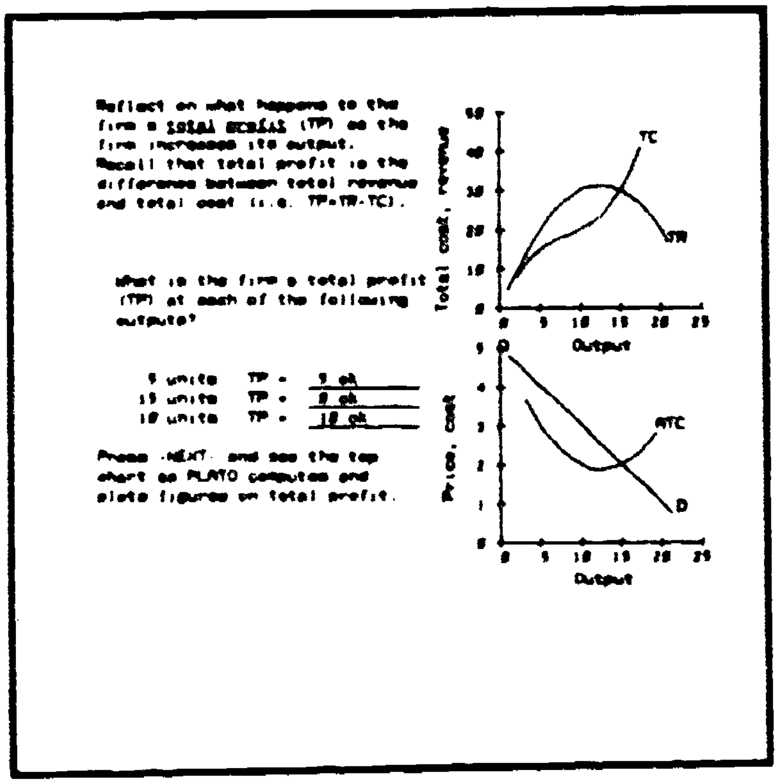

Figure 60. Imperfect Competition, by Donald W. Paden, James H. Wilson, and Michael D. Barr. Copyright © 1975 by the Board of Trustees of the University of Illinois.

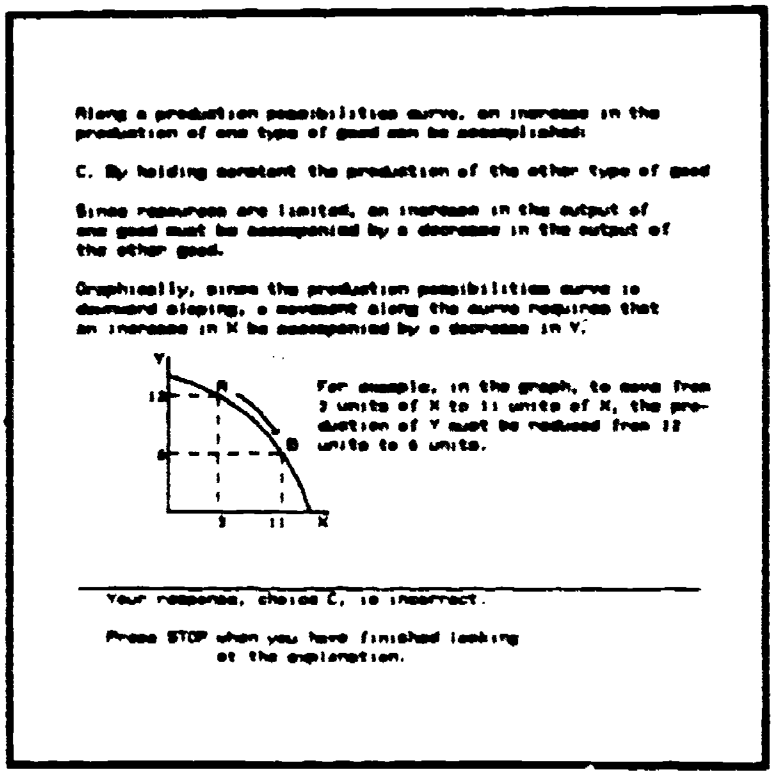

Figure 61. Economics Practice Problems, by Jeffrey Miller, Charles Link, Lenore Pienta, Keith Slaughter, et al. Copyright © 1980, 1983 by the University of Delaware.

responses. In figure 62, the student has correctly answered a question on marginal cost of producing. Upon pressing NEXT, the student sees the graphical representation of the problem. Upon successive NEXT presses, the graph changes to indicate the effect of changes in related economic parameters.

Research on the problem bank's use and its effect on student performance in these courses is being conducted. This research is a joint effort between the Department of Economics and the Instructional Resources Center. Data on student responses to testbank questions is being collected for a group of 300 students. The results of this research will be used to revise the problem bank to insure that all of the problems are demonstrably useful and challenging to University students.

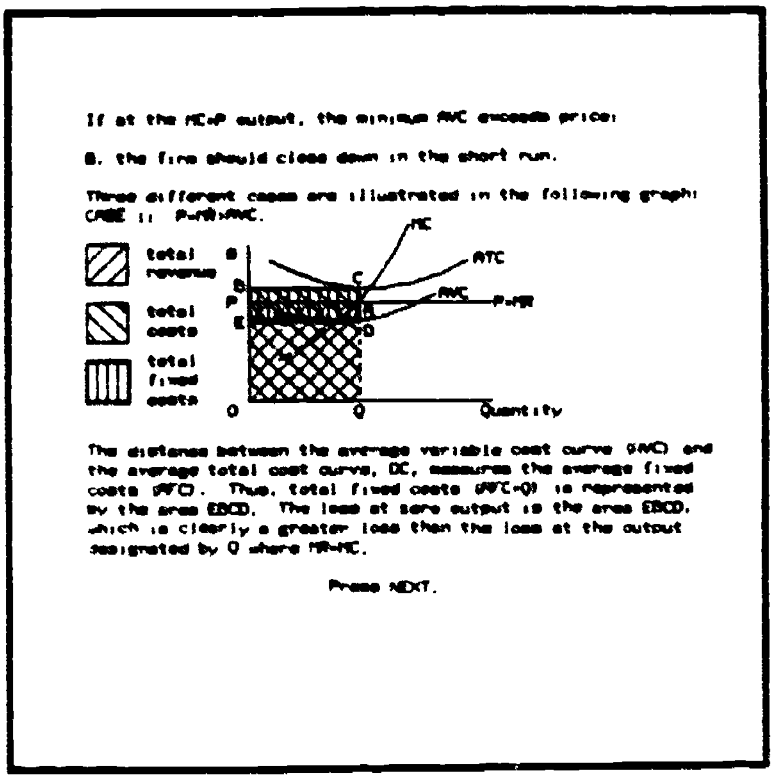

Figure 62. Economics Practice Problems, by Jeffrey Miller, Charles Link, Lenore Pienta, Keith Slaughter, et al. Copyright © 1980, 1983 by the University of Delaware.

Education

College of Education faculty members have been active in research programs relating to the reading process, special education, and cognitive development in reading and math. The PLATO system is being used in these programs to present stimuli, collect data, and perform statistical analyses. Education faculty have also produced lessons on the PLATO system in the areas of reading, statistics, instructional planning, and evaluation. A masters program in Computer-Based Education is now being offered through the Department of Educational Studies.

Research into the Reading Process. Three PLATO programs have been developed for studying aspects of the reading process. "Window" is a program that presents text as if it were seen through a moving window. By varying the width of the window and the rate at which the window moves, the experimenter can control the duration of exposure of the text and the amount of text that can be seen at one time. This program is being used to study the effects of peripheral vision in reading. A second program called "Field" maps the sensitivity of the human visual field by randomly exposing dots of specified duration on the PLATO screen. Subjects indicate detection of a light spot by touching the area where the spot occurred. A third program called "LSC" tests knowledge of letter-sound correspondence within a multiple-choice format.

A study has also been done on the relationship between orthographic structure and letter string recognition. A one hundred fifty-item list of synthetic words in five linguistic categories was used to study language processing in adult subjects. Words were presented individually in random order at one terminal with responses recorded phonologically by an experimenter on an adjacent terminal. For each word the analytical results included a talley of response time and a percentage of correct responses for each of four alternative responses.

Special Education. In a special education project, samples of autistic and non-autistic children were given a series of short-term recall tasks to test for possible differences between the two diagnostic groups in recall pattern (i.e., the order in which sequentially presented material is recalled). Subjects were shown sets of digits or other stimuli in such a manner that the successive (temporal) order of appearance of each member of a set does not correspond to a left-to-right (spatial) configuration. They were asked to indicate which pattern they had seen from among an array containing a temporally ordered and a spatially ordered set along with one in some random order. Analysis of the data collected in this project will seek to determine the proportion of responses favoring one order versus another. This will be done to test an hypothesis of no difference between the groups. Additional analyses of differences within the groups will focus on possible relationships between order chosen and receptive language ability of respondents, type of stimulus presented, and rate of stimulus presentation. The outcomes are expected to enhance current understanding of cognitive differences between the two subgroups of disabled children and to have implications both for etiological and clinical diagnosis.

Research is also being done to study social comparison behavior among mainstreamed handicapped children. All members of a third grade class that includes nine handicapped and twenty-six nonhandicapped students and two fourth grade classes with ten handicapped and twenty nonhandicapped students will have access to a terminal which will allow each member to check points received in a behavior management point system. When using the terminal, students will be able to access their own points as well as those of classmates who are participating in the study. The number of times handicapped students audit (access) scores of nonhandicapped students will be used as a measure of the extent to which these mainstreamed students are comparing their performance to that of their classmates. Comparison behavior of this kind is one of the expected outcomes of mainstreaming programs, and the project is aimed at developing a methodology for evaluating the aspect of mainstreaming.

Cognitive Development. A school-based research and development program used a PLATO terminal in a local elementary school. The overall aim of this program was to increase the coordination of laboratory research with actual classroom practice in reading and mathematics.

Working within the framework of a protomodel of reading, lessons on the PLATO system were used to gather data on decoding and comprehension. The microprocessor capabilities of the IST-I terminal provided quick displays and precise timing for such tasks as matching the initial sound of a spoken word with its visual counterpart and reading stories. Phoneme/grapheme matching lessons allowed selection of stimulus order, delay intervals, and blocked or randomized presentations. Stories lessons used typical classroom materials, and resultant sentence reading times are viewed in relation to context and structure, as well as student recall of the material. The cloze procedure was used to assess readers' dependence on context. Measurements of reading and listening spans were facilitated by the use of an EIS Instavox Rapid-Access Audio Unit for presentation of aural stimuli. Reading research results have been reported in "Cognitive Analyses of Basic School Tasks," by S. Farnham-Diggory and Billie Nelson, in F. Morrison, D. Keating, and K. Lord, Eds., Advances in Applied Developmental Psychology, Volume 1, New York: Academic Press, 1982.

The school-based research program also involved mathematics. A math research lesson provided options for selecting various ranges of sums, numbers of trial blocks, and magnitudes of error when presenting incorrect sums. Complete trial-by-trial information and summary data were immediately available on-line. In figure 63, the data summary from one child's session shows prediction equations and other descriptive statistics.

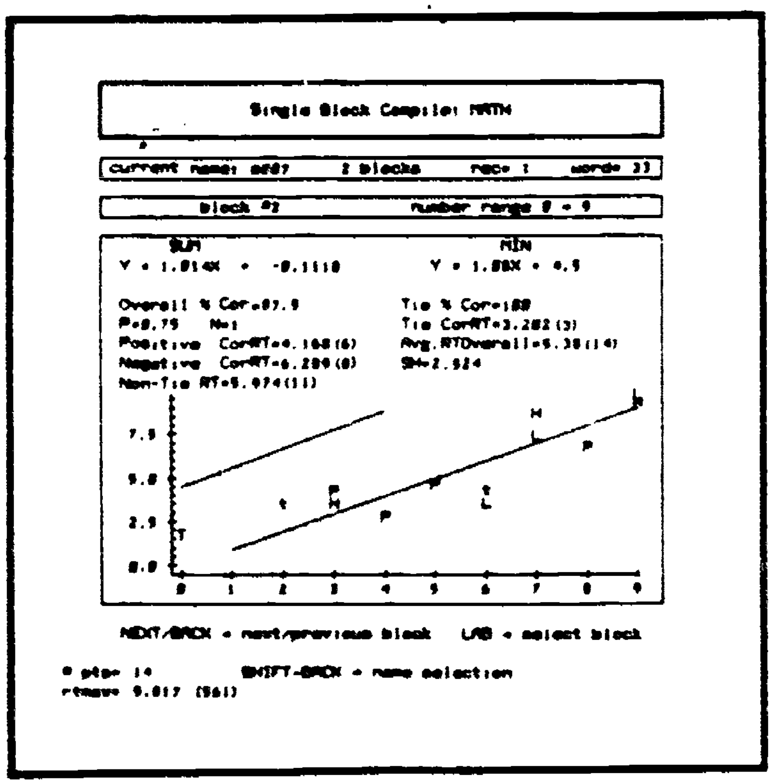

Figure 63. CEDR Math Statistics, by Billie Nelson and Michael Frank. Copyright © 1981 by the University of Delaware.

Reading Study Center. The Reading Study Center has developed a package of remedial reading lessons designed to teach both "survival" words (words that an adult needs to be able to recognize in order to get through daily life, such as "telephone" and "stop") and words from the Dolch sight word list. These lessons follow a theme involving spies and secret passwords. The basic instructional lesson is called "SWAT" (Sight Word Attack Team). The Reading Center has also developed instructional games in which the students practice distinguishing target words from each other. In "Make a Spy," for example, the students' reward for "guessing" the secret message is the chance to select parts of a spy disguise for themselves. The students like to fix sentence after sentence just for the opportunity to make their own funny spy faces. Like all other reading materials developed on PLATO, the SWAT package uses random access audio to deliver instructions and feedback to the student. However, where previously written lessons automatically initiate the delivery of audio, the SWAT lessons use a different strategy known as learner-controlled audio. With learner-controlled audio, all of the directions and feedback are written on the screen. The students initiate the messages by touching them on the screen when they are ready to listen.

The Reading Study Center has also used the Office of Computer-Based Instruction's microcomputer classroom in a tutorial program with inner-city children. Reading clinicians and children played spelling and word recognition games on Apple computers.

Statistics. In the area of statistics, the education faculty has developed a Multi-Dimensional Scaling Survey Package that permits researchers to collect and edit data amenable to analysis by a state-of-the-art multidimensional scaling routine. The lessons in this package present stimuli, store responses, and provide a number of visual displays that permit the researcher to assess the quality of data collected. After editing, the data can then be routinely transferred for analysis using the ALSCAL program on the University's B7700 computer system. Using this set of routines, research that is ordinarily difficult to carry out can be done quite easily.

"The Effect of Sample Size on the Sample Variability of Pearson's Coefficient of Correlation" is a statistical sampling laboratory lesson that exploits the unique graphic capabilities of the PLATO system in order to allow students to examine the sampling variation of selected statistics and the relationship between such variation and sample size. This lesson has been used in several courses at the University. In addition to being a useful pedagogical tool, the sampling laboratory provides the potential for doing research on discovery learning.

Instructional Planning. The College has also developed a PLATO lesson dealing with instructional planning and evaluation. Called "Charon," this program allows school districts to establish instructional calendars for curricular subjects, to generate schedules based on those calendars, and to gather cumulative statistics on performance of instructional groups according to test mastery and content covered relative to expected coverage. The name Charon is derived from Greek mythology in order to stress the guidance aspects of this program. Charon is a son of Erebus who guides the souls of the dead over the Styx.

A significant achievement in 1981-82 was the establishment of a Master's program in computer-based education. Offered by the Department of Educational Studies, this program combines courses in educational research and educational computing with a variety of laboratory and field experiences that prepare graduate students for careers as professional designers and administrators of computer-based education projects. The program requirements are listed as follows:

Core Courses (15 credits)	Specialization (15 credits)
Educational Research Procedures	Introduction to Computer-Based Education
Advanced Educational Psychology	Design of Computer Instruction
Sociology of Education	Advanced Educational Computer Programming
Philosophy of Education	Computer Systems: Architecture
History of Education in American Culture	Computer Systems: Software
	Master's Thesis/Research Project

Tutor LOGO is a research-based learning environment designed to facilitate the study of how children learn computer programming. The system is composed of a graphics subset of the LOGO programming language, a protocol collection and presentation program, and a complete on-line guide to the system, including component descriptions and a glossary of commands.

Instructional facilities include capabilities for viewing and commenting on individual students' LOGO procedures and writing new commands for specific student groups; also included are educational games that give practice in Tutor LOGO skills. A student monitoring program displays a classroom map and queue of help requests.

Figure 64 illustrates the Tutor LOGO display. Immediate mode or "Tell Mode" is shown. Students tell "Pogo," the Tutor LOGO turtle, commands that are immediately executed in the 400 X 400 pixel workspace. Students can create procedures in an editor called "Tutor Mode." Procedures are saved automatically for future use. A sample procedure is shown in figure 65. Procedures take a structured format for easier learning, viewing and debugging. Beyond the usual LOGO graphics commands,

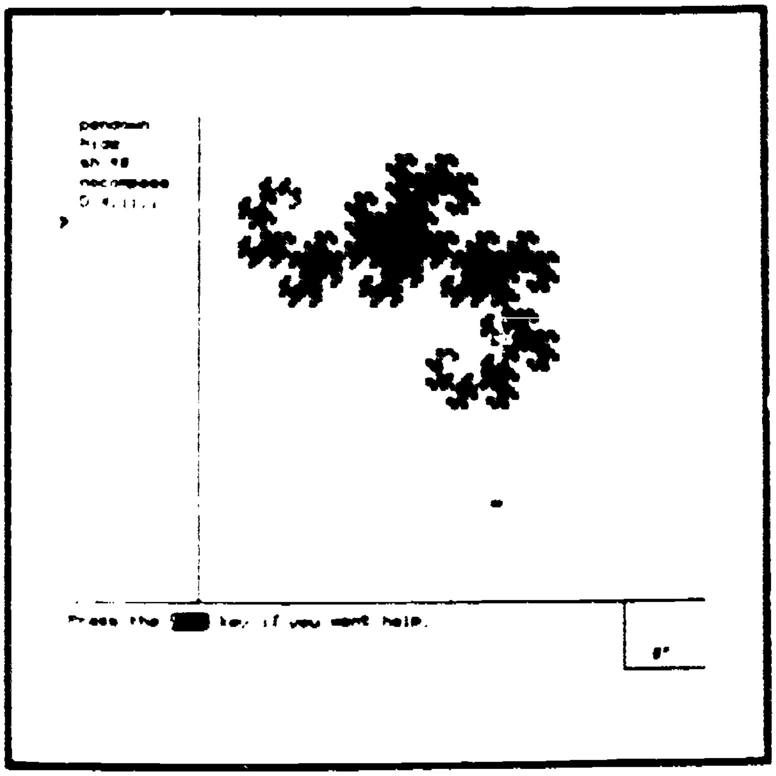

Figure 64. Tutor LOGO, by Suzanne R. McBride, James W. Hassert and Craig Prettyman. Copyright © 1982, 1983 by the University of Delaware.

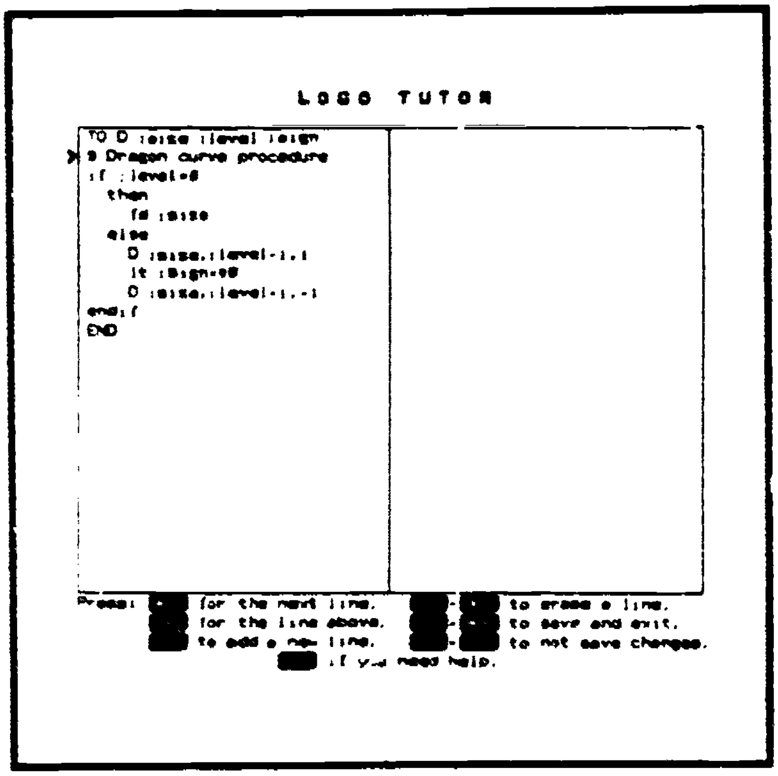

Figure 65. Tutor LOGO, by Suzanne R. McBride, James W. Hassert and Craig Prettyman. Copyright © 1982, 1983 by the University of Delaware.

BEST C... ...BLE

this version provides all trigonometric and mathematical functions available on the PLATO system. It supports complex, recursive functions and several looping structures.

The system was pilot tested in the Saturday Morning Math Program at the University and in a summer course for eight-year-old students. In August of 1983, sixteen second-grade children participated in a three-week course to learn Tutor LOGO programming. Protocols of their learning efforts were automatically stored, and are presented in a separate lesson with viewing and printing options.

Figure 66 shows a sample protocol from a child's programming session in Tutor LOGO. Information in the header includes student name and group, date and time the session begins, and session number. Each time a command is typed and followed by a NEXT keypress, the typing is stored in the protocol along with the time, to the nearest tenth of a second, since the session began. Other protocol information includes the informative messages received by the student, requests for help, indicators for when help is received, and the nature of the inquiry.

Separate pages can be accessed from the protocol to show the content of procedures before and after editing, as shown in figure 67. Yet another display shows a protocol of the actual keypresses involved in creating a procedure. The last screen of each protocol gives the count of all commands used within and between sessions.

Findings from analysis of Tutor LOGO protocols have contributed toward an understanding of the cognitive processes of how children learn and solve problems in programming. A procedural model of these cognitive processes is being developed. Such a model can aid instructional and system design, particularly in constructing Intelligent Tutoring Systems and computer-based cognitive modelling.

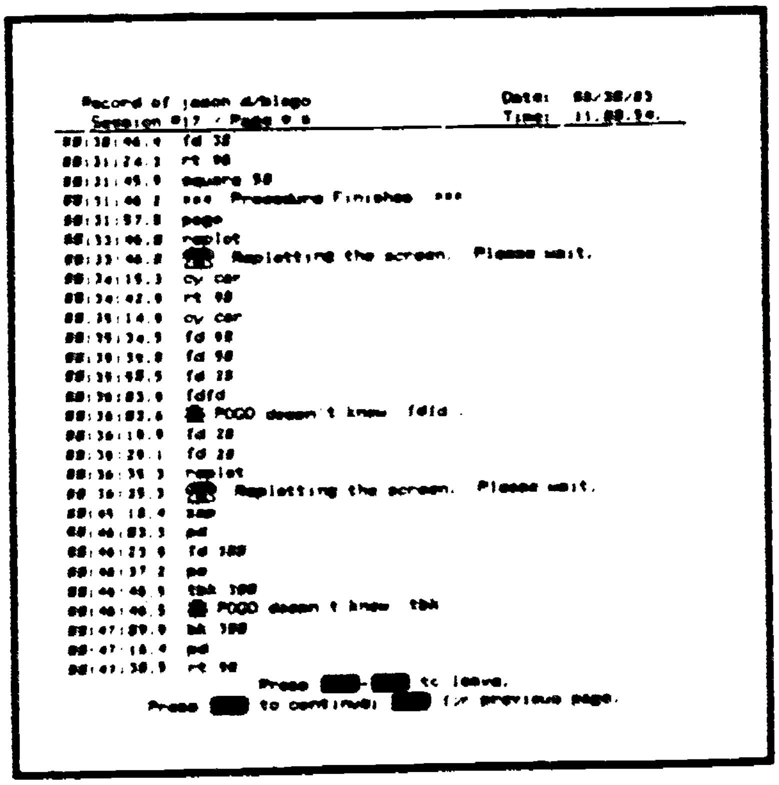

Figure 66. LOGO Data, by Suzanne R. McBride, James W. Hassert and Craig Prettyman. Copyright © 1983, 1984 by the University of Delaware.

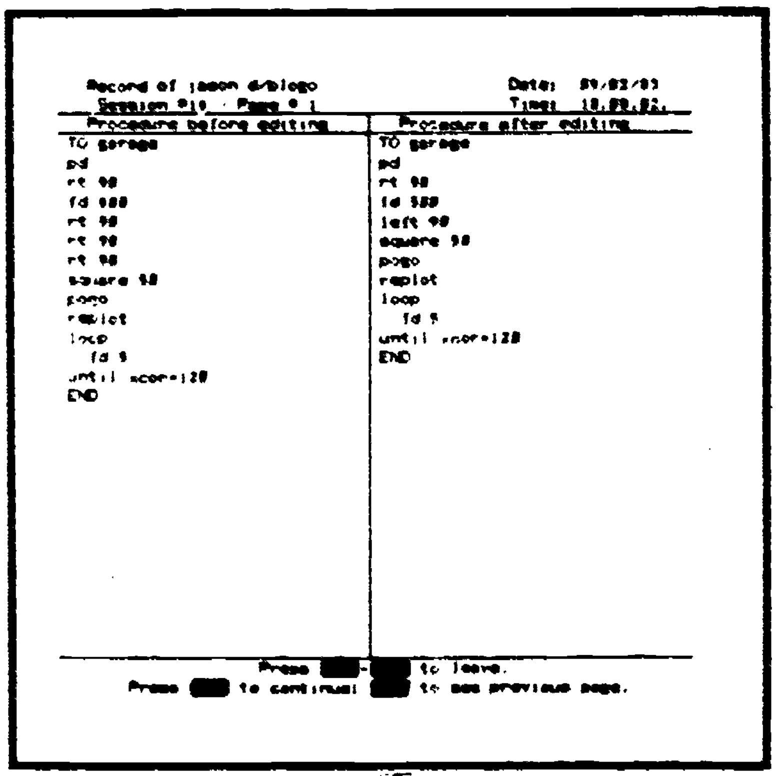

Figure 67. LOGO Data, by Suzanne R. McBride, James W. Hassert and Craig Prettyman. Copyright © 1983, 1984 by the University of Delaware.

English

The Department of English has found the PLATO system to be a valuable tool for improving writing skills, especially for those students taking the pre-introductory level college English course taught by the Writing Center staff. Students use PLATO lessons developed at the University of Delaware and at the University of Illinois to strengthen basic skills in punctuation, sentence structure, spelling, paragraph structure, verbs, and verb forms.

The Writing Center has developed a package of lessons that teaches classroom English language skills. This package includes a diagnostic test and four tutorial lessons covering four language features common to speakers of inner city dialects. These features include multiple negation, copula deletion, 's' endings on verbs, and habitual 'be'. After taking the diagnostic test, the students are branched to the tutorials they need.

Figure 68 shows an introductory screen display from a lesson that teaches third person verb endings. This display introduces the key concept, common to all lessons in the package, of the distinction between informal and classroom English, illustrating examples of acceptable settings for each.

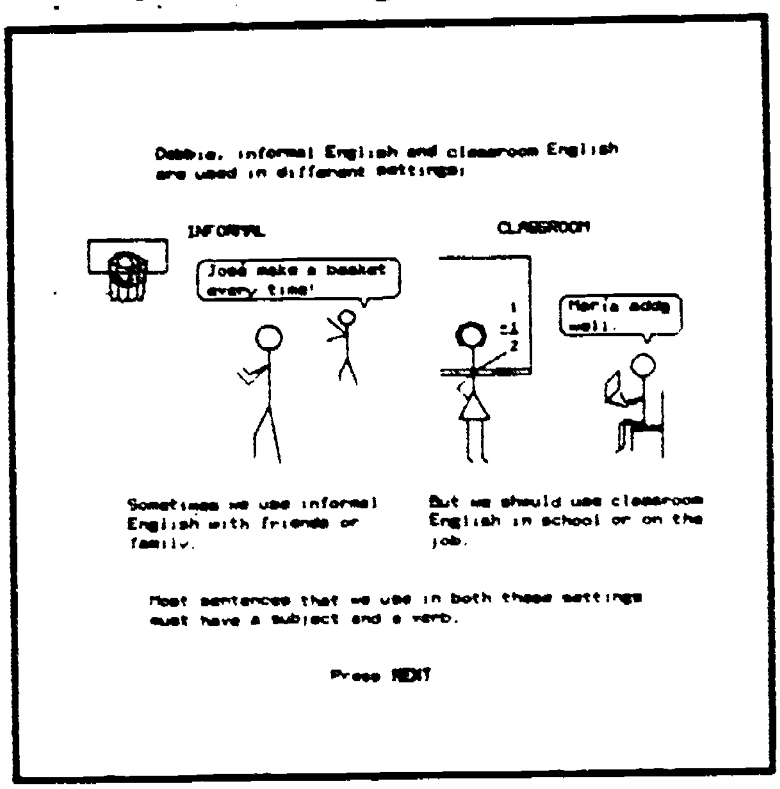

Figure 68. "S" on Third: When to Put an S on a Verb, by Louis A. Arena, Phyllis N. Townsend, and Jean Patchak Maia. Copyright © 1980 by the University of Delaware.

Figure 69 shows an exercise from a lesson that teaches students how to construct classroom English negative sentences. Students are asked to find the sentences that contain multiple negatives. After they choose a sentence, the students are told whether they have correctly spotted an informal English sentence. They are then given the opportunity to change any incorrect responses. When the students have successfully spotted all informal English sentences, the lesson changes the sentences to conform to correct classroom English.

Geography

The Department of Geography is developing a package of lessons on the IBM Personal Computer for the purpose of improving instruction in cartographic design and map layout. By using the highly sophisticated graphics features of the Personal Computer system, students will be able to create and alter maps interactively on the computer screen. The students will be able to move various map elements on the screen by using the cursor keys and to increase and decrease their size by using the + and - keys. They will then be able to make a color print of the finished map layout for later reference and for grading by the instructor. Maps that would otherwise take ten hours to complete on paper will be done in two hours on the computer terminal, thereby giving students the opportunity to create many more and better maps than they could before. They will also develop a better aesthetic judgment because the lesson will make it very easy for them to alter their map designs. If they do not like part of a layout, they will be able to change that part while retaining the remainder of the design. Figure 70 shows a map drawn by a student using this lesson.

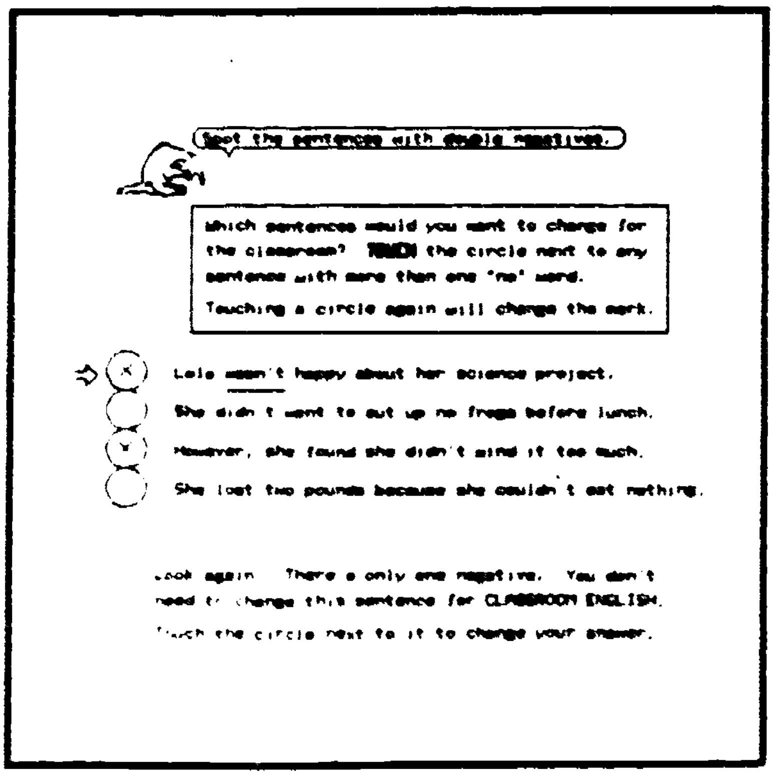

Figure 69. The Power of Negative Thinking: Using Negatives in Classroom English, by Louis A. Arena, Sophie Homsey, Jessica R. Weissman, and Rae D. Stabosz. Copyright © 1979, 1980, 1981 by the University of Delaware.

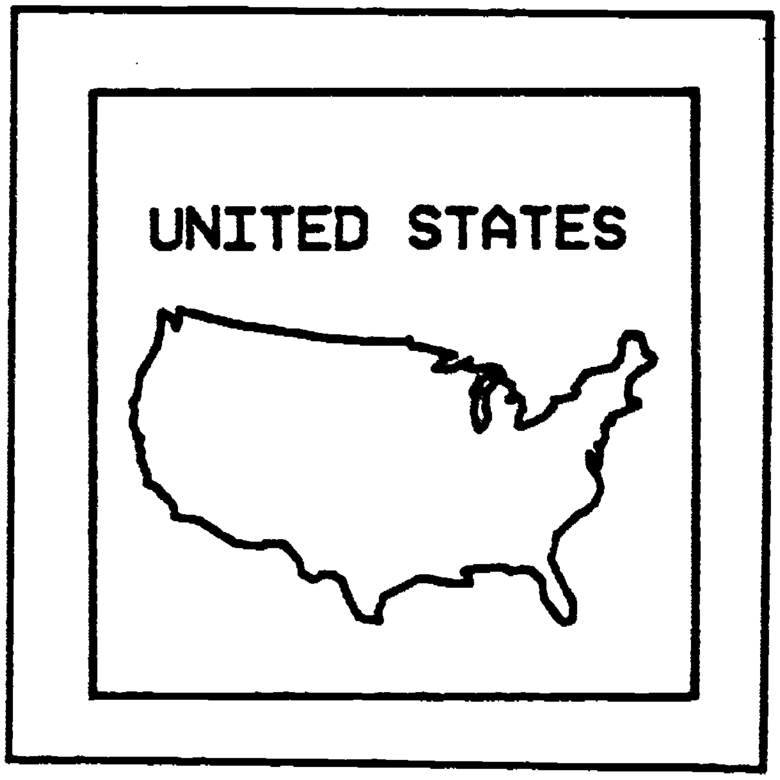

Figure 70. A Computer-Based Cartographic Learning System: Map Layout, by Frank Gossette, Paige Vinall, and Ben Williams. Copyright © 1983, 1984 by the University of Delaware.

Geology

To improve understanding of the process of sedimentation, the Department of Geology is developing a lesson called "The Sedimentology of Floodplains" on the IBM Personal Computer. After introducing students to terminology and the effects of individual parameters on the outcome of floods, this lesson enables students to observe the effects of combinations of parameters.

Through use of the color graphics on the IBM PC, a variety of screen displays and graphs enable students to grasp quickly each parameter's contribution to the overall process. For example, students are asked to choose a number of grain sizes for sand, silt, and clay particles; each grain moves down the screen with the velocity at which it would fall in still water. The lesson graphically compares the distances each of these particles would fall in an equal time, as shown in figure 71, and the accumulations that would occur if equal amounts of a number of grain sizes settled during a fixed time, as shown in figure 72. The instruction is highly interactive; students may repeat the experiments as often as they wish, changing values and immediately observing results.

Building on results obtained from experiments with single parameters, the lesson produces a graphic simulation showing the thicknesses and characteristics of deposits as they accumulate in a floodplain after many floods. By choosing the number of floods and varying the parameters, students gain an understanding of floodplain interactions.

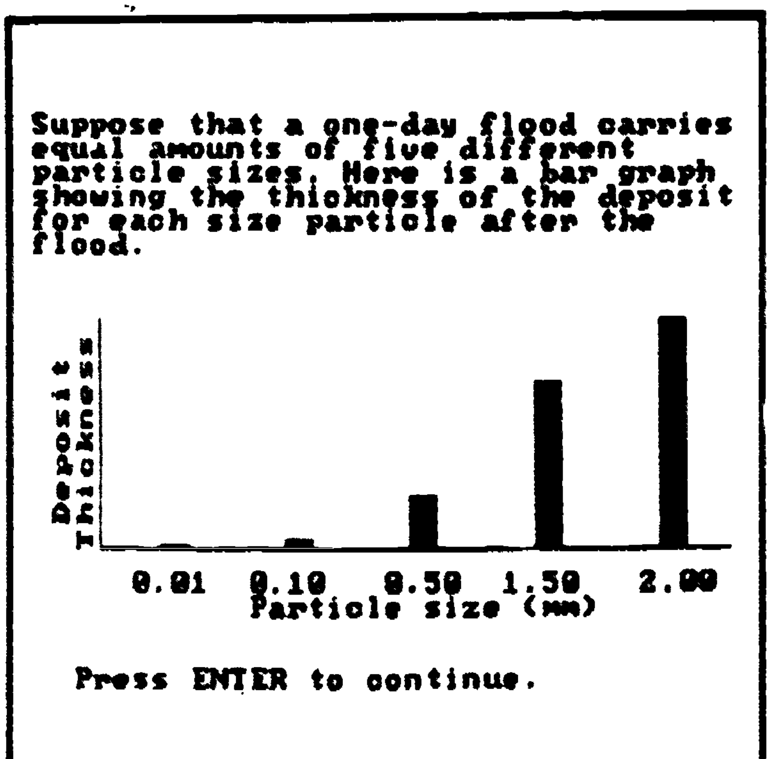

Figure 71. The Sedimentology of Floodplains, by James F. Pizzuto, Nancy J. Balogh, Michael Frank, and Mathew Toschlog. Copyright © 1984 by the University of Delaware.

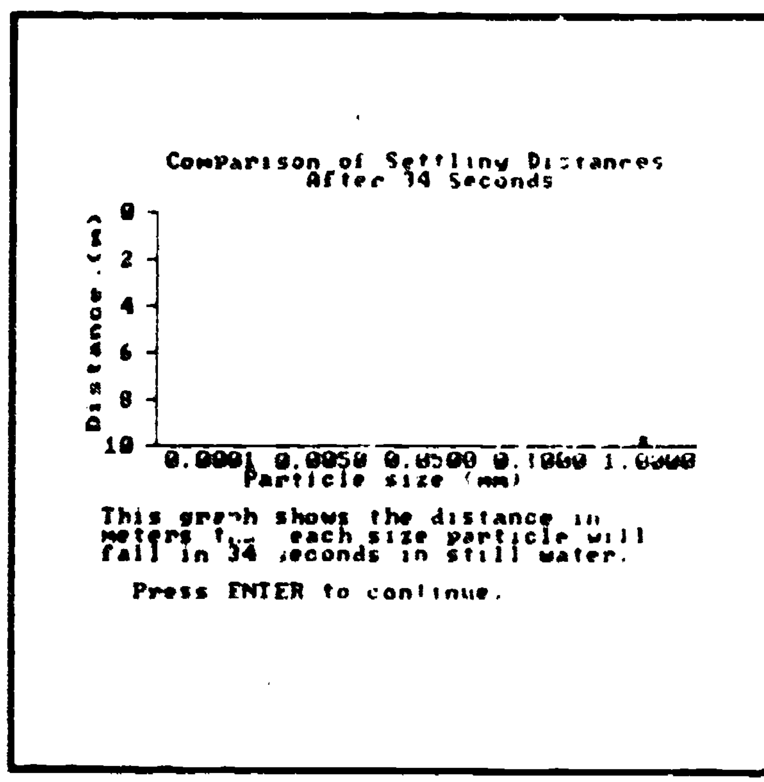

Figure 72. The Sedimentology of Floodplains, by James F. Pizzuto, Nancy J. Balogh, Michael Frank, and Mathew Toschlog. Copyright © 1984 by the University of Delaware.

Honors

The PLATO system became part of the Freshman Honors Program in Dover during the Spring Semester of 1978. With four terminals installed on the Wesley campus, it became a very popular part of the program. Use among the students and staff took several forms. In addition to using PLATO lessons in their classes, some of the students were interested in programming their own lessons. Fifteen honors students became lesson authors. They learned to display drawings, to compose music, and to prepare animations.

Several honors faculty members became PLATO authors and designed lessons to be used by their students. One lesson designed for class use plots a vector field $V = M(x,y)i + N(x,y)j$. Students are asked to supply functions M and N. Any valid expressions in x and y may be used. Figure 73 shows the plot of the corresponding vector field. Another faculty lesson written in a game format teaches polar coordinates. In this game, students must aim the cannon of a tank at a target and fire the proper distance to score a hit. Students aim the tank by guessing the polar coordinates (r,θ) of the target. If the target is hit, points are awarded. The goal is to score 4000 points in twenty shots. Some targets are worth more than others, based on the difficulty of the coordinates and the size of the target. Figure 74 shows the result of hitting a target with coordinates (62,577).

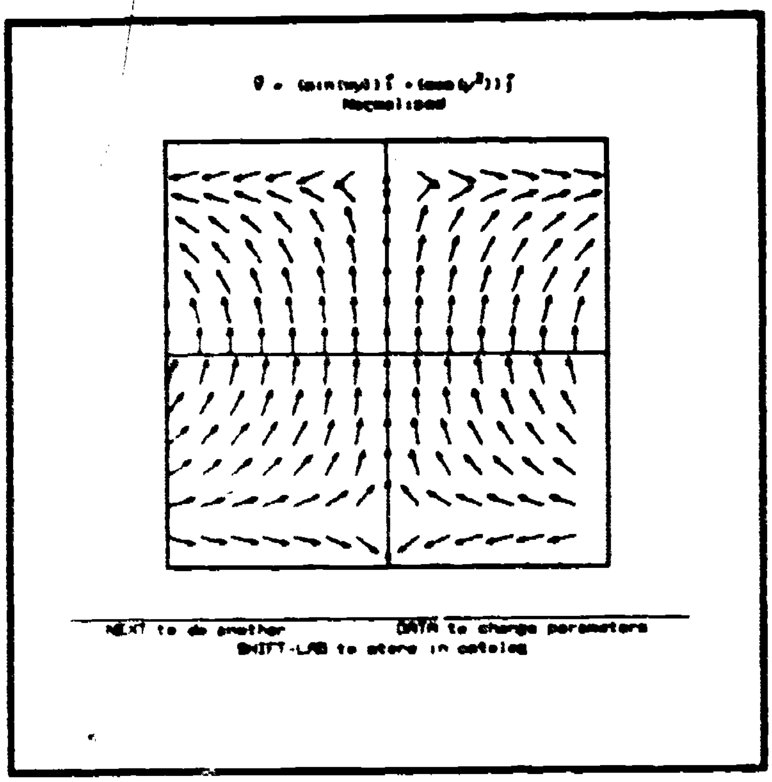

Figure 73. Vector Field Plotter, by Morris W. Brooks. Copyright © 1978 by the University of Delaware.

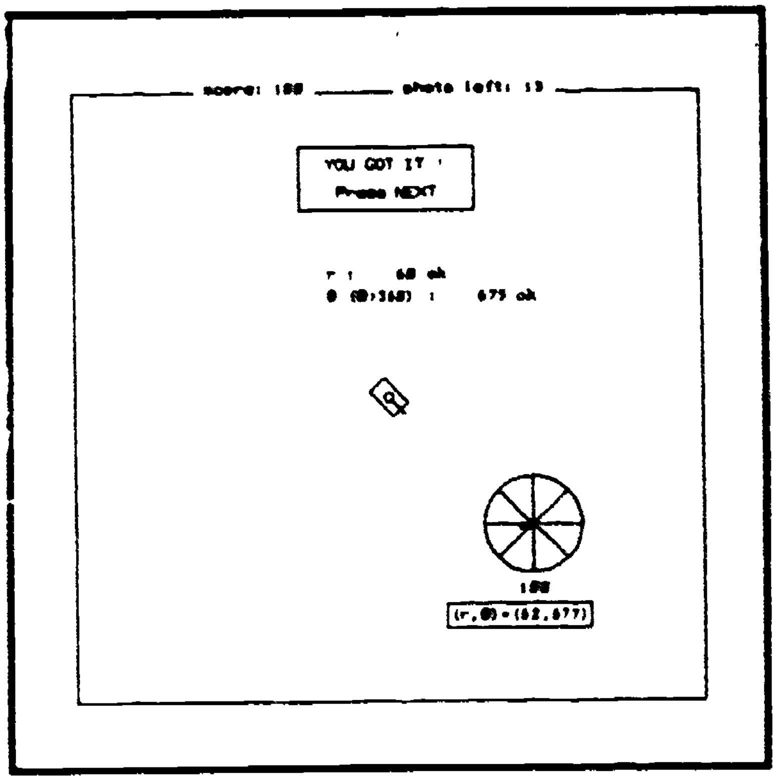

Figure 74. Polar Coordinates, by Alan Stickney. Copyright © 1978 by the University of Delaware.

Figure 75 shows a sample display from a logic lesson. Students enter premises and conclusions in standard logical notation. The lesson then analyzes the logical argument, checks its validity, and responds with a judgment on the validity of the argument. This lesson also reviews basic concepts in symbolic logic.

Figure 76 shows a sample display from the differential equations lesson, which graphically illustrates the Cauchy-Euler method of numerically approximating the solution of an ordinary differential equation. Students are asked to supply a function in two variables f(t,x) and initial conditions. The lesson responds by displaying the graph of the approximating solution. This lesson is useful in studying qualitative properties of differential equations for which it is difficult to obtain analytical solutions.

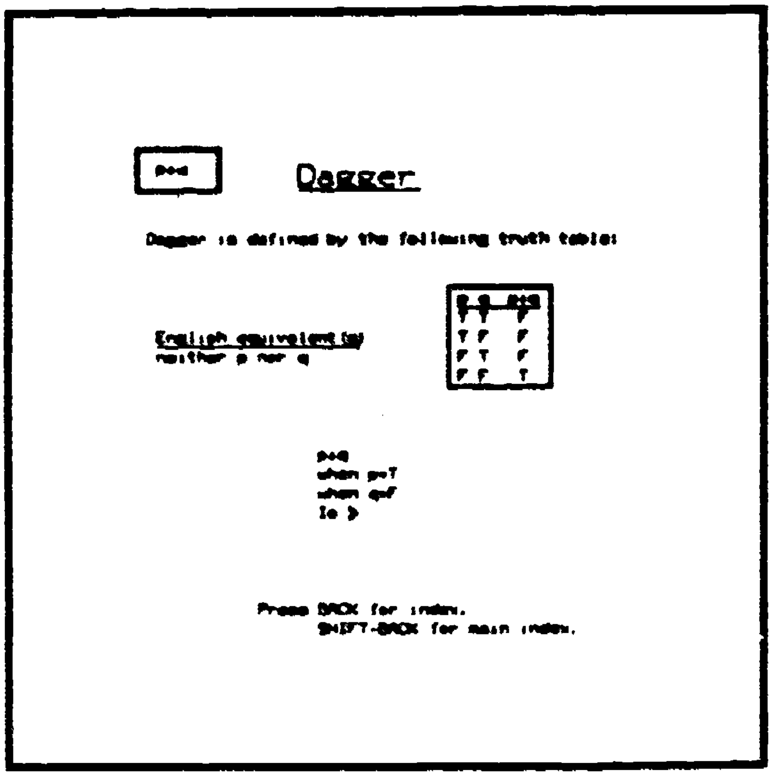

Figure 75. Logic, by Gerard C. Weatherby and Robert Scott. Copyright © 1978 by the University of Delaware.

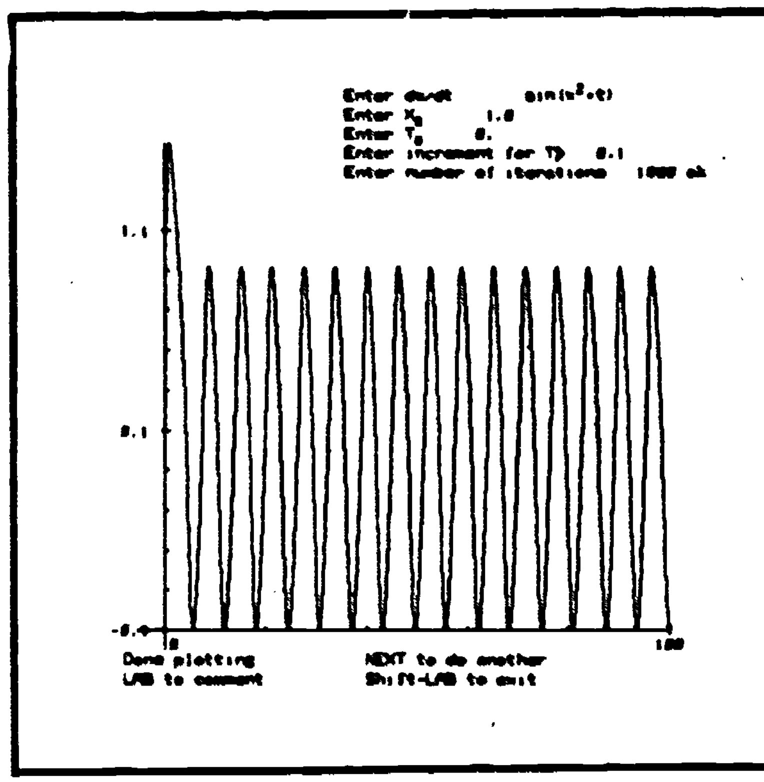

Figure 76. The Cauchy-Euler Method of Approximating Differential Equations, by Tanner Andrews and Stanley Samsky. Copyright © 1979 by the University of Delaware.

During the 1979-80 academic year the Freshman Honors Program was moved to Newark where an Honors Center was set up as part of the University Honors Program. PLATO terminals were installed in the honors library/study area. Students completed assignments for various courses, programmed lessons, and used the PLATO system as a resource for independent or remedial study.

To encourage this independent study, a package of Basic Skills Calculus lessons was written which allows students to practice problems until they feel that a particular type of problem has been mastered. The Basic Skills I lesson, designed for students in a beginning calculus course, provides practice in finding derivatives of the elementary functions. Polynomials, reciprocal powers, exponentials, and trigonometric functions are included. Figure 77 shows a practice session on polynomials. Diagnostic feedback information is provided in anticipation of the most common errors. The Basic Skills II lesson provides drill in elementary anti-derivative problems. These problems are divided into groups of similar kind that deal with concepts like monomials, polynomials, and signed exponents. Figure 78 illustrates a test session on exponentials. Students are given two tries on each question, and they are considered to have mastered a topic if they have attained a score of eighty or higher.

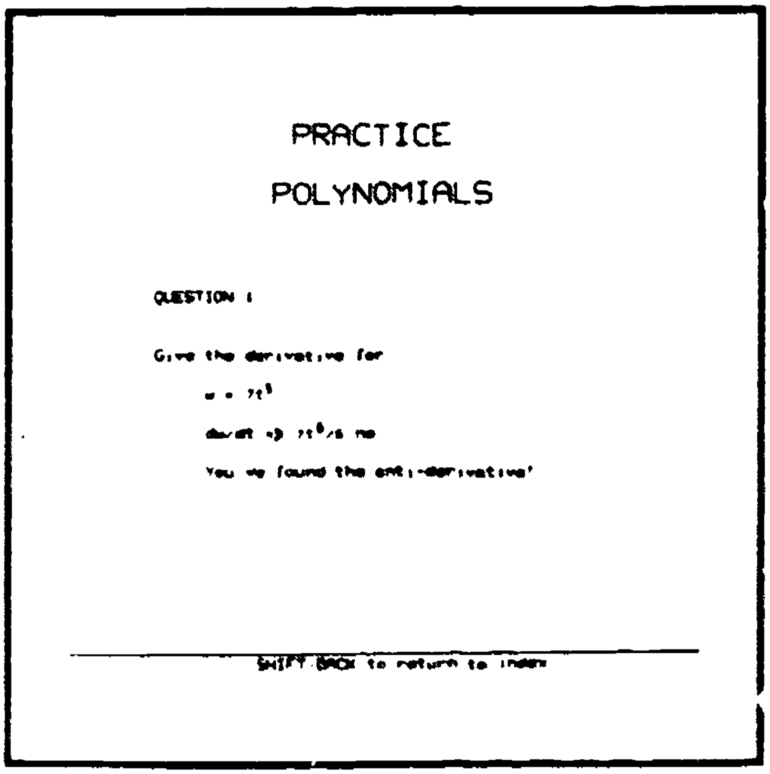

Figure 77. Calculus Basic Skills I, by Morris W. Brooks. Copyright © 1978 by the University of Delaware.

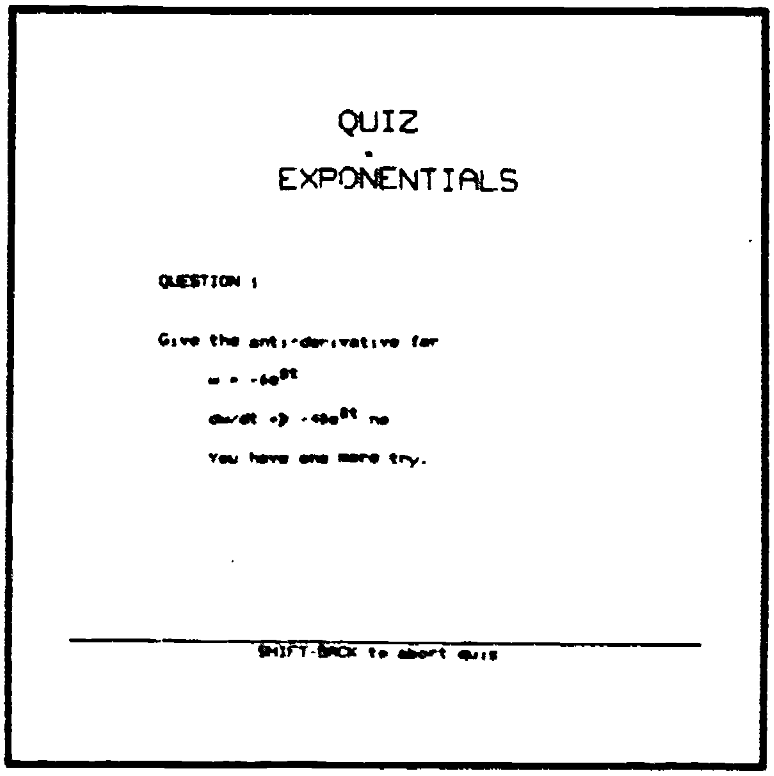

Figure 78. Calculus Basic Skills II, by Morris W. Brooks. Copyright © 1978 by the University of Delaware.

Yet another use of the PLATO system in the honors program is exemplified by a ten-minute film created by a student while working with a professor on a research grant. Entitled "Four Dimensional Rotations," this film uses the PLATO system to illustrate some complex mathematical ideas by showing photographs of shapes and functions rotating on the screen. Figures 79 and 80 show a hypercube and a hypersphere, both of which are rotated in the film.

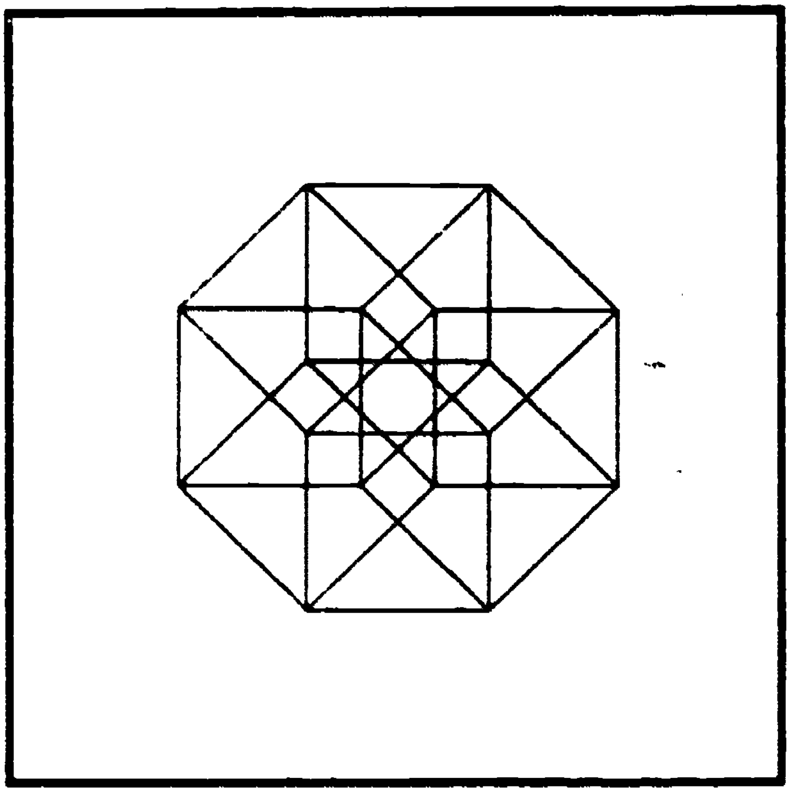

Figure 79. Four Dimensional Rotations, by Paul E. Nelson. Copyright © 1980 by the University of Delaware.

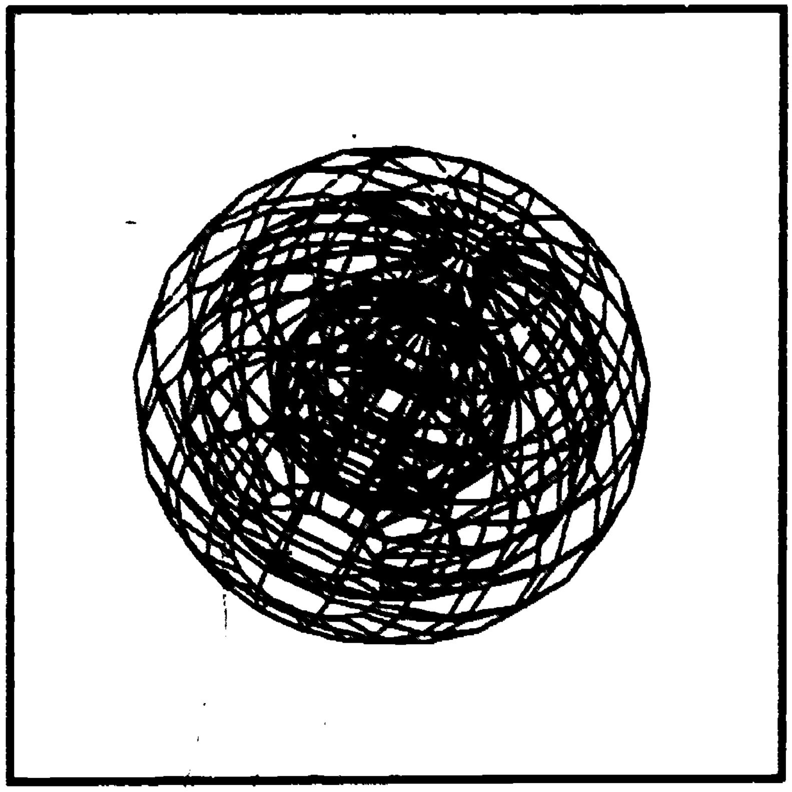

Figure 80. Four Dimensional Function Plotter, by Paul E. Nelson. Copyright © 1980 by the University of Delaware.

Human Resources

The faculty of the College of Human Resources has been extremely active in the field of CBE and is taking advantage of the teaching and research potential of the PLATO system. Activities in each department are discussed in turn as follows.

Food Science and Human Nutrition

In the area of nutrition, lessons are being developed that deal with weight control and nutritional management of diabetes mellitus. The weight control lessons discuss the metabolic basis of weight control and the short-term and long-term implications of hazardous dietary regimens. The nutritional management lessons allow students to calculate the energy needed for a hypothetical patient so that they can plan the patient's diet. The chart in figure 81 shows how students calculate the amounts of various kinds of foods in terms of carbohydrate, protein, fat, and energy content, according to the energy requirements of the patient.

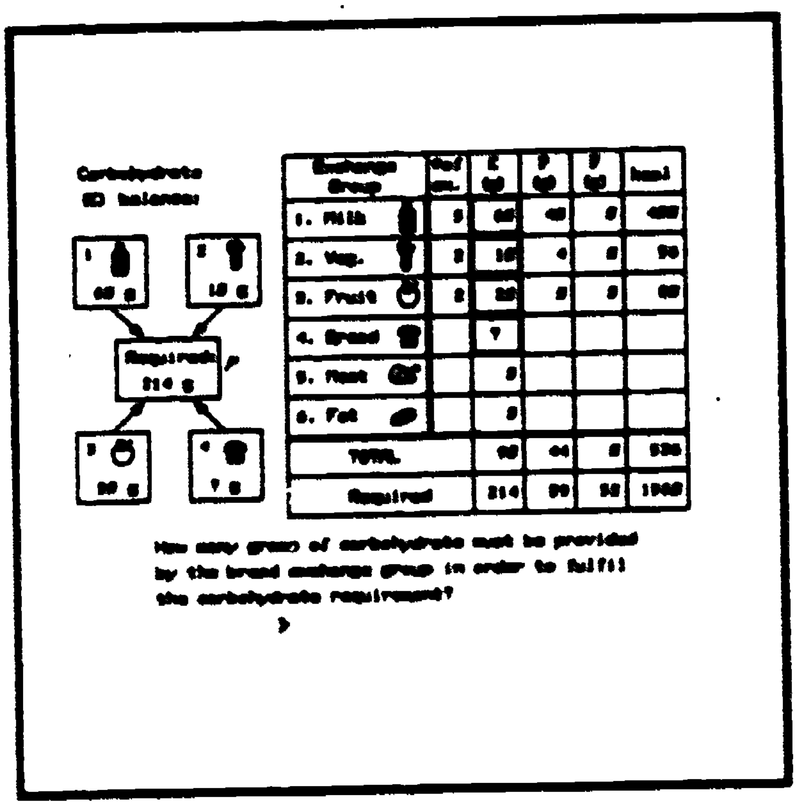

Figure 81. <u>Using Exchange Lists for Meal Planning</u>, by Leta Aljadir, Jeffrey Snyder, and Evelyn V. Stevens. Copyright © 1982, 1983, 1984 by the University of Delaware.

Individual and Family Studies

The Computer-Active Preschool Project (CAPP) is designed to develop a model for the orientation and use of the computer as an interactive instructional tool for preschool children. One of the objectives of this project is to develop approaches to integrate the use of the computer into preschool classroom activities and curriculum. To accomplish this goal, visual aids and related classroom materials were developed to prepare the children for their introduction to the computer.

Using a computer became a popular classroom activity. The children especially enjoyed a program called "Face Maker," which allows them to add features such as smiles and ear wiggles to the outline of a face. Another popular activity was drawing pictures in color on the screen using the Koala Pad Touch Tablet; figures 82 and 83 show drawings that were done this way.

Physically handicapped children found using a computer particularly rewarding in that they were able to achieve computer skills equal to those of their non-handicapped peers.

In the summer of 1983 CAPP held its first four-week computer camp for thirty-six children, aged four through six. The kindergarten classroom was equipped with two PLATO terminals, two Apple IIe computers, an Atari 800, a LOGO turtle robot, computer toys, and commercially available preschool software.

The computer camp attracted international attention, and articles about it appeared in the Chronicle of Higher Education, Infoworld, and the Peking Press.

During the camp, footage for a videotape was taken. This tape, designed to illustrate orientation and teaching techniques with young children on microcomputers, is now commercially available from the University of Delaware's Instructional Resources Center. The title of the videotape is "Young Children and Computers."

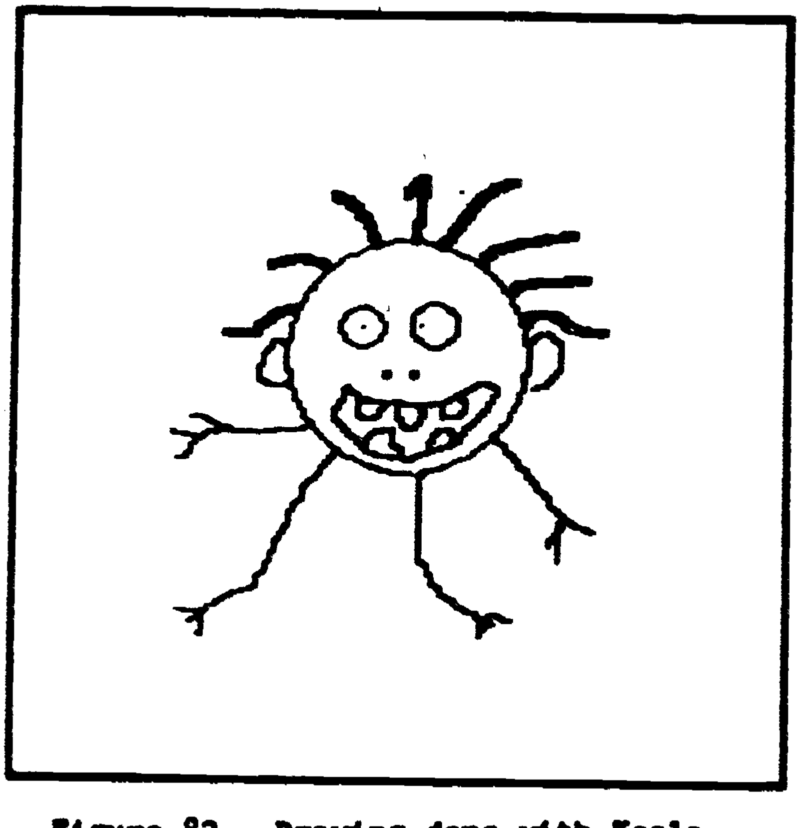

Figure 82. Drawing done with Koala Touch Pad.

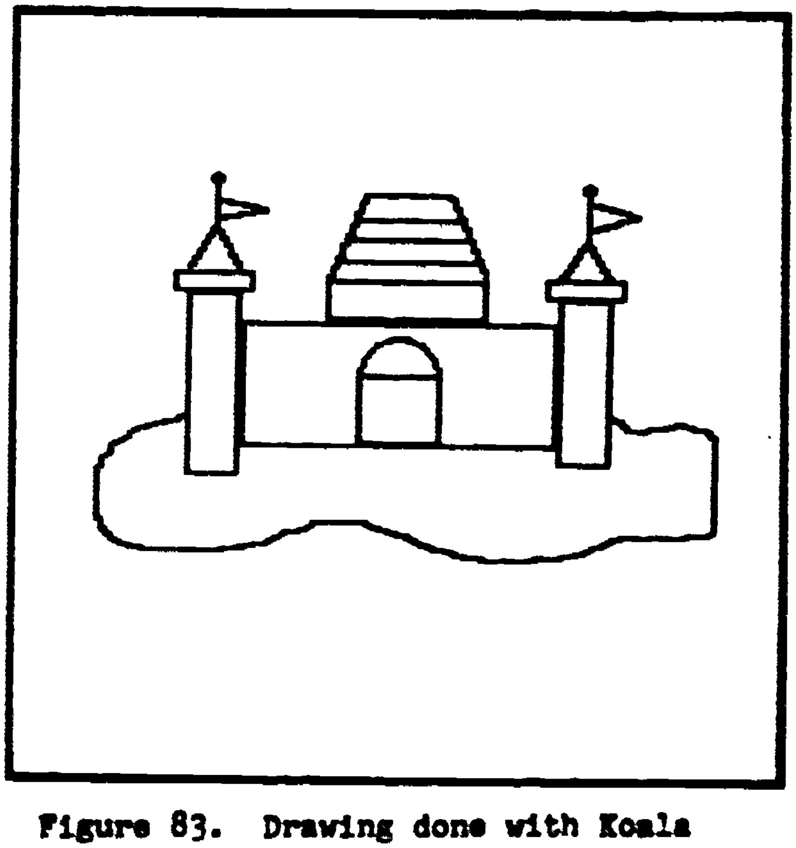

Figure 83. Drawing done with Koala Touch Pad.

On April 5-6, 1984, the College of Human Resources and the Department of Individual and Family Studies sponsored a National Conference on Computers and Young Children. National leaders in the field were featured speakers. Included were Dr. Barbara Bowen, Director of the Apple Education Foundation, and Dr. Barbara Stewart, Executive Director of the Children's Television Workshop.

Textiles, Design and Consumer Economics

A series of lessons on clothing construction that includes metric measurement, body measurement, pattern measurement, ease requirements, alteration practice, fitting, determining pattern size and figure type, and determining needed alterations is being developed and revised.

One of the criteria in lesson development has been to make full use of the special features of the PLATO system. The extensive graphing capabilities of the PLATO system are used in many of the clothing construction lessons, including the lesson on body measurement. The student is presented with a line drawing of a male or female figure with three sets of points, as shown in figure 84. The student is asked to specify the correct set of points for a given measurement. The student may press HELP to clarify the location of any measurement. The student's answer is judged correct or incorrect, and meaningful feedback is given when errors are made.

Consumer in the Marketplace is a series of lessons presenting sixteen basic consumer economics concepts used in analyzing consumer behavior. The first lesson deals with consumption and explores the concepts of scarcity and utility, as shown in figure 85. The student learns to make wise purchasing decisions to maximize satisfaction by using a consumption plan model. Other lessons cover consumer education topics such as information gathering, decision-matrix analysis, the consumer price index, the time-probability concept, sovereignty, opportunity cost, investment in human capital, rational behavior in the marketplace, consumer delivery systems, the optimal consumption stream, and the concept of product liability.

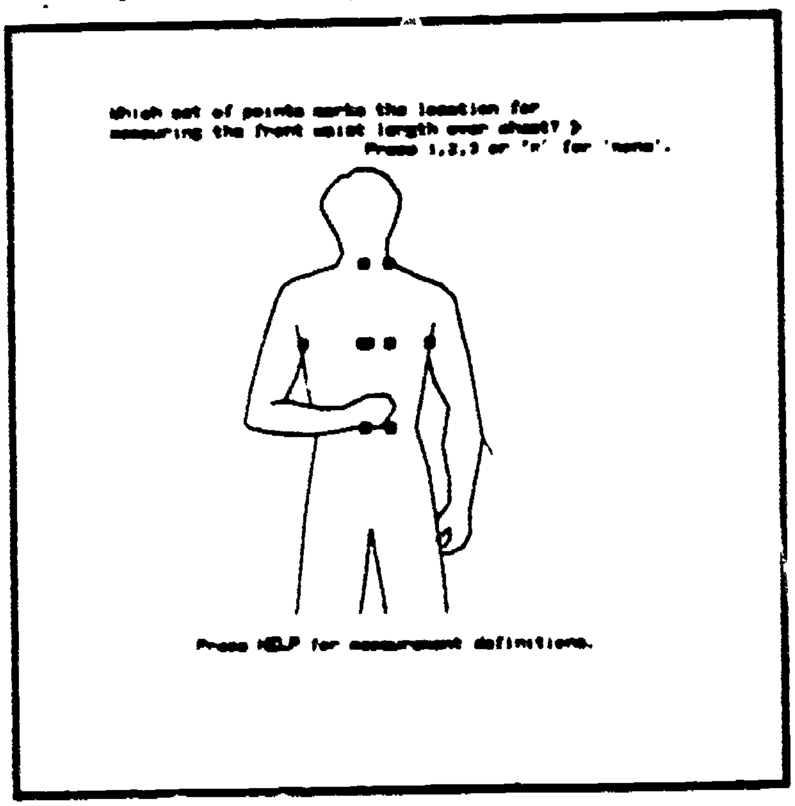

Figure 84. Body Measurement, by David G. Anderer, Kathleen Bergey, Dorothy Elias, Frances W. Mayhew, Bonnie A. Seiler, and Frances Smith. Copyright © 1977, 1978, 1979, 1980 by the University of Delaware.

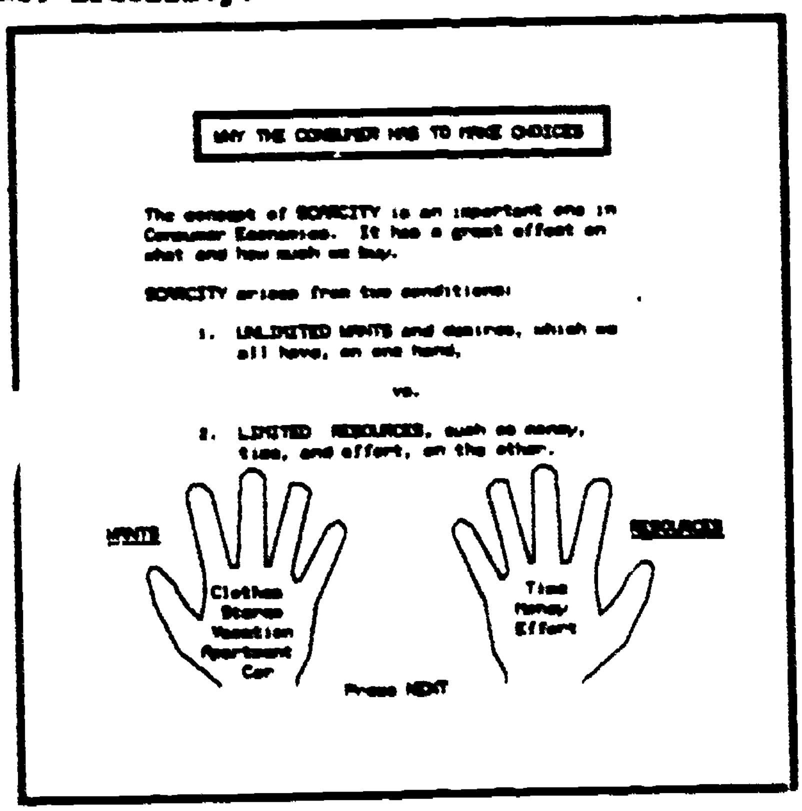

Figure 85. Consumption, by James Morrison, Deborah G. Mellor, and Kathleen Bergey. Copyright © 1980 by the University of Delaware.

Another consumer economics lesson under development is "Consumer Financial Management," a simulation of financial planning in which the student assumes the role of a certified financial planner. The student interviews a client and then assists that client in the development of a personal financial strategy by applying ten personal finance principles. Student progress is recorded in order to evaluate the financial strategy.

"The Consumer Education Resource Network" is a guide to available resources on consumer education for use in the state. New resources are frequently added to the network. Another consumer education lesson has been developed that drills a student on the five steps used in a problem-solving approach. Figure 86 shows how this lesson asks the student to put the steps in order using the touch panel.

Students have also benefited from a series of lessons in Architectural Drawing. Figure 87 shows a display from a lesson called "Sketch Lines." Other lessons deal with architectural lettering and dimensioning. Interior design majors, as well as students from other disciplines, apply the content of these lessons to the drawing of floor plans, elevations, section view, and perspective.

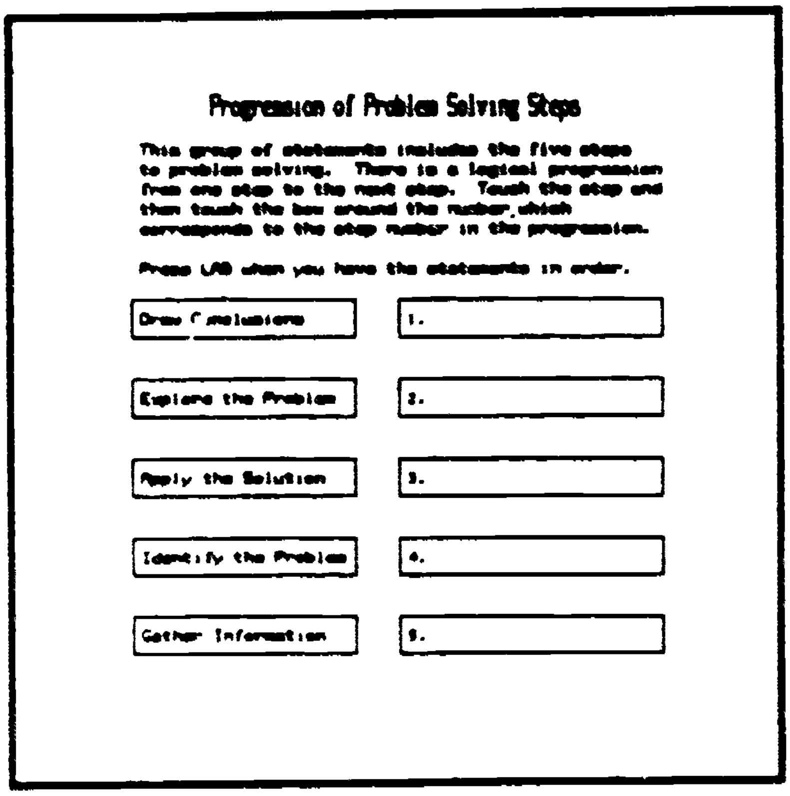

Figure 86. Consumer Economics: Steps to Problem Solving, by Hester Stewart, Nancy McShaw, and Kathleen Bergey. Copyright © 1980, 1981 by the University of Delaware.

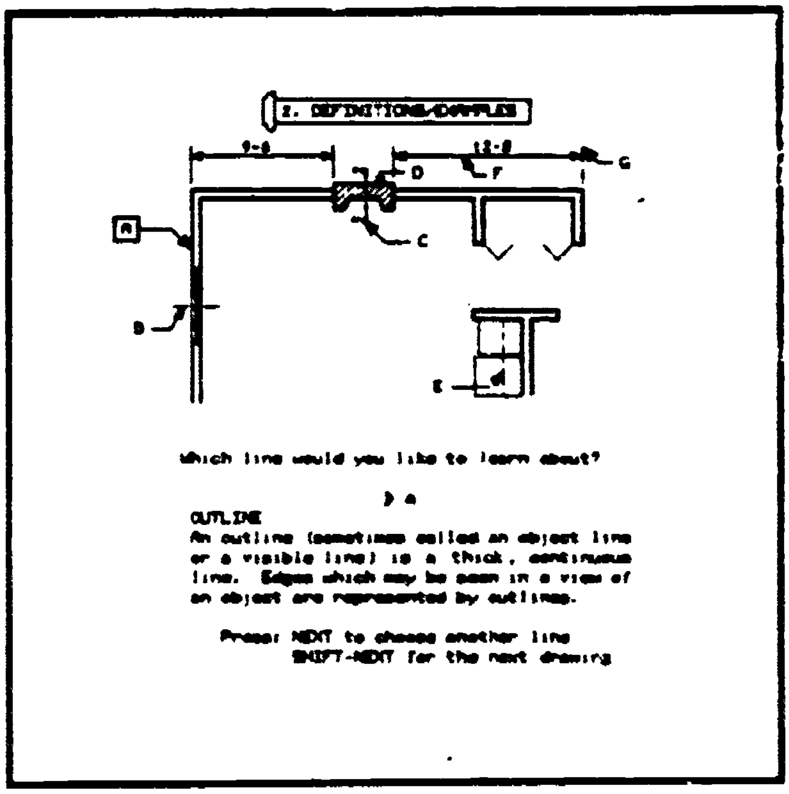

Figure 87. Sketch Lines, by Louisa Frank. Revised by Laurie Gil, Sue C. Garton, and Wayne Boenig. Copyright © 1981, 1982 by the University of Delaware

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Languages

Lessons developed within the Department of Languages and Literature fall into two categories. The first category includes lessons used for all foreign languages and contains two packages, namely, Substitution Drill and Underliner. Each package has its own editor and driver. The second category includes all lessons written for a specific foreign language, namely, Latin, Spanish, or French.

Substitution Drill. The "Editor" in the substitution drill package guides teachers through the steps of creating their own curricula of drills. Without a knowledge of programming or the benefit of a programmer, the teacher can insert drills in almost any alphabetic language. Figure 88 shows a drill written by a teacher of ancient Greek. The lesson has separated the teacher's sentence into a column of words and indicates what the student should do with the sentence. The third word is underlined to show that the student will be asked to substitute a different word. Boxes are put around the words that the student should change grammatically as a result of the substitution. In the completed drill the model sentence is shown, with an underlined word and the word (in brackets) that the student should substitute.

Underliner. The general-purpose editor in the Underliner package allows the instructor to enter a foreign-language passage and its English translation. The program guides instructors through the text, allowing them to underline each word or phrase in turn, to specify its English equivalent, and to append a comment. When the students use the lesson, they may indicate any word by underlining it; the related words of the foreign-language phrase are then highlighted, as is the English translation, and the instructor comment on that word (if any) is displayed. When ready, the students proceed to a quiz on the passage in which words are omitted at random and must be filled in, as shown in figure 89.

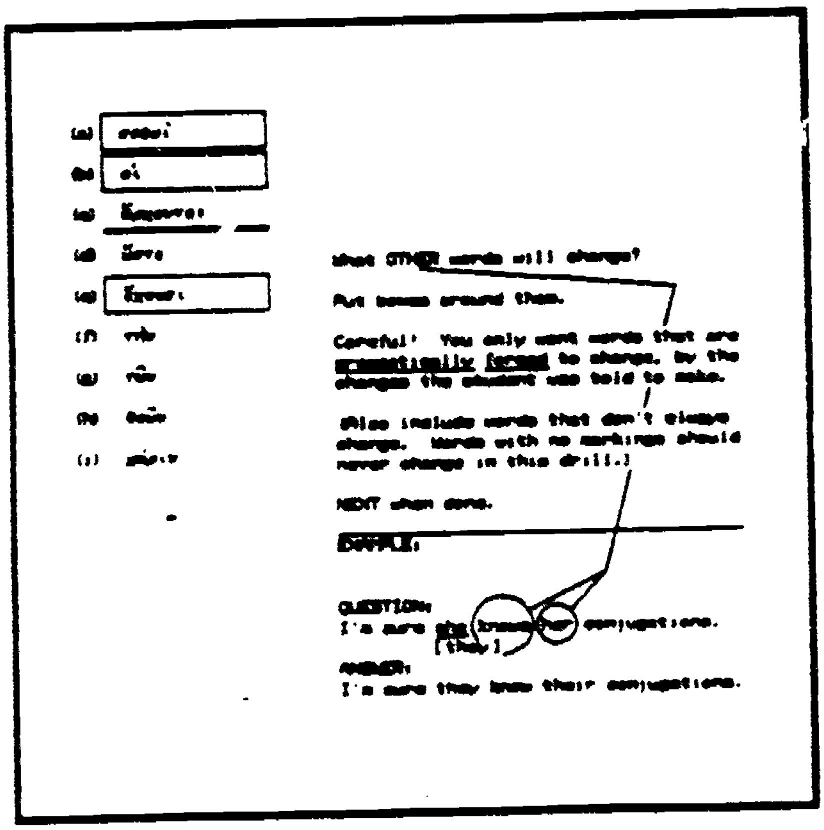

Figure 88. Substitution Drill Editor, by Dan Williams. Copyright © 1977, 1978, and 1979 by the University of Delaware.

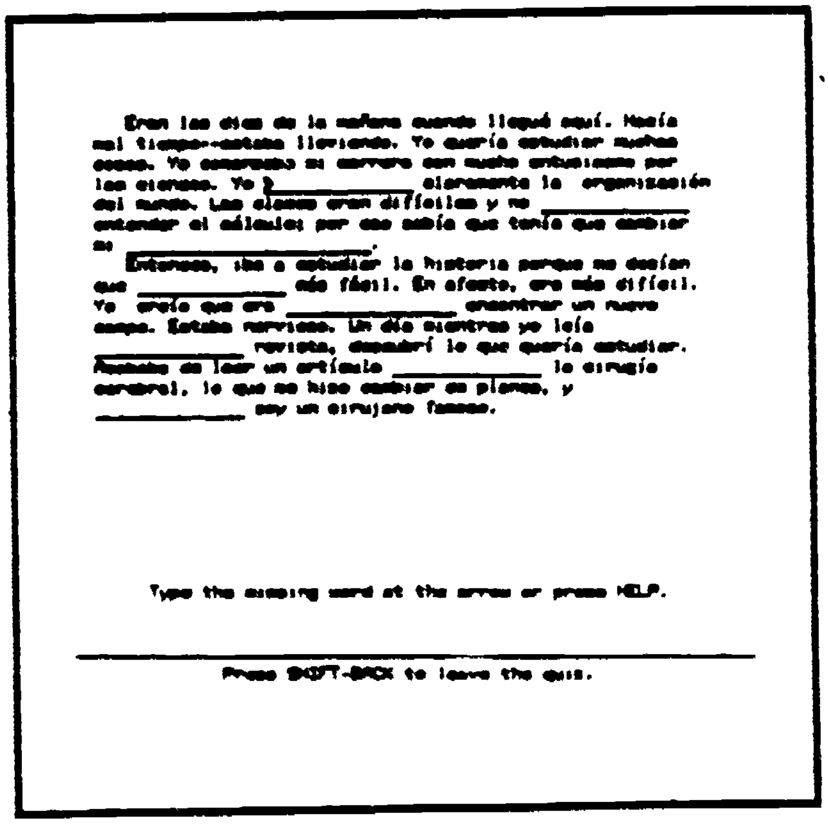

Figure 89. Underliner, by Thomas A. Lathrop, George W. Mulford, and Eileen Ka[illegible] Copyright © 1981, 1982 by the University of Delaware.

Spanish. A thirteen-lesson package has been developed for use with the Spanish text ¡Español! Lengua y cultura de hoy. Each lesson is a drill that deals with up to five areas of grammar. Most lessons end with a quiz. Figure 90, from lesson 5, shows a mouse (el raton) behind a chair (la silla). The student must decide where the mouse is in relation to the chair. In this case, the student has typed the correct response, but has forgotten the accent on "está." The feedback includes help on which key will give the accent.

French. The French language project develops lessons that emphasize three approaches to the study of a language: vocabulary, verbs, and word order. Each approach is discussed in turn as follows.

For the vocabulary approach the French section of the Department of Languages and Literature has restructured its introductory course to emphasize vocabulary acquisition, reducing the previous emphasis on grammar in the first semester. Required exercises on the PLATO system are part of the new materials produced by the department. The lessons rely on the computer's record-keeping ability to tell the students which words they have mastered and which need more work.

To study the vocabulary, students choose one of three methods. The first method is illustrated in figure 91, where the student correctly identified one of the 140 pictures created for this lesson.

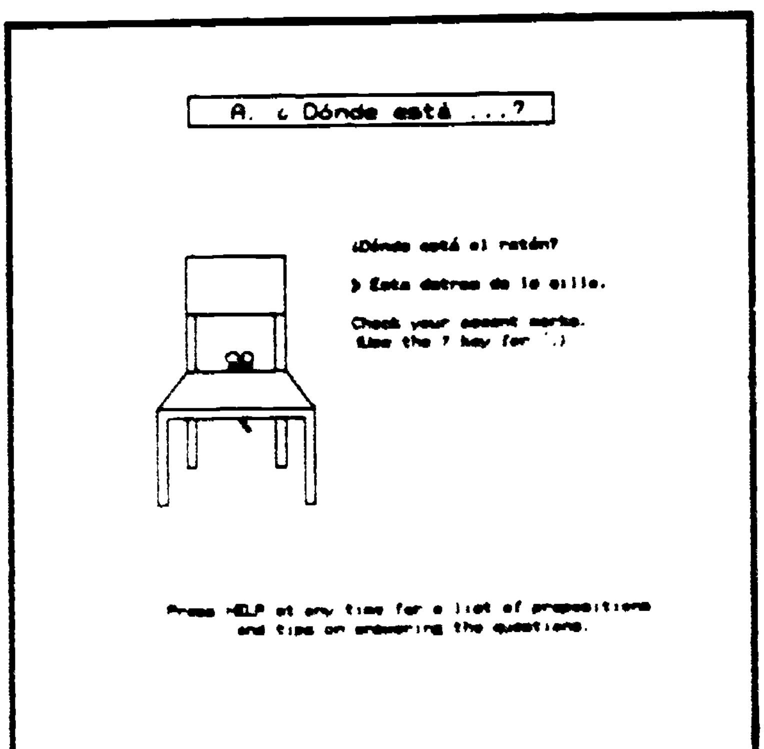

Figure 90 ¡Español! Lengua y cultura de hoy 5, by Thomas A. Lathrop, Eileen Kapp, and George W. Mulford. Copyright © 1981 by the University of Delaware.

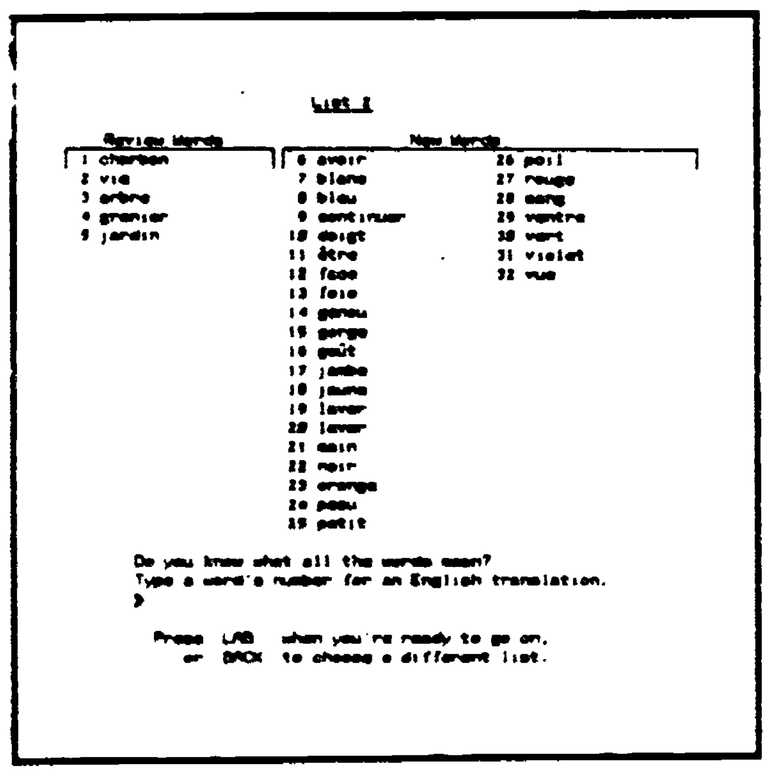

Figure 91. Les quatre cents Mots: 400 French Words, by T.E.D. Braun, Vickie Gardner, George W. Mulford, Charles Collings, and Mark Baum. Copyright © 1982, 1983 by the Univesity of Delaware.

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The second method is based on an earlier PLATO lesson written by Professor John P. McLaughlin of the Department of Psychology. Students are asked to arrange words on the screen by touching them. Because Professor McLaughlin's work confirmed earlier research showing that grouping together words of similar meaning is an effective way to remember them, students in the French lesson are encouraged to arrange the words on the screen so they "make sense." After completing an arrangement, the students must recall the words and type them in. Figure 92 shows the exercise almost complete; the blank lines show where the words not yet remembered belong.

In a third method, a French sentence with a missing word is shown to the student. At the same time, a random-access audio device presents the completed French sentences to the student through a set of headphones. The student must listen to the recording, identify the word and type it correctly.

A "French Verb" lesson now under development drills students in verb conjugation. The instructor enters up to 300 verbs arranged in up to 60 chapters. Each chapter covers a single tense or contrasts two tenses. Students use the instructor's chapters or make up their own.

Students who do not know the answer have access to several kinds of help. Figure 93 shows the choices available. The choice "rules for forming the present subjunctive" leads the student through the rules and then provides an animated display of the construction of any verb the student chooses. This is possible because the lesson has a built-in knowledge base covering all the rules of derivation of both stems and endings. For the animated display, the lesson draws on these rules, detects any point at which the particular verb is an exception to the rule, and explains both the rule and the exception to the student.

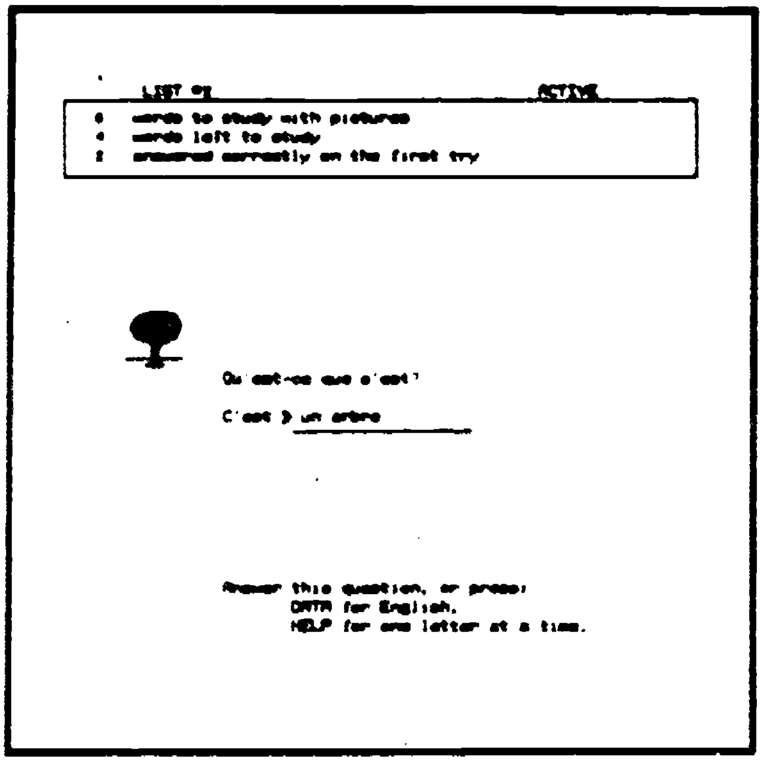

Figure 92. Les quatre cents Mots: 400 French Words, by T.E.D Braun, Vickie Gardner, George W. Mulford, Charles Collings, and Mark Baum. Copyright © 1982, 1983 by the University of Delaware.

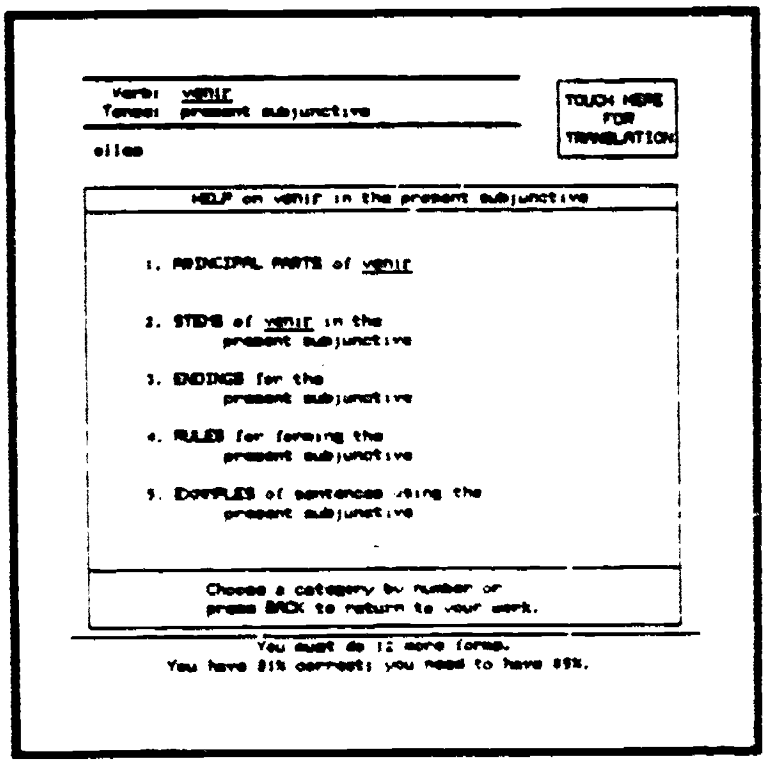

Figure 93. French Verbs, by T.E.D Braun, George W. Mulford, Cheinan Marks, and Kent Jones. Copyright © 1984 by the University of Delaware.

"Touché" is a word-order lesson that uses the touch panel to help students learn word order in a foreign language. Figure 94 shows how "Touché" presents the student with all of the words of the sentence displayed in a scrambled manner in a vertical column. The student is asked to touch the words on the screen in the proper order, building the correct sentence word by word. As the student touches each word, it disappears and then reappears at the top of the screen, as long as the student continues to touch the right order. When the last word has been touched, an English translation appears at the bottom of the screen. If the student makes a mistake by touching a word out of order, the screen goes blank and the whole sentence reappears in a newly scrambled order. Using this simple procedure it has been possible to design exercises covering many of the difficulties encountered in the first two years of instruction in French. To correctly complete the sentences, the students must recognize parts of speech, verb agreements, different types of object structure, and the grammatical function of each noun or pronoun. An explanatory display preceding each exercise points out the rules governing the particular word order problem being drilled; the student can recall that display along with the completed correct sentence and its English translation at any time by touching the HELP box.

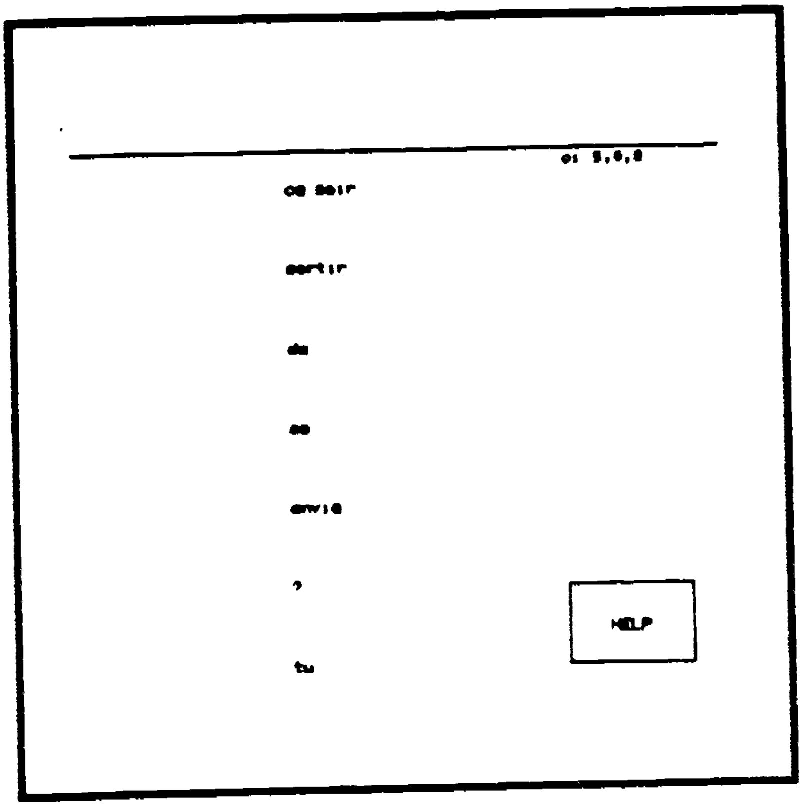

Figure 94. Touché: A French Word Order Touch Lesson, by Geroge W. Mulford and Dan Williams. Copyright © 1978, 1979, 1981 by the University of Delaware.

Latin. A five-lesson Latin curriculum developed for PLATO from 1977 to 1982 has been converted to run on Apple II, Apple IIe, IBM PC with Quadlink board, Franklin, and Bell & Howell microcomputers.

Routines written for the PLATO system enable all five Latin lessons to inflect the variable parts of speech. This technique permits flexibility of responses to student errors because the lessons "understand" the structure of Latin forms. Figure 95 shows a display from "The Verb Factory." The student tried to write the Latin translation of the phrase "you (singular) are well." The typed form "valetis" was judged correct in stem and tense/mood sign, but wrong in its personal ending. Whenever students have severe difficulty in getting the right answers, the lesson takes them through a checklist of grammatical components to help isolate any problems, and the "Verb Factory" manufactures the correct verb form, one part at a time. This diagnostic lesson is paired with a verb-form game, "Cursus Honorum," which builds skill in producing and parsing verb forms. The content and skill level are set by the student, a feature that permits continued use of the lesson throughout the year.

A third lesson, "Mare Nostrum," applies features analogous to those in the verb lessons to noun-adjective phrases, and a fourth lesson, "Translat," handles sentence translation. For any word from the 180 sentences it contains, the student may quiz the computer and learn the dictionary entry, the English meaning, the grammatical form, or the word's function in context. Thus freed from the task of juggling dictionary and grammar books, the student concentrates on the translation process itself.

In figure 96 from the fifth lesson, "Artifex Verborum," the student practices analyzing the words in Latin sentences. After correctly parsing the first six words

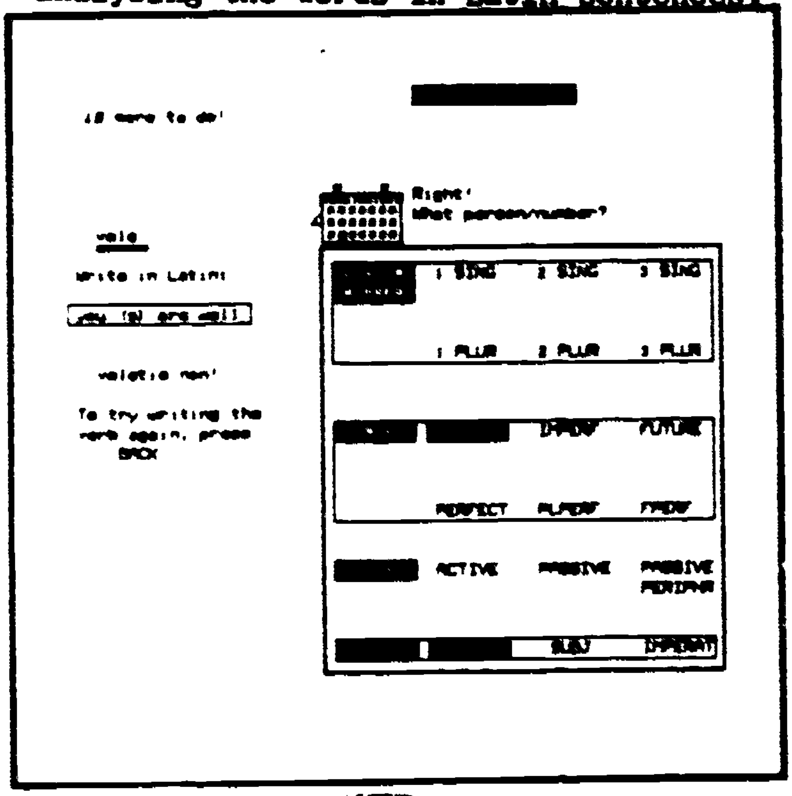

Figure 95. The Verb Factory, by Gerald R. Culley. Copyright © 1978, 1981 by the University of Delaware.

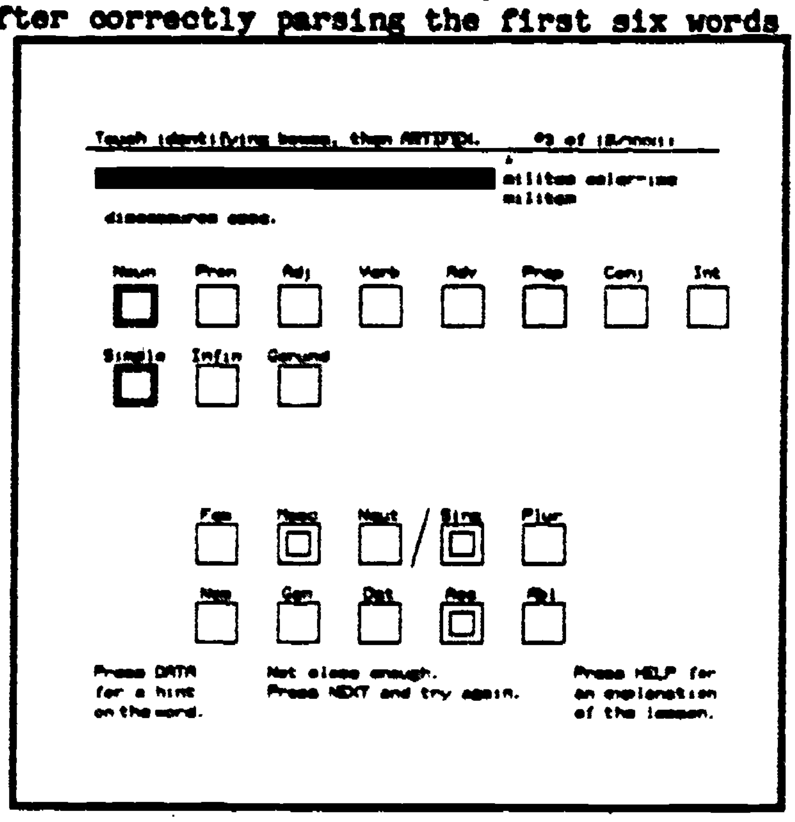

Figure 96. Artifex Verborum: An Exercise in Latin Sentence Analysis, by Gerald R. Culley. Copyright © 1979 by the University of Delaware.

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in this sentence, the student encounters "milites" and identifies it correctly as a simple noun, but then touches boxes to mark it as masculine singular accusative, which is incorrect. The lesson illustrates the error by computing and then displaying the masculine singular accusative of the word below the form that the student is analyzing. All of the lessons in the Latin series can be edited by an instructor without programming knowledge.

Developers found it necessary to program two utilities to aid in the conversion of the PLATO materials to the Apple. The first utility allows the programmer to recreate the original PLATO display within the specifications of the Apple screen as shown in figure 97. The second utility provides the programmer with the capability of translating the TUTOR code into BASIC code, as is demonstrated in figure 98. These utilities have saved approximately one-third of the time needed for lesson conversion.

The Apple version of the five Latin lesons uses a specially designed light-pen to simulate PLATO's touch capability. The light-pen is accurate, quick, and frees the user from complicated keyboard input. Further information about the Latin Skills Package is contained in a press release that can be obtained from OCBI.

Figure 97. Micro Script Converter, by Louisa Frank. Copyright © 1983, 1984 by the University of Delaware.

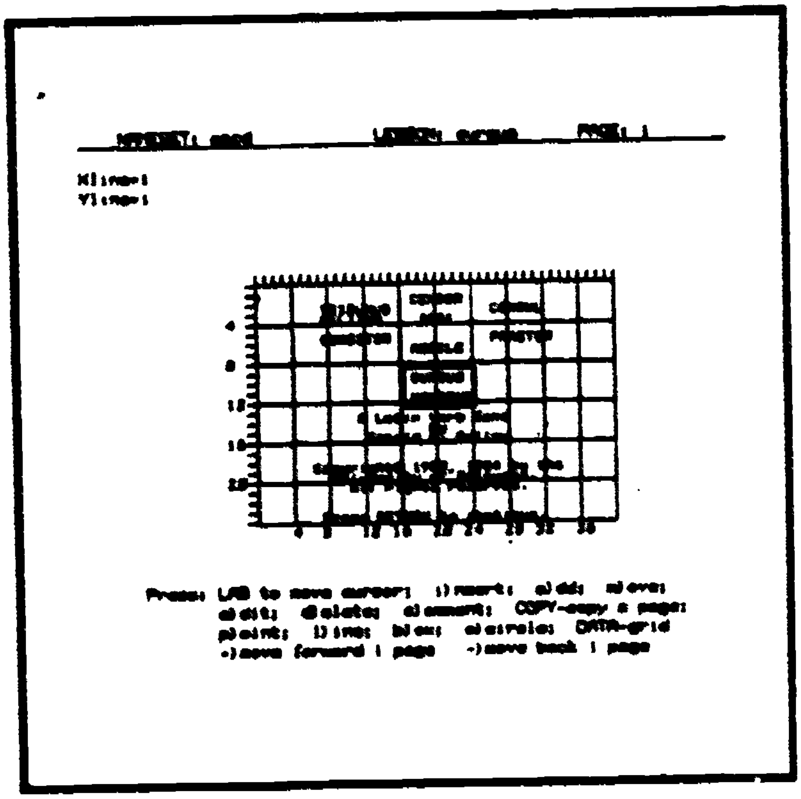

Figure 98. Micro Code Converter, by Graham Oberem and Louisa Frank. Copyright © 1983, 1984 by the University of Delaware.

Library

The library has developed a package of five PLATO lessons that teach basic library research skills to University of Delaware students when they take freshman English. These lessons have replaced lectures that were previously given by reference librarians. The library research package includes five tutorials with built-in drill-and-practice and a forty-question multiple choice test.

The first lesson, "Card Catalog," explains how the card catalog is used to locate books by author, title, or subject. This lesson also discusses the use of the Library of Congress Subject Headings in determining appropriate subject headings to be used in the card catalog. Figure 99 shows how this lesson summarizes the search strategy for locating books in the library.

The second lesson, "Periodical Indexes," discusses periodical articles as a source of information and teaches the use of various periodical indexes to find articles on specific topics. This lesson also introduces the student to the University of Delaware Library's serial records catalog. Figure 100 shows part of an explanation of the contents of a holdings card. The student is shown how to interpret the information on the card in order to locate the periodical in the library.

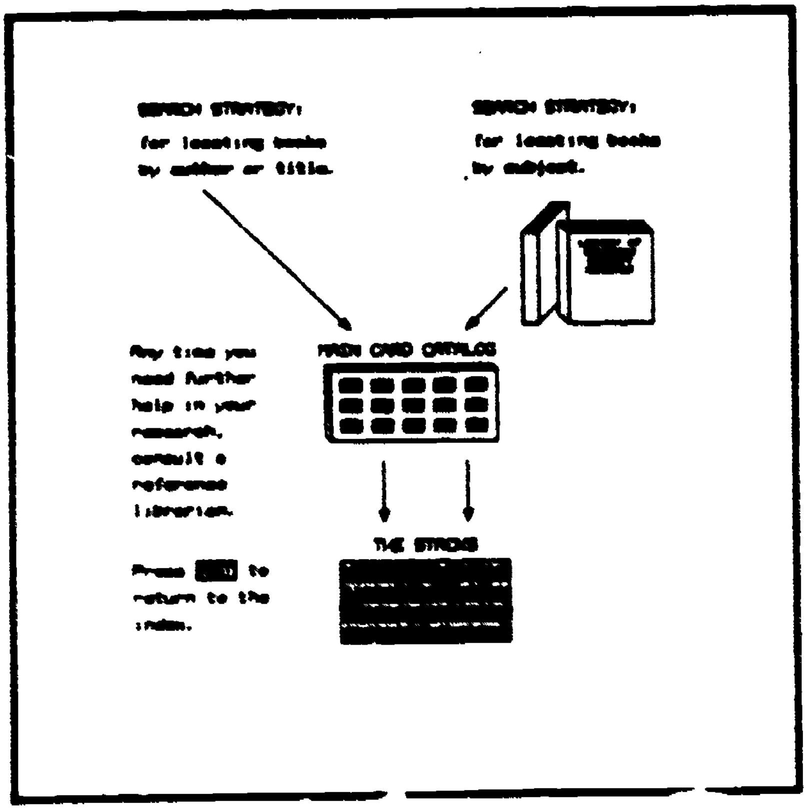

Figure 99. Card Catalog, by Patricia Arnott, Patricia FitzGerald, Lynne Masters, Jeffrey Snyder, Cynthia Parker, and Deborah E. Richards. Copyright © 1981, 1982, 1983 by the University of Delaware.

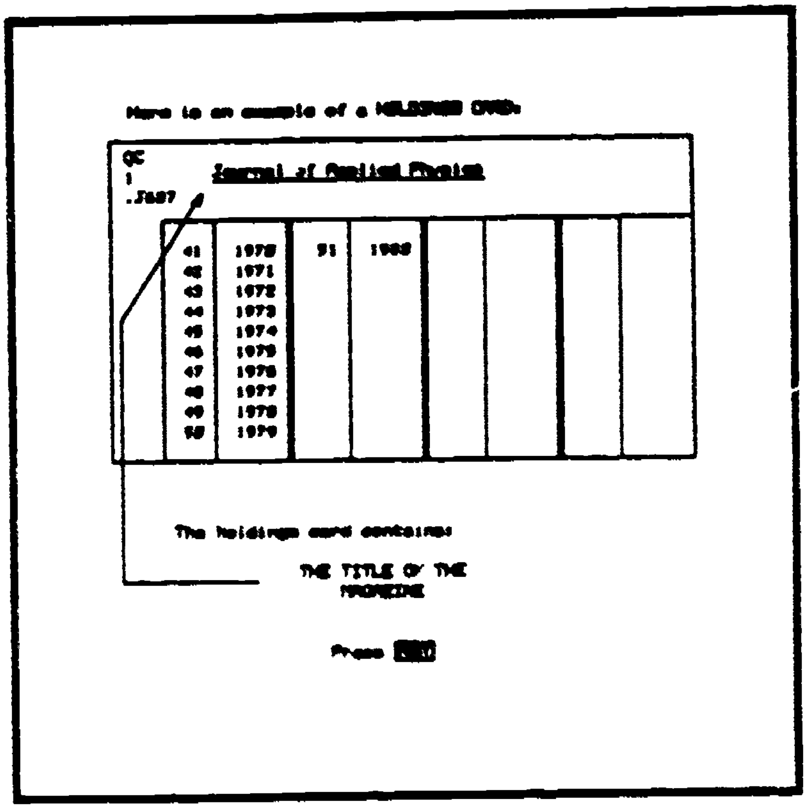

Figure 100. Periodical Indexes, by Patricia Arnott, Patricia FitzGerald, Lynne Masters, Dawn Mosby, Cynthia Parker, and Deborah E. Richards. Copyright © 1981, 1982, 1983 by the University of Delaware.

The third lesson, "Newspaper Indexes," discusses newspapers as a source of information and explains the use of newspaper indexes. An example of a drill on the parts of a citation found in a newspaper index is shown in figure 101. In this example, the student has misinterpreted the abbreviation for the length of the article as part of the date. Appropriate feedback is given, and the student is asked to fix the incorrect response.

The fourth lesson, "Government Documents," discusses the types of information published by the U.S. Government and explains how to locate this information by using government documents indexes. Figure 102 shows an example of a drill on the parts of a citation taken from the Monthly Catalog of United States Government Publications. The student must identify an element by typing the number of the arrow that points to it. If the student makes three incorrect attempts, the arrow of the correct response will flash on and off.

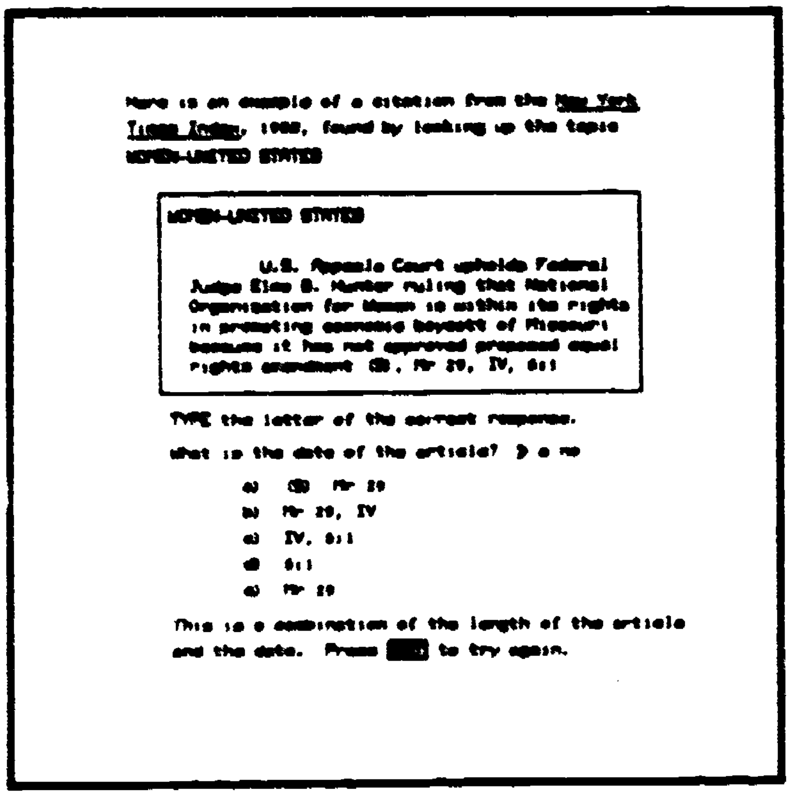

Figure 101. Newspaper Indexes, by Patricia Arnott, Patricia FitzGerald, Lynne Masters, Amy Sundermier, Jeffrey Snyder, and Deborah E. Richards. Copyright © 1981, 1982, 1983 by the University of Delaware.

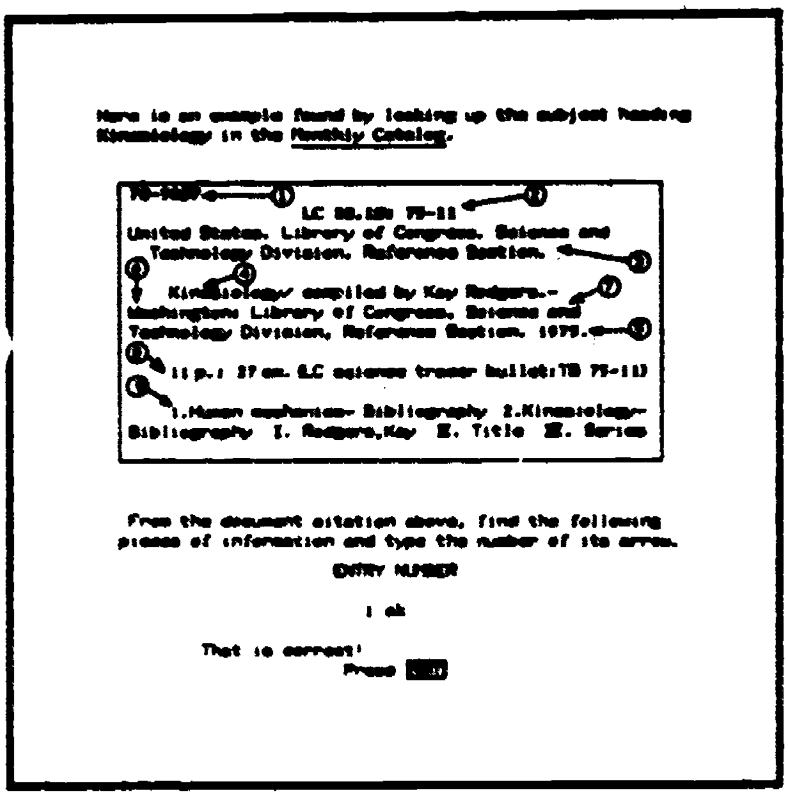

Figure 102. Government Documents, by Patricia Arnott, Patricia FitzGerald, Lynne Masters, Ivo Dominguez, Jr., and Deborah E. Richards. Copyright © 1981, 1982, 1983 by the University of Delaware.

The fifth lesson, "Locating Library References," is specific to the University of Delaware Library. It gives information on the physical location of books, periodicals, newspapers, and government documents. Each section of the lesson guides the student through a step-by-step process for locating these materials in the library. The final step in finding books in the library is illustrated in figure 103.

The forty-question multiple choice test includes information from all five tutorials. The student answers the questions by touching or typing the letter of the correct response.

The library is converting four of the library skills lessons to run on the IBM Personal Computer, namely, "Periodical Indexes," "Newspaper Indexes," "Government Documents," and "Card Catalog." The format of the lessons will remain basically the same; however, elements specific to the University of Delaware Library are being removed so that the lessons will be generally applicable to college and university libraries.

Another package of four PLATO lessons, designed to teach upperclassmen to use the citation indexes, is under development. The first lesson in the package, "Using the Citation Indexes," explains the concept of citation indexing and some of the features common to all citation indexes. The remaining lessons in the package will explain the use of the Social Sciences, the Arts and Humanities, and the Science Citation Indexes.

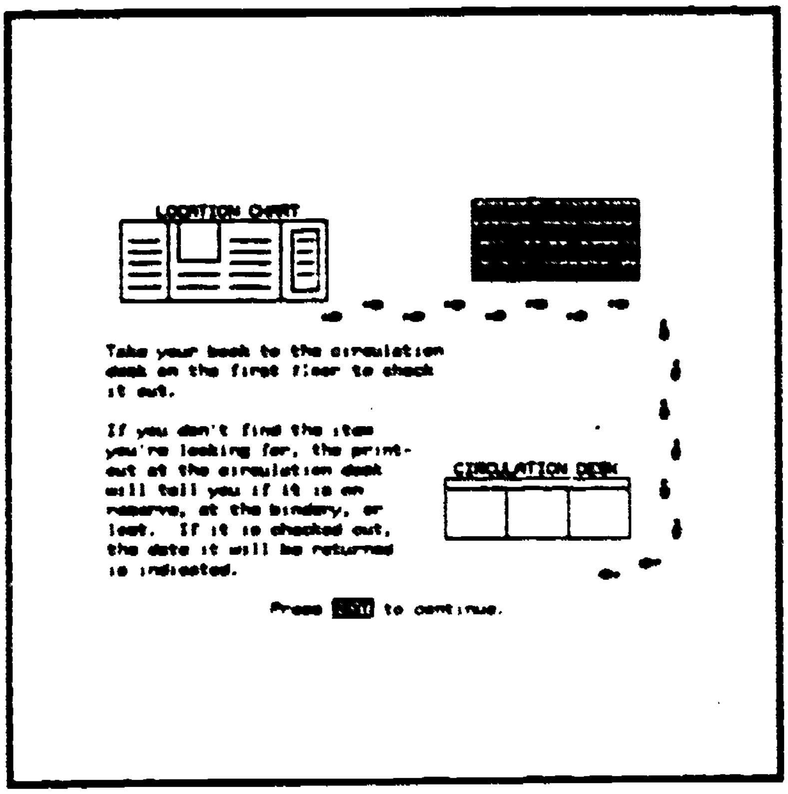

Figure 103. Locating Library References, by Patricia Arnott, Patricia FitzGerald, Lynne Masters, Mark Baum, and Cynthia Parker. Copyright © 1981, 1982 by the University of Delaware.

Mathematics

Beginning in the academic year 1977-78 with modest student use of lessons developed at the University of Illinois, the mathematics project has grown steadily in numbers of students served, faculty involved, and scope of developmental effort. This growth reflects the University's desire to enhance student performance in mathematics courses. A critical milestone for the project was the formation of the Mathematical Sciences Teaching and Learning Center in the spring of 1981. The purpose of the Math Center is threefold:

1. Improvement of student success in lower division mathematics courses
2. Involvement of pre-service and in-service teachers and mathematics educators throughout the state in improving the quality of mathematics instruction
3. Stimulation of research into relevant facets of mathematics teaching and learning

The Math Center uses a variety of materials and strategies, but it is particularly oriented toward computer-based approaches. It houses a CBI classroom with fourteen PLATO terminals that play a major role in the delivery of instruction and in the conduct of research. The Center is also keenly interested in evaluating and developing microcomputer-based mathematics courseware. Microcomputers are located in the Center for this purpose.

A versatile drill package called the "Mathematics Interactive Problem Package" (MIPP) presents a variety of problems to students enrolled in lower-division mathematics courses. Over one thousand problems are available through MIPP in the following two modes:

1. Mixed List Mode. Students may choose sections from the course text and work through randomly selected problems related to those sections. Solution steps are immediately available in this mode.
2. Test Mode. Students may take a complete test under timed test conditions. Solution steps are available upon test completion.

In figure 104, a student has chosen the problem to find cos(-pi). The indicated response choice "d" has been marked incorrect. The student may touch the screen or press the DATA key to see the solution to the problem in steps, as is shown in figure 105. The student may go through all of the steps of the solution, the last of which gives the correct answer, or may return to the main problem display at any time during the presentation of the solution steps in order to select a new response.

An experiment that compared students in Math 115 workshops using the PLATO system to those receiving only traditional instruction showed that although the mathematics background of the students in the sections using the problem package was weaker than that of those in the other sections, more students from the sections using the problem driver passed the course. There were significantly fewer failures in these sections. While the course drop rate was higher, use of the problems on the PLATO system appears to have helped some students determine that their background was inadequate for the course. In addition, student attitudes toward the use of the PLATO system are extremely positive.

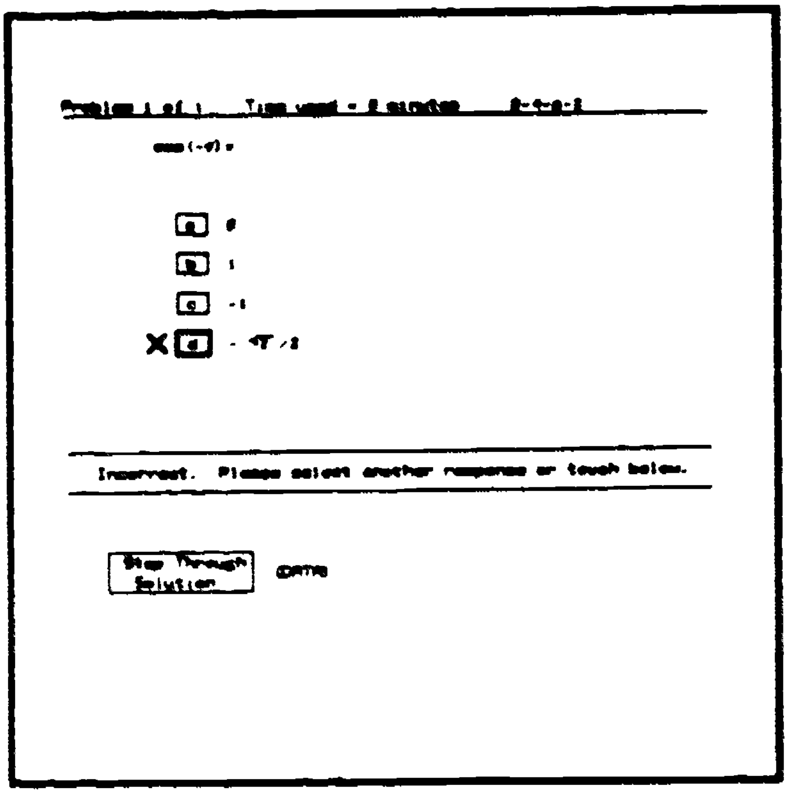

Figure 104. Mathematics Interactive Problem Package, by Ronald H. Wenger, Morris W. Brooks, Keith Slaughter, and Richard Payne. Copyright © 1978, 1979, 1980, 1981, 1982 by the University of Delaware.

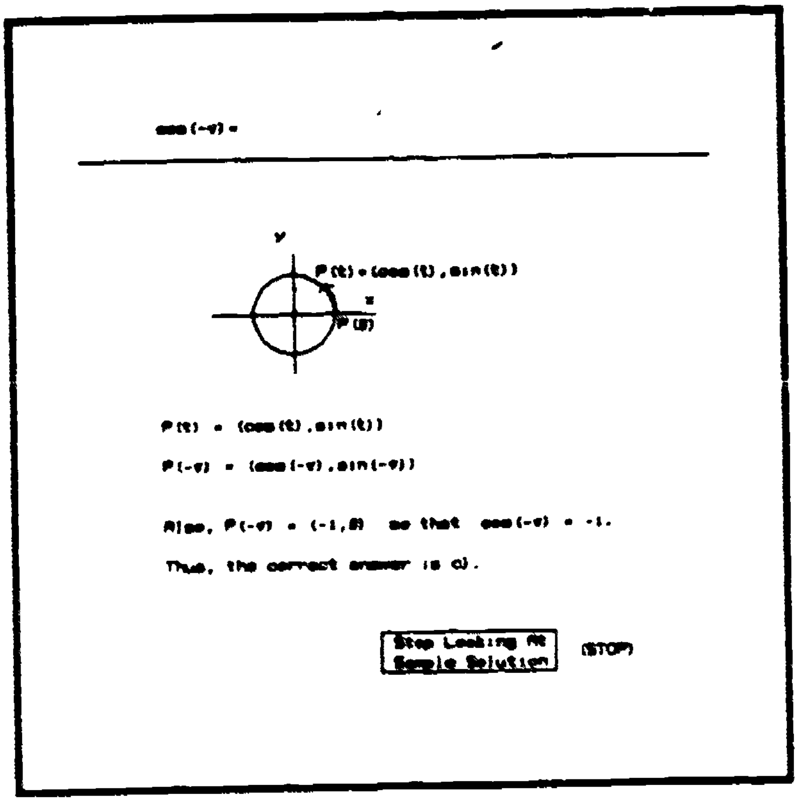

Figure 105. Mathematics Interactive Problem Package, by Ronald H. Wenger, Morris W. Brooks, Keith Slaughter, and Richard Payne. Copyright © 1978, 1979, 1980, 1981, 1982 by the University of Delaware.

Figure 106 illustrates a problem in which students are asked to find the negative of an algebraic expression that contains parentheses. Research has shown that responses to this type of problem often reveal faulty understanding of the rules of algebra. The student has erred by changing all of the signs in the problem. Figure 107 shows how the PLATO system recognizes this error pattern and gives the student an appropriate diagnostic message. Thirteen modules of PLATO Learning Management are also used to support the intermediate algebra course (Math 010). Designed to help students proceed through the course at their own pace, these modules provide diagnostic testing and study prescription.

In 1983, development began on a series of tools for mathematics problem solving. The series includes utilities for plotting mathematical functions, solving systems of linear equations, finding the best-fitting curve to a set of data points, and solving linear programming problems. The tools are being programmed for the IBM PC using the C programming language. They use powerful numerical algorithms but are designed to be easily used by students with little previous computing experience.

The Math Center has received two grants from the National Science Foundation. One has allowed the Center to conduct a Leadership Training Program on the Uses of Microcomputers in the Mathematics and Science Curriculum. Twenty-four teachers from the State of Delaware with previous experience using computers in the classroom were appointed Fellows in the Math Center and attended a series of nine monthly workshops and a summer institute on the University campus. These workshops were conducted by University faculty from the Departments of Mathematical Sciences, Chemistry, and Physics. The goal of the program was to prepare the teachers for conducting in-service training sessions for other teachers in their respective counties and local districts on the uses of computers in mathematics and science education.

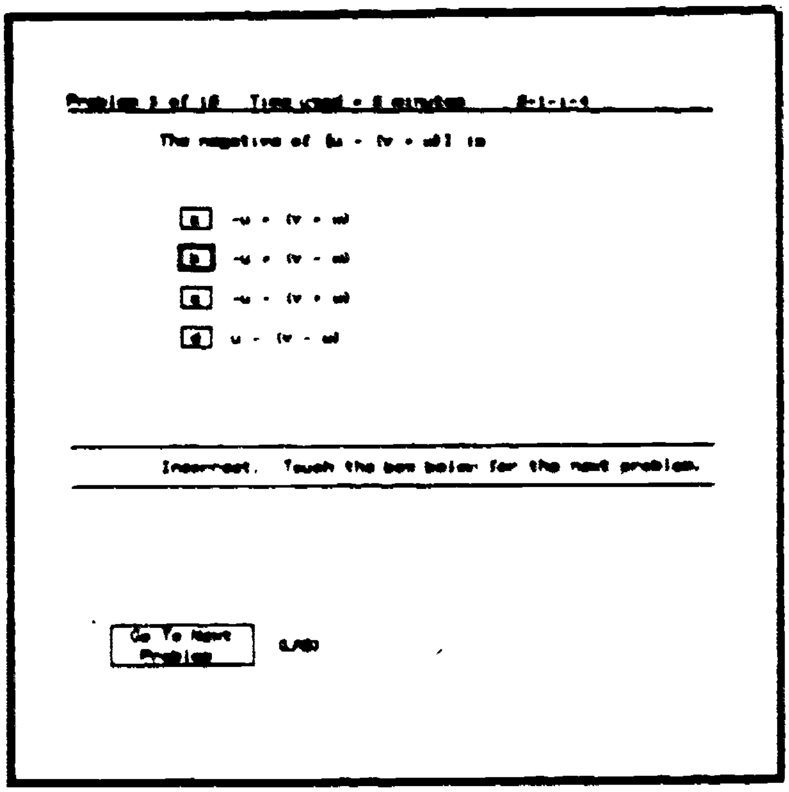

Figure 106. Module I - Diagnostic Test I, by Ronald H. Wenger, Morris W. Brooks, and Richard Payne. Copyright © 1982 by the University of Delaware.

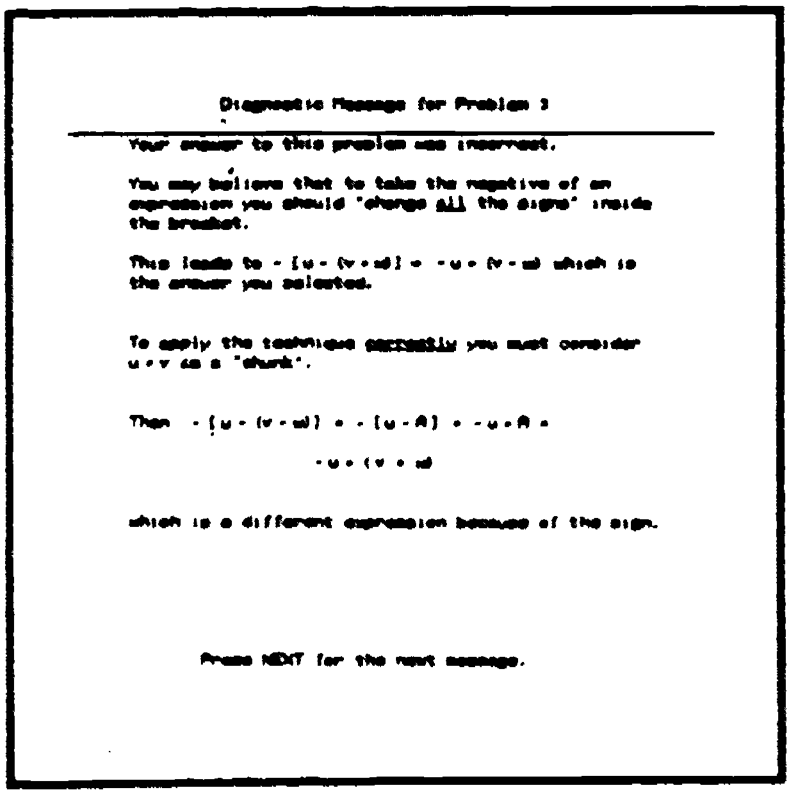

Figure 107. Module I - Diagnostic Test I by Ronald H. Wenger, Morris W. Brooks, and Richard Payne. Copyright © 1982 by the University of Delaware.

The second grant, under the Comprehensive Assistance to Undergraduate Science Education (CAUSE) Program, is a three-year $249,000 award that supports the Math Center's efforts to improve mathematics instruction at the University. The main components of the CAUSE project are as follows:

1. Development of a computer-based diagnostic test to provide a detailed profile of a student's conceptual and algorithmic strengths and weaknesses

2. Revision and extension of the MIPP program to incorporate features of intelligent CAI systems, especially the formation of a student model that will be used to provide individualized tutorial instruction

3. Development of a package of CBI lessons using mathematical models in economics and social science with the goal of improving student attitudes toward mathematics and of motivating students to study mathematic

4. Development of University courses dealing with the role of computers in mathematics education for pre-service teachers of mathematics

5. Expansion of the microcomputer facility in the Math Center

In addition to the grants received by the Math Center, two other mathematics development grants have been awarded. Dr. John Bergman received an Improvement of Instruction Grant for the summer of 1981 to develop computer-based learning materials for the special section of Calculus B, Math 242, which is taught for incoming freshman who have already taken a calculus course in high school. Among these materials is a PLATO lesson designed to help students understand the concept of the center of mass of a plane region and the application of the definite integral to computing centers of mass. In figure 108, the student is being shown how the

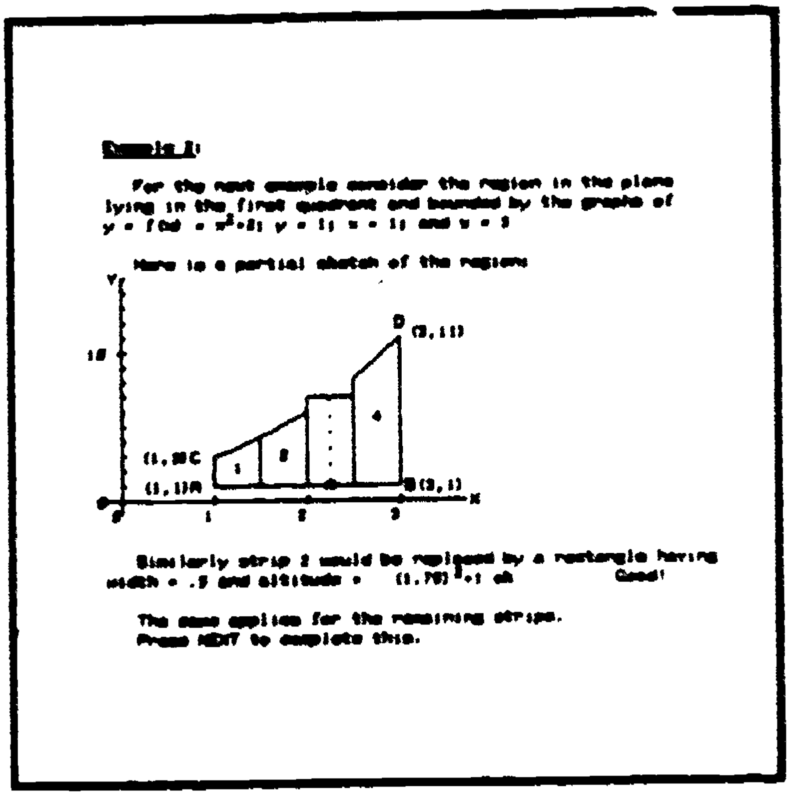

Figure 108. Centers of Mass, by John Bergman and Mark Rogers. Copyright © 1981, 1982 by the University of Delaware.

center of mass of a region with a curved boundary may be approximated by the union of four rectangular regions for which the center of mass is easily calculated.

Dr. Clifford W. Sloyer received a Development in Science Education (DISE) grant from the National Science Foundation for a math enrichment project. The purpose of this project is to develop a series of five modules dealing with practical applications of mathematics for motivated high school students. These modules are being prepared both in printed form and as CBI lessons that make use of the computational, graphical and interactive capabilities of the PLATO system. The topics of the five modules are (1) dynamic programming, (2) mathematics in medicine, (3) queues, (4) graph theory, and (5) glyphs. Some dynamic programming lessons are already being tested with students.

Figure 109 shows a situation in which a student is naming and determining the length of a path. As the student investigates each path, it is highlighted. Figure 110 shows a picture of Saturn which utilizes eleven grey levels. Before solving the problem to reduce the eleven levels to the optimal three using dynamic programming, the student guesses which levels result in the best detail and is shown the photo in the chosen shades.

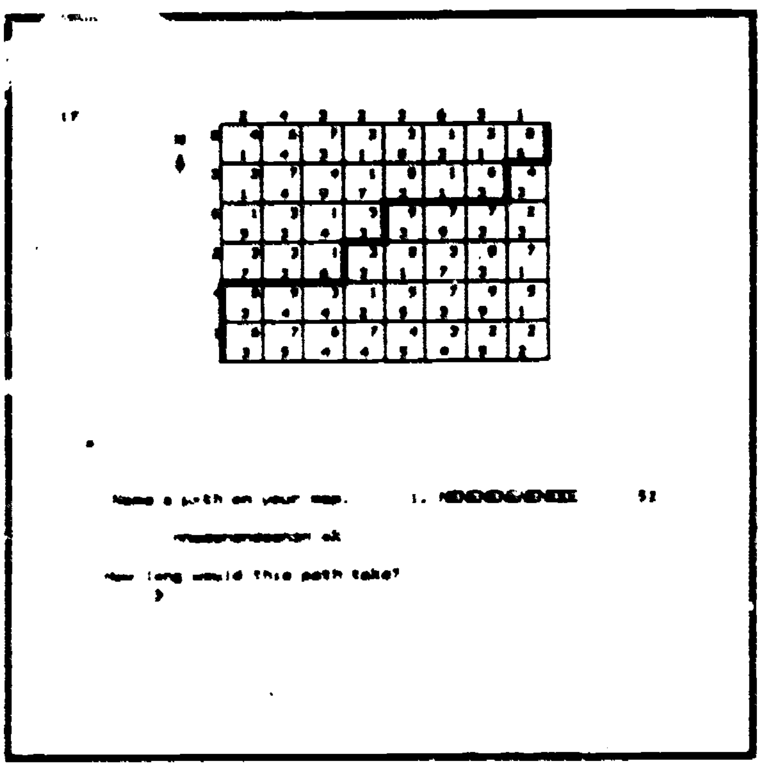

Figure 109. Dynamic Progamming, by Clifford Sloyer and Tri-Analytics, Inc. Copyright © 1982 by the University of Delaware.

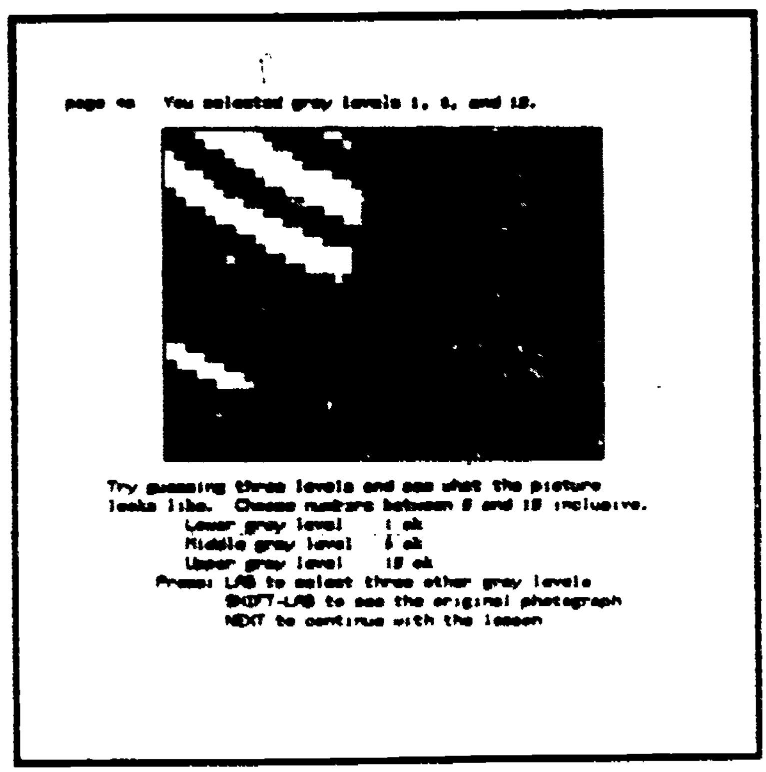

Figure 110. Optimal Coding of Digitized Photographs, by Clifford Sloyer and Tri-Analytics, Inc. Copyright © 1982 by the University of Delaware.

The five mathematics enrichment lessons developed under the National Science Foundation grant as PLATO courseware are being converted to run on the Apple II+ and Apple IIe microcomputers. The Dynamic Programming lesson will form four disks, the Graph Theory lesson will form three disks and each of the other lessons will form two disks. These microcomputer implementations retain the content and format of the original lessons wherever possible. Figures 111 and 112 show the Apple versions of the same screens as figures 109 and 110 from the PLATO lessons.

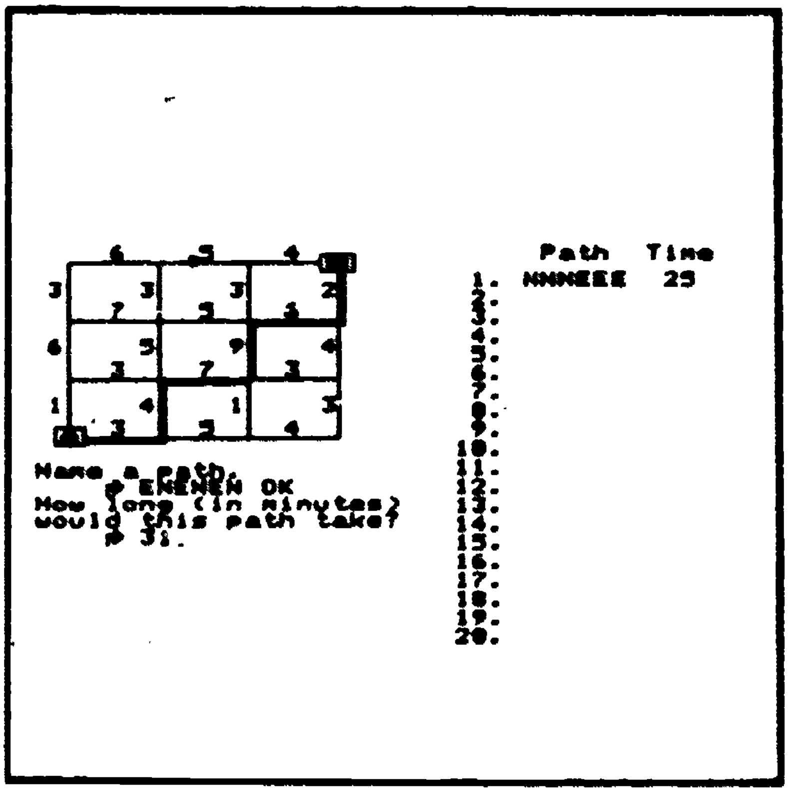

Figure 111. Dynamic Programming I: The Shortest Path Program, by Clifford Sloyer. Copyright © 1983, 1984 by the University of Delaware.

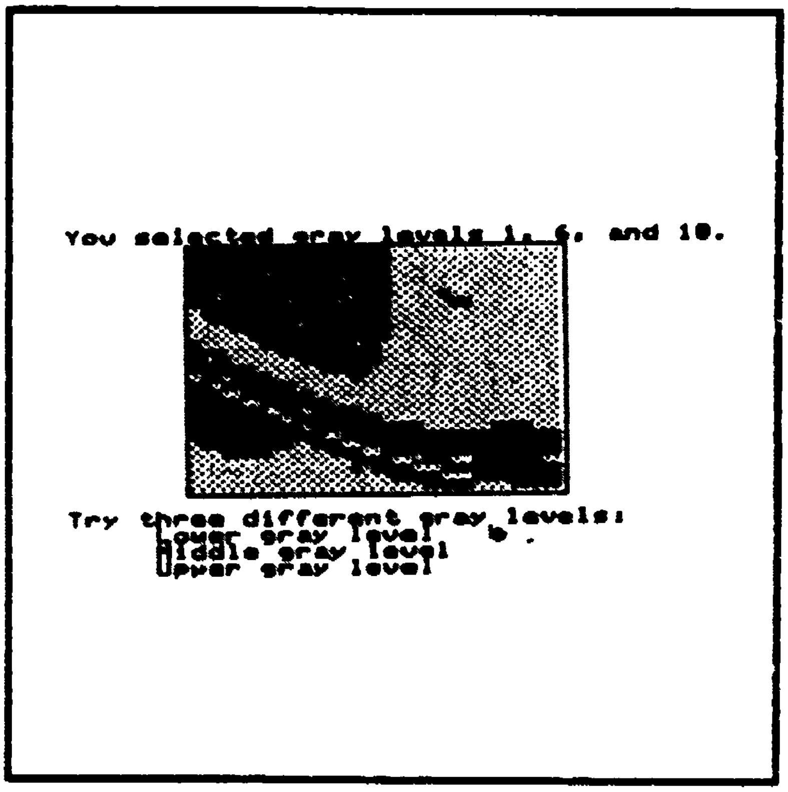

Figure 112. Dynamic Programming IV: Optimal Coding of Digitized Photographs, by Clifford Sloyer. Copyright © 1983, 1984 by the University of Delaware.

Music

The Department of Music is developing a package of PLATO lessons called the GUIDO music learning system, a videodisc music instruction series funded by the National Endowment for the Humanities, and a home music learning system that is being marketed by Atari, Inc. It has also developed a music synthesizer for use with most computer terminals and microcomputers. Each of these projects is discussed in turn as follows.

The GUIDO Music Learning System. Guido d' Arezzo is the eleventh-century musician and music educator who invented the staff and established the principles of solmization. Since he was the first real music educator, the system has been named after him, using his first name as an acronym for Graded Units for Interactive Dictation Operations. The GUIDO system consists of two main parts, namely, aural skills and written skills.

In the area of aural skills the first two years of ear-training materials have been organized according to levels of difficulty into graded units which form the basis of a competency-based curriculum including drill-and-practice in intervals, melodies, chords, harmonies, and rhythms. Ear-training students spend an average of two hours each week at GUIDO learning stations which consist of a PLATO terminal and a digital music synthesizer.

The basic design of the aural skills programs consists of a three-part process whereby GUIDO first displays an answer form on the terminal screen; second, plays a musical example using the digital synthesizer; and third, asks questions about the students' perception of the example. GUIDO keeps track of how well the students are doing and issues weekly progress reports to the instructors.

Figure 113 shows a sample display from the intervals program. By studying this display the basic features of the GUIDO system can be understood. At the top are two

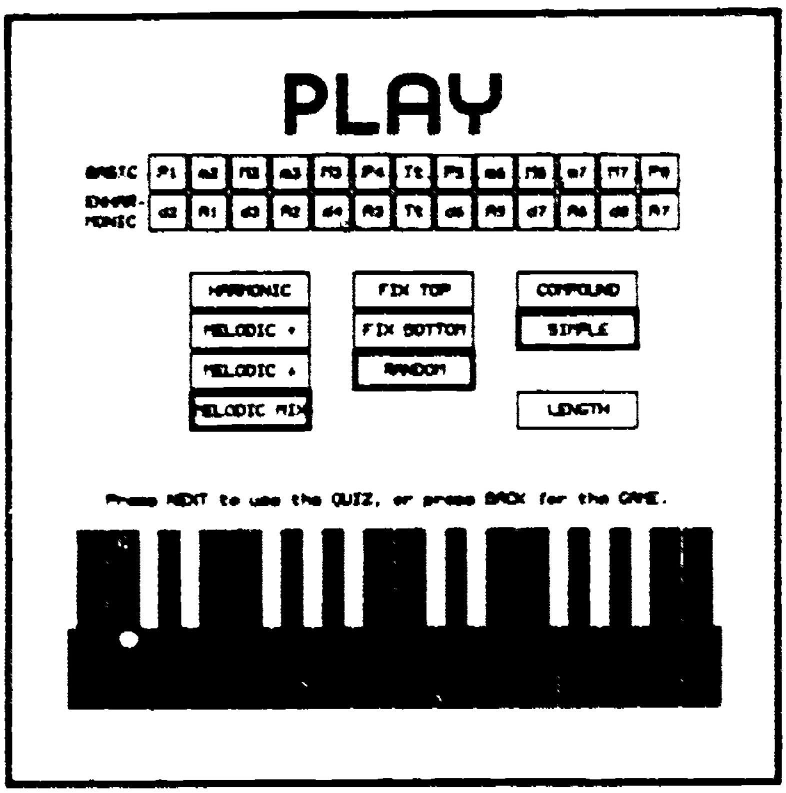

Figure 113. GUIDO Intervals Program, by Fred T. Hofstetter and William H. Lynch. Copyright © 1977 by the University of Delaware.

rows of boxes which contain the names of musical intervals. When students want to hear an interval, all they have to do is touch one of the boxes. When they do, the box lights up and the interval designated by the box is played by the computer-controlled synthesizer. Conversely, when the students are going through one of GUIDO's formal units, the computer plays an interval, and the students respond by touching the box which contains the interval they think was played.

Underneath the interval names are three columns of teacher or student control boxes. These boxes are used to control the way in which dictation is given. The teacher can preset them for the student, or the teacher can allow the students to set them at will. The first column of boxes allows for the intervals to be played as harmonic, melodic up, melodic down, or melodic intervals up and down. The second column gives the option of being able to fix the top or bottom notes of the intervals, or to have them selected at random. The box marked "intervals" allows students to eliminate intervals from the boxes at the top of the screen, so that only some of the intervals will be played. In the third column of boxes, students can select compound or simple intervals, can have an interval played again, and can change the length of time the intervals last. Finally, there is a keyboard at the bottom of the screen. When intervals are played in formal units one of the notes of each interval is shown on the keyboard, and the students are asked to touch the other note played in the interval. In this way, students are quizzed on the spelling as well as on the aural recognition of intervals.

During 1981-82, all of the aural skills GUIDO programs were converted to run in a low-cost format on Micro PLATO stations. Micro PLATO conversions were also begun for the GUIDO written skills lessons. Dealing with the fundamentals of music, these written skills lessons cover the following topics:

1. Note Reading
2. Half Steps and Whole Steps
3. Scales and Modes
4. Written Intervals
5. Beat Divisions
6. Rhythmic Notation
7. Key Signatures
8. Chord Functions
9. Partials
10. Transposition
11. Bass Figurization
12. Basic Part Writing

Figure 114 shows a display from the drill on chords in keys. GUIDO has asked the student to write a ii chord in the key of F major, and the student has responded by using the touch boxes to enter a correct SATB voicing. GUIDO has informed the student that there is more than an octave between the soprano and the alto. The student can press PLAY to hear the chord.

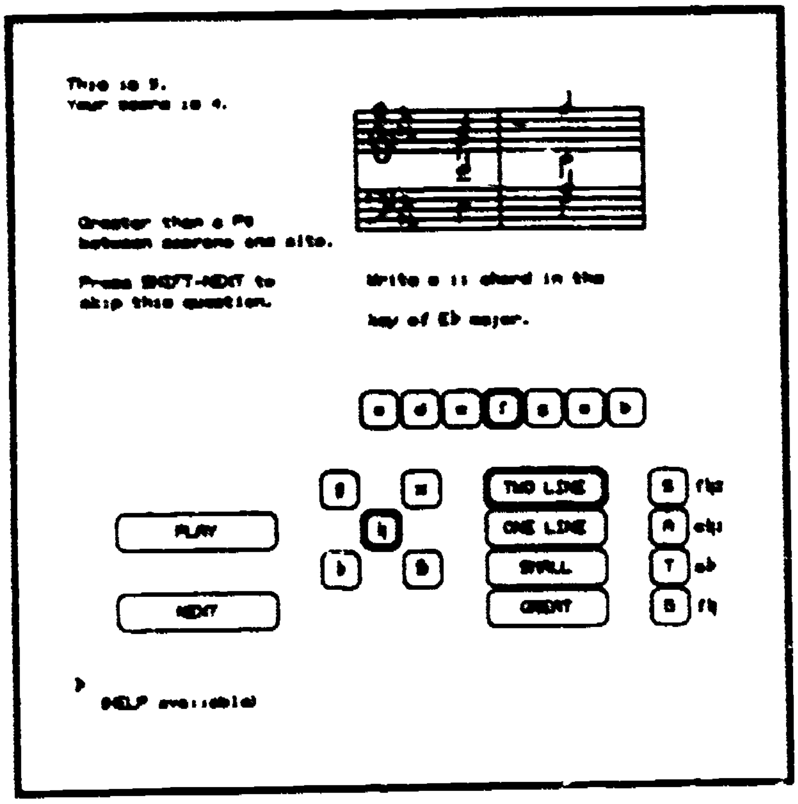

Figure 114. Basic Part Writing, by Michael A. Arenson and Paul E. Nelson. Copyright © 1981 by the University of Delaware.

The University of Delaware Sound Synthesizer (UDSS). Containing its own Z-80 microprocessor, the UDSS can be used with most any microcomputer or terminal, including all versions of the PLATO terminal. Fully programmable in the domains of frequency and time, the UDSS has thirty-two harmonics for each of its four voices which are optionally expandable to eight voices. Tremolos and vibratos can be made by means of amplitude and frequency modulation, respectively. Glissandos and portamentos can be defined, and programmable memories are included to permit real-time performance controls.

An article describing the background, design goals, features, and ease-of-use of the synthesizer is available from the Office of Computer-Based Instruction, which is producing the UDSS. Copies of this article, pricing information, and more technical information can be obtained by calling or writing to the Office. An orchestration program has been designed whereby students can easily change the instrumentation of the UDSS. Figure 115 shows how they can load ensembles which have already been defined. They can also make up their own ensembles, and they can even create their own instruments. Figure 116 shows how a UDSS instrument consists of a waveform, an amplitude envelope, a frequency envelope, and a glissando factor.

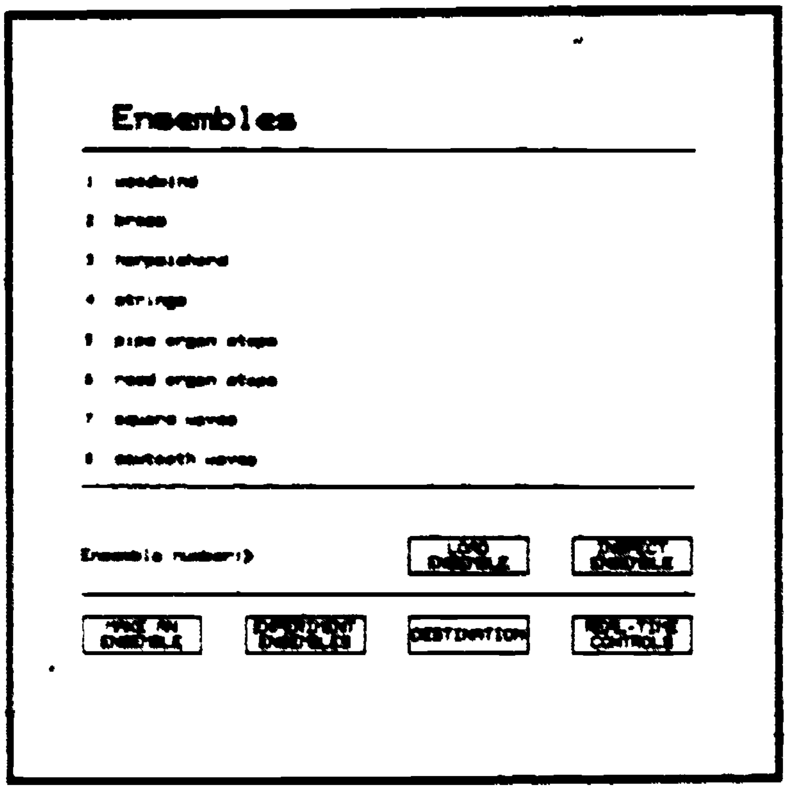

Figure 115. Ensemble Selection in the Orchestration Program, by Fred T. Hofstetter and William H. Lynch. Copyright © 1981 by the University of Delaware.

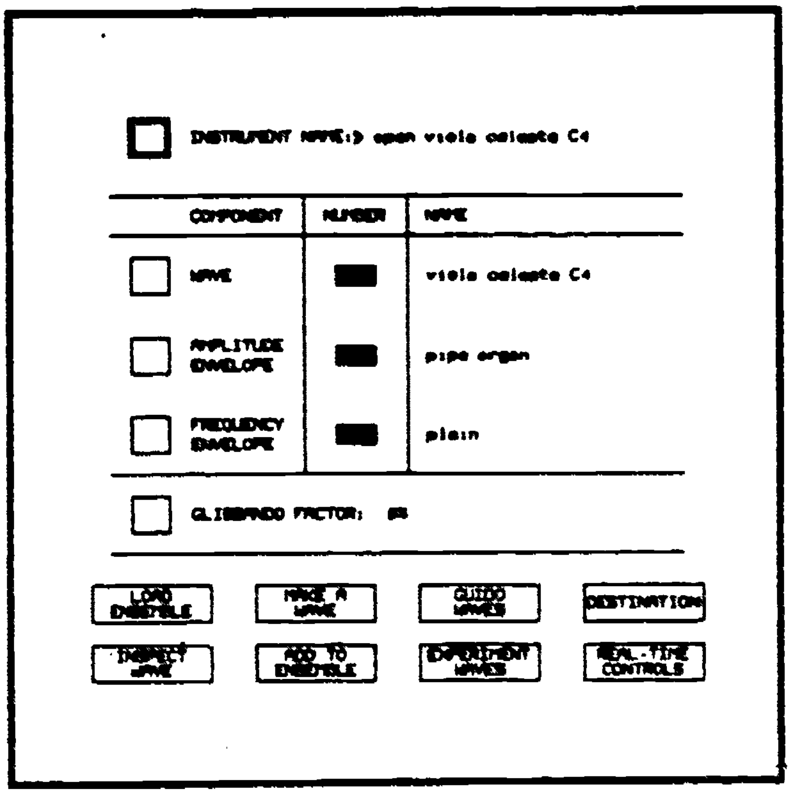

Figure 116. Defining an Instrument in the Orchestration Program, by Fred T. Hofstetter and William H. Lynch. Copyright © 1981 by the University of Delaware.

Students can use waveforms and envelopes which have been predefined by others, or they can make up their own. Figure 117 shows how they can create waveforms by setting the intensities of overtones in a harmonic spectrum, and figure 118 shows how they can make envelopes by touching points on the display screen. The arrows indicate a loop which will repeat until the instrument rests at which time the decay will occur. By using loops in amplitude envelopes a wide variety of tremolo effects are produced, and by using loops in frequency envelopes, vibratos can be similarly achieved.

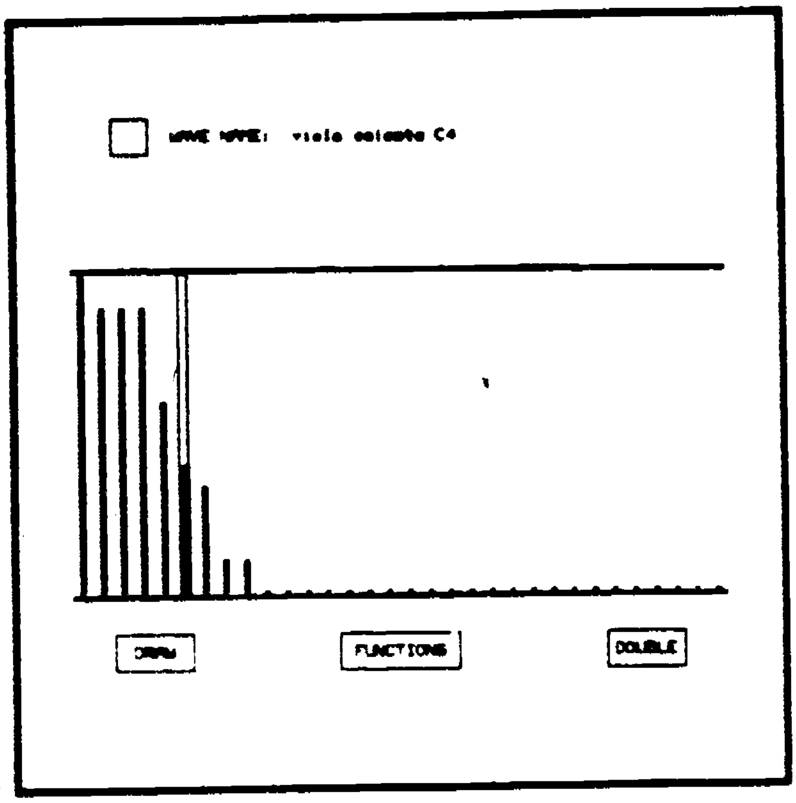

Figure 117. Creating a Waveform from a Harmonic Spectrum in the Orchestration Program, by Fred T. Hofstetter and William H. Lynch. Copyright © 1981 by the University of Delaware.

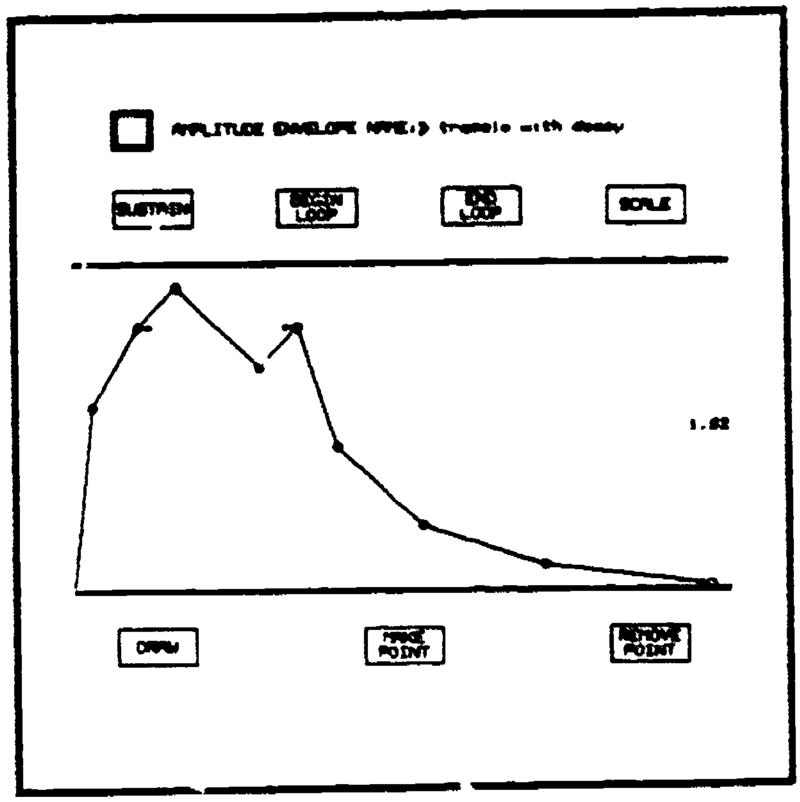

Figure 118. Making Envelopes with Breakpoints in the Orchestration Program, by Fred T. Hofstetter and William H. Lynch. Copyright © 1981 by the University of Delaware.

Videodisc Music Instruction Series. In 1982, the National Endowment for the Humanities awarded a three-year, $274,280 grant to the Department of Music, the Instructional Resources Center, and OCBI for the production of a series of four videodiscs that will be used to improve the teaching of theoretical and stylistic concepts in eleven musical masterworks. The content of the series was determined by an editorial review board that met twice on the Delaware campus. The review board consists of music educators, historians, and theorists from Oberlin, Illinois, North Carolina, Berkeley, Indiana and Delaware. Production work was done at Yale, Curtis, Oberlin, Michigan, Ars Musica, Indiana, Delaware, and at the Smithsonian. The Instructional Resources Center is directing the productions, and the videdises are scheduled for pressing in the fall of 1984. Ordering information is contained in a brochure that can be obtained from OCBI. Copies of the complete proposal are also available from OCBI.

Atari Home Music Learning System. Also awared in 1982 was a grant from Atari to produce a home music learning system. The first two packages in this system have been completed and are now being marketed by Atari. The first package, AtariMusic I, contains two strands that teach note reading and whole and half steps, respectively. AtariMusic II teaches major scales, key signatures, and scalewise melodies. Three outerspace music video games are included that encourage students to learn how to read notes, make whole and half steps, and name key signatures as quickly as they can. Designed for lifelong learners, the package can be used by anyone of age nine or older.

Nursing

The College of Nursing has developed client simulations for use in its adult physical health and illness and its psychopharmacological nursing courses. These simulations offer opportunities for students to utilize skills of analysis, priority setting, problem-solving, and decision-making in delivering appropriate patient care in response to lifelike client needs. Use of these simulations provides a transition from classroom theory to clinical practice. Students can practice the nursing process without endangering client safety, making it possible to stress student learning over timely patient care. Students may work at their own pace, and they may repeat the same clinical situations as often as is necessary to learn appropriate nursing care.

In the situation shown in figure 119, a client has returned to his room from the operating room following an abdominal perineal resection. The student has been asked to identify one of a series of steps that should be taken in response to the needs of the client. The student has chosen one from a list of steps possible at that point. The simulation has advised the student that another response would be more timely. In figure 120, the student has identified an appropriate step, and the simulation has indicated a reason for performing that step.

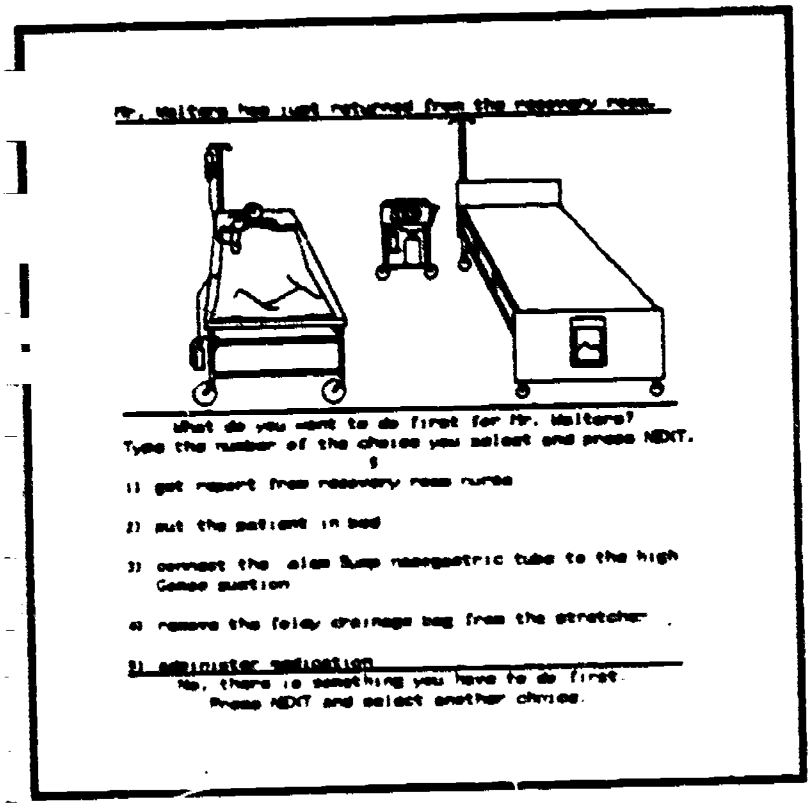

Figure 119. Abdominal Perineal Resection: A Patient Care Simulation, by Mary Anne Early and Monica Fortner. Copyright © 1979, 1980 by the University of Delaware.

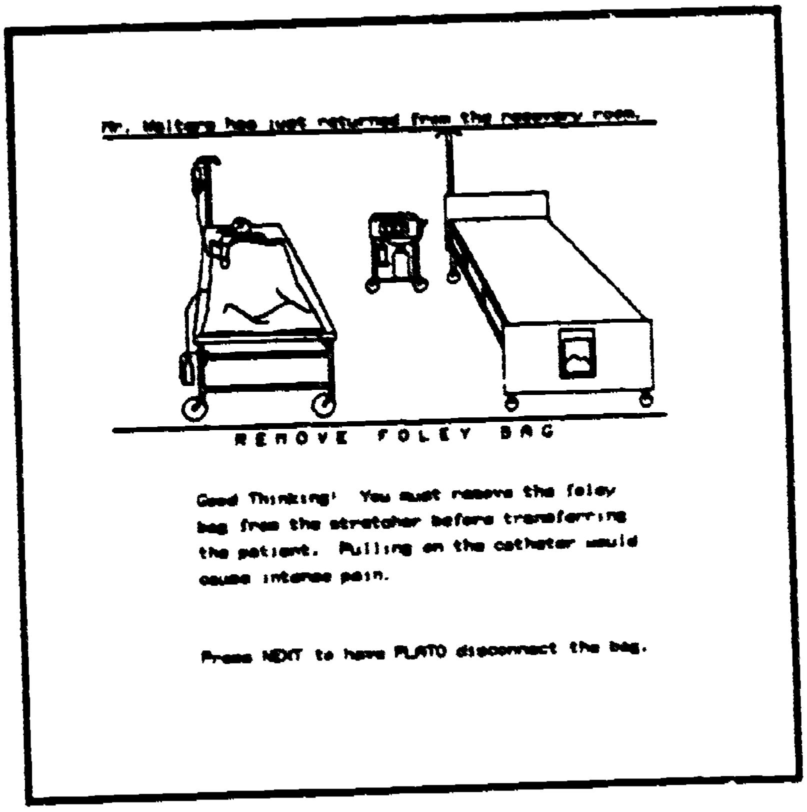

Figure 120. Abdominal Perineal Resection: A Patient Care Simulation, by Mary Anne Early and Monica Fortner. Copyright © 1979, 1980 by the University of Delaware.

Figure 121 is taken from one of a series of simulations in which the student applies the steps of the nursing process in clinical situations. Students collect data on clients, make assessments based on the data, plan for their clients' care, decide which plans to implement first, and evaluate the outcomes of their interventions. In figure 121, a student made an unacceptable number of mistakes in considering which pieces of information were relevant to a particular assessment. The lesson kept track of the student's performance, and it will provide an appropriate study assignment.

Six client simulations have been implemented on the PLATO system to date. Formative testing of the last two lessons took place in the fall of 1981. The entire series was used for the first time by all students taking the course on adult mental health and illness during the spring of 1982. Data collected on student responses provided the basis for revision of the series the past academic year. A research study of the effectiveness of two of the simulations was conducted, and the results of the study have been published (cf. below, p. 180).

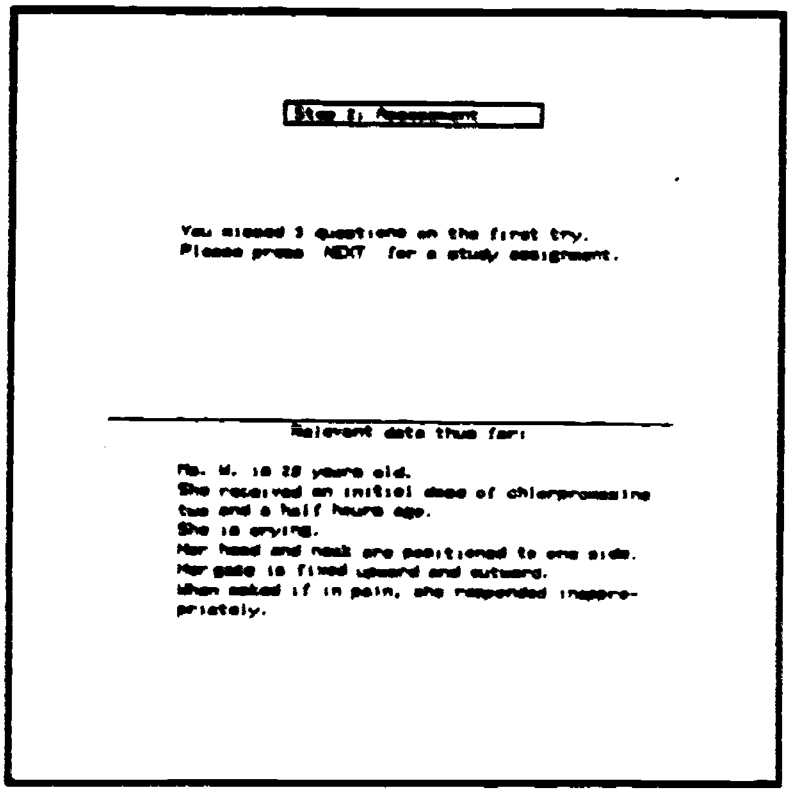

Figure 121. The Nursing Process and Psychotropic Medication: Antipsychotic Medication, by Sylvia F. Alderson, Elaine Boettcher, Evelyn V. Stevens, Francis J. Dunham, and Miriam Greenberg.

Professor Madeline Lambrecht was awarded a fellowship by the Center for Teaching Effectiveness under which she designed a lesson on death and dying. This lesson uses the interactive features of the PLATO system to encourage students to focus on a topic that most of them are reluctant to confront. Individualized feedback and branching techniques allow responses to be handled at the level most appropriate for each student.

The College of Nursing continues to use the PLATO system to allow registered nurses to challenge nursing courses for credit by examination. During the past five years, multiple choice tests covering the theoretical portions of the first and second courses in adult physical health and illness have been used a total of fifty-two times by registered nurses studying for a higher degree.

Finally, the audio-visual technologist of the College of Nursing now maintains on the PLATO system an inventory of all of the instructional modules available to students in the media library of the College, as well as the equipment available for delivering these modules.

Physical Education

During the 1983-84 academic year, the College of Physical Education, Athletics and Recreation developed courseware in four areas: sport science, sport skills, health, and physiology.

In the sport science area, "Film Motion Analysis," a lesson that uses a digitizer interfaced to a PLATO terminal, continues to be an integral part of the biomechanics program. Students enter body coordinates of nineteen segmental endpoints that have been acquired through the filming of athletes. The lesson uses these coordinates to provide the students with a graphical representation of the body, location of center of gravity positions, and kinematic compounds of both linear and angular velocities. In addition, the angle is calculated for each vertex. This lesson has been published by the Control Data Corporation. Figure 122 is an example of a graphic display that is formed from data that the student has entered.

Another lesson developed in the sport science area is "Equine Biomechanics and Exercise Physiology." Using the same biomechanical concepts as "Film Motion Analysis," this lesson is more flexible in that the student is not limited to nineteen segmental endpoints. The student may choose to enter more or less endpoints. After using the digitizer to enter the chosen number of endpoints, this lesson provides the student with a graphic representation similar to the "Film Motion Analysis" lesson. Figure 123 shows multiple frames of sample output for a particular horse.

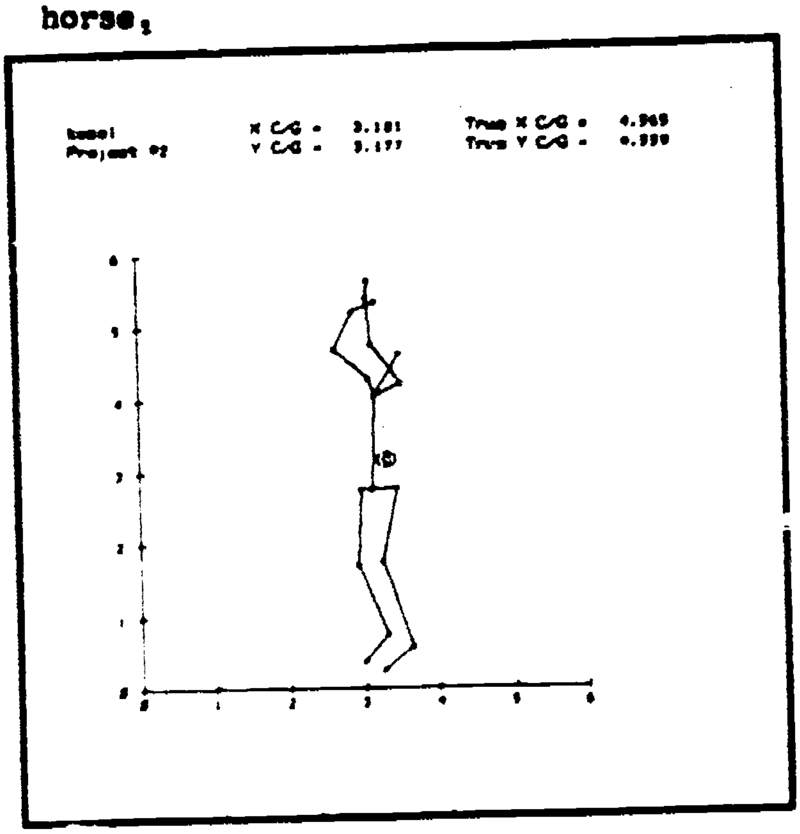

Figure 122. Film Motion Analysis, by David Barlow, James Richards, A. Stuart Markham, Jr. Copyright © 1977 by the University of Delaware.

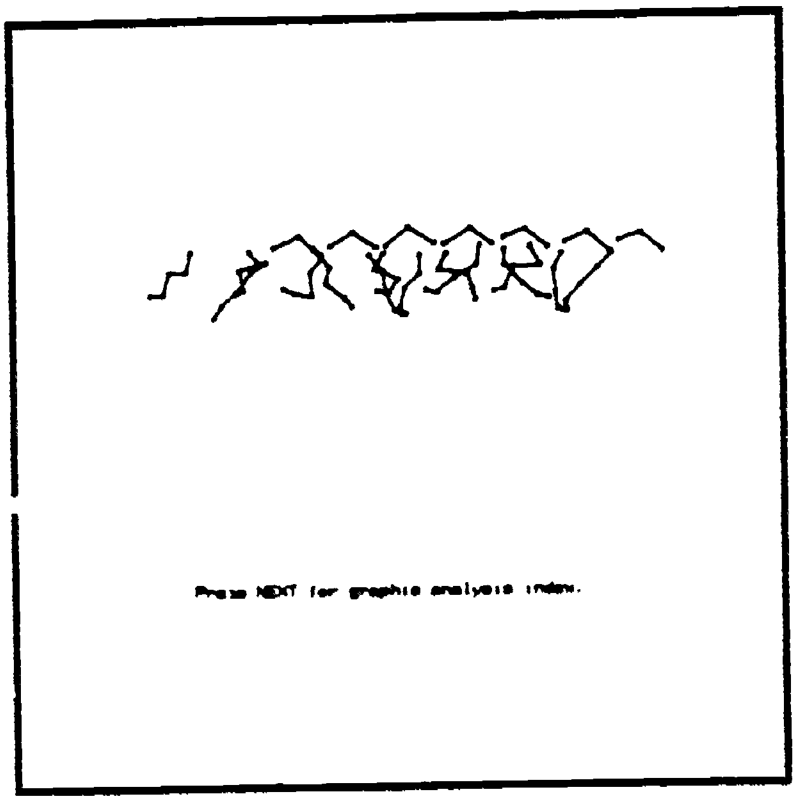

Figure 123. Equine Biomechanics and Exercise Physiology, by David Barlow, Shawn Hart, Jeffrey T. Davis, and Mark Baum. Copyright © 1981, 1982 by the University of Delaware

A Basic Mathematics and Trigonometry Package is used extensively by students preparing to study biomechanics. This eleven-lesson package provides a self-paced presentation of materials so that students will be prepared for the level of mathematics necessary to complete biomechanics coursework. Examples of biomechanics formulae and terminology are provided, and drill-and-practice is given in the laws of signed numbers, balancing equations, formula transformation, proportionality, unit conversion, trigonometric functions, and vector motion analysis in sports. A pre-test and a post-test are also included. Figure 124 shows a vector motion analysis problem, and figure 125 shows the detailed solution that is provided for students who cannot solve it on their own.

In the sports skills area, a volleyball strategies series is widely used. The volleyball lessons begin with a tutorial on each volleyball strategy. After the tutorial, a volleyball court is set up, and the student is informed of what the opponents are about to do. The student then positions players on the court by touching the screen. When all of the players have been set up, positioning is judged and appropriate feedback is given.

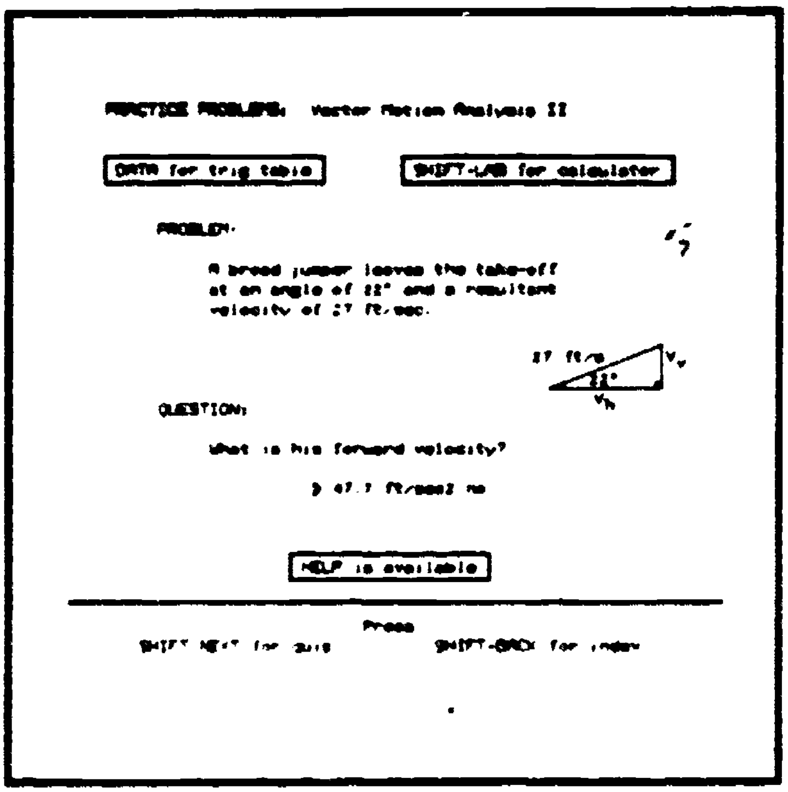

Figure 124. Vector Motion Analysis in Sport: Part II, by David Barlow Patricia Bayalis, and Nancy J. Balogh. Copyright © 1981, 1983, by the University of Delaware.

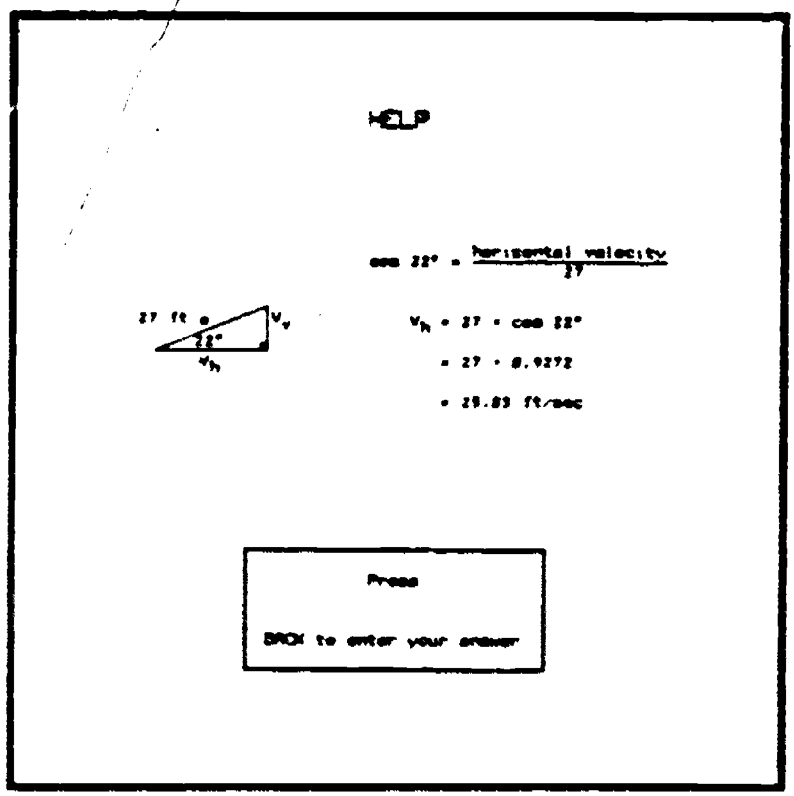

Figure 125. Vector Motion Analysis in Sport: Part II, by David Barlow Patricia Bayalis, and Nancy J. Balogh. Copyright © 1981, 1983, by the University of Delaware.

Figure 126 is an example of a court that a student has set up.

A package of lessons on doubles racquetball strategies has been developed. Offensive and defensive strategies for doubles play are discussed in this three-lesson series. Students are instructed on court markings, positioning, and techniques of doubles play. Doubles play can be very hazardous for the beginning racquetball player. The beginning player has not yet learned to control stroke technique and has not mastered spatial awareness of the stroke space. Instructors feel obligated to teach doubles play strategies but are reluctant to let beginners play doubles matches. The PLATO lessons were developed to provide the opportunity for students to learn doubles play without the risk of injury. Figure 127 shows how one of these lessons uses PLATO graphics in discussing doubles strategies.

In addition to volleyball and racquetball, the sport skills area has also developed a lesson on social dancing. In this lesson, a musical example is played on a music synthesizer, and the student identifies the dance step that would be appropriate to use with the musical example. Students use this drill-and-practice lesson to learn how to recognize the dance step that should be used with a particular style of music. The dance steps studied in the series include the alley cat, cha cha, charleston, disco, fox trot, jitterbug, polka, rhumba, tango, and waltz.

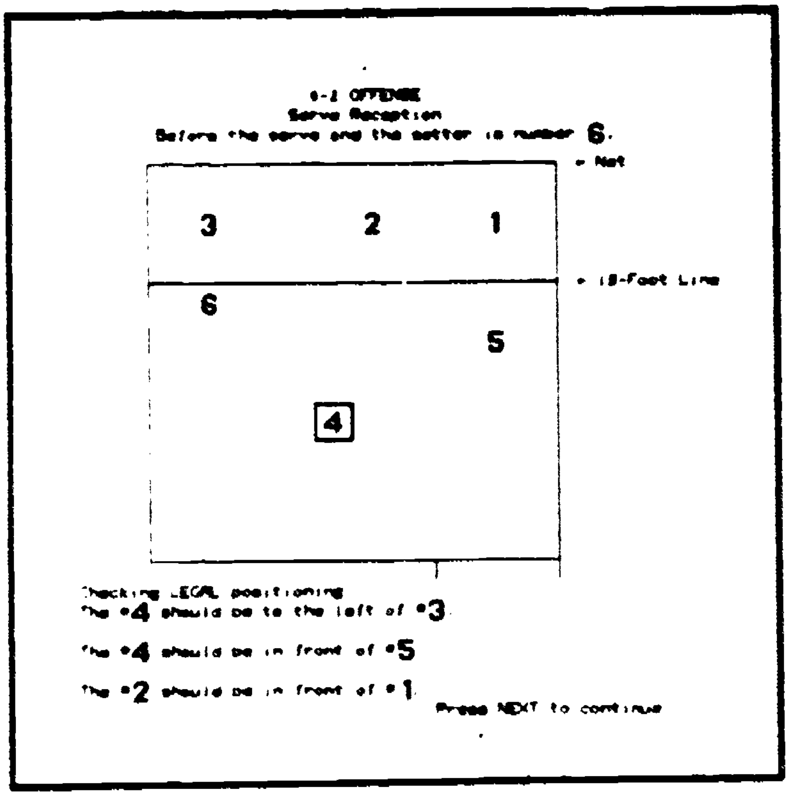

Figure 126. Volleyball Strategies, by Barbara Viera and A. Stuart Markham, Jr. Copyright © 1980, 1982 by the University of Delaware.

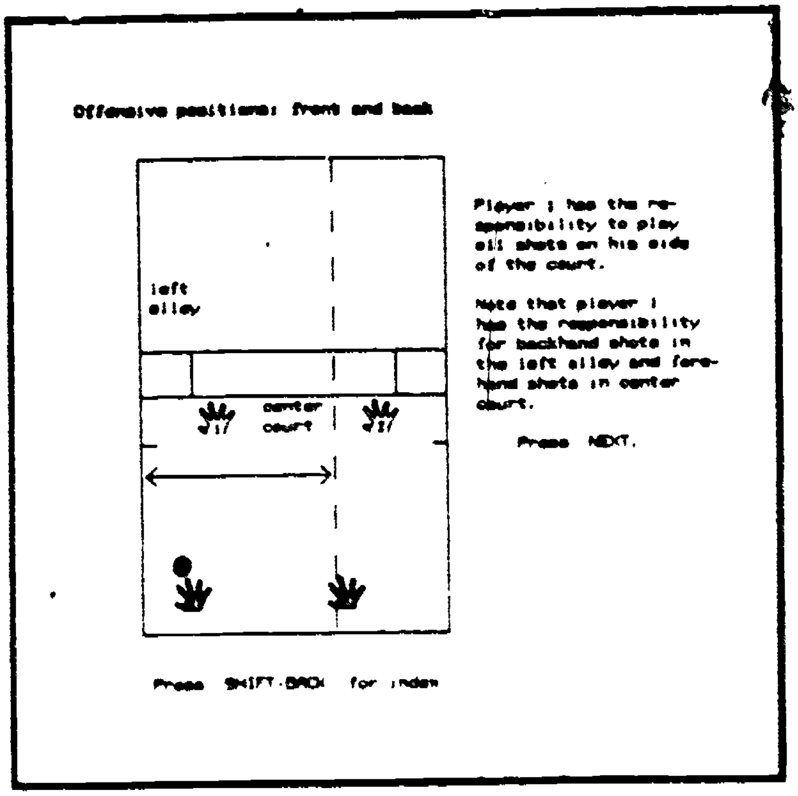

Figure 127. Basic Racquetball Strategies for Doubles Play, by James Kent and Patricia Bayalis. Copyright © 1980, 1982, 1983 by the University of Delaware.

Health lessons under development include a nutrition lesson, an activity assessment lesson, and a fitness lesson. The nutrition lesson compares calories and nutritional values of a student's daily diet to the recommended daily allotment (RDA) for a particular age and sex group. Figure 128 shows the first chart, which lists nutritional values in the foods that a student ate during one meal. The total nutrients for a day are later compared to the minimum requirements for the student. Suggestions are also made to help students balance their diets nutritionally and calorically.

The activity self-assessment lesson analyzes a student's daily exercise routine and determines whether more exercise is needed for the student to be physically fit. Students are asked to identify various activities that they have done during the day and to enter the number of minutes that they have engaged in that activity. Figure 129 is an example of how students break down a 24-hour day into various activities. After students enter all of the activities they have done, the information is analyzed and results are explained.

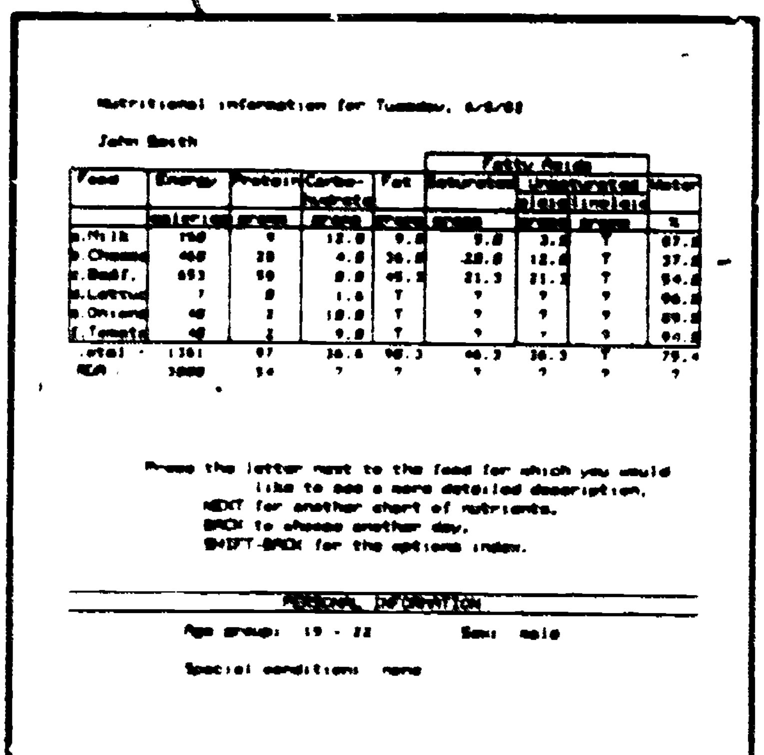

Figure 128. Nutrition and Calorie Counter, by Barbara Kelly, Patricia Bayalis, and Sharon Correll. Copyright © 1981, 1982 by the University of Delaware.

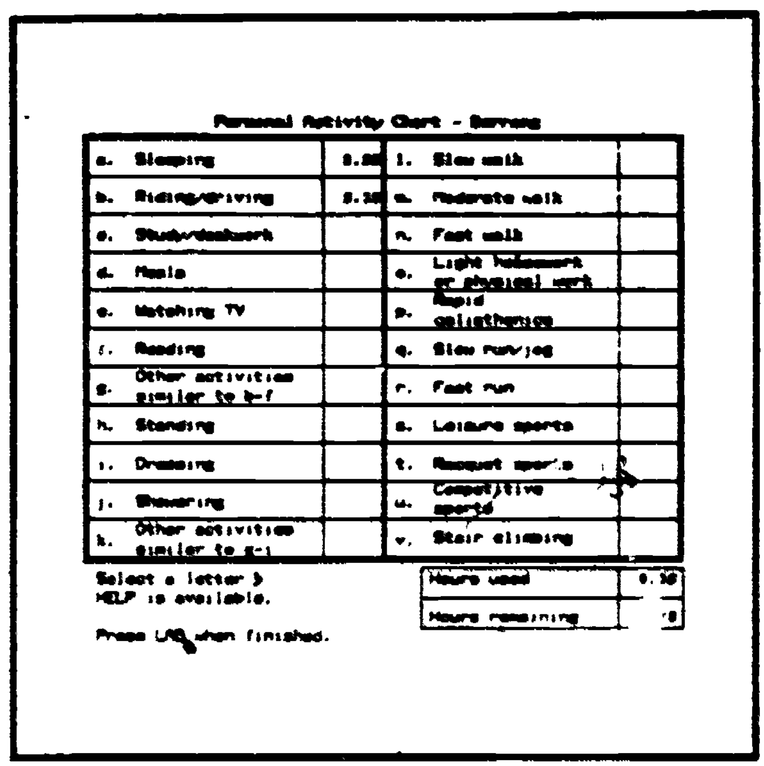

Figure 129. Activity Self-Assessment, by Barbara Kelly and Deborah E. Richards. Copyright © 1981, 1982, 1983 by the University of Delaware.

The fitness series has become an integral part of the sport skill classes in physical education. With the emphasis these classes place on lifetime sport and physical fitness, it is extremely important that students understand the basic principles of fitness. This series begins by discussing the importance of the threshold level and the proper procedure for monitoring pulse rate. It continues by outlining the ingredients of an effective fitness program and eventually aids students in establishing their own personal physical fitness program. Figure 130 explains the pulse monitoring procedure that students practice during the lesson.

In the physiology area, two lessons have been developed. The first lesson deals with muscle identification and is presented in a multiple choice, drill-and-practice format that quizzes students on identifying the action, origin, insertion, and innervation of the muscles of the human body. The addition of a series of slides is planned to help students incorporate new terminology. Figure 131 shows a sample question from this lesson.

The second lesson deals with the mechanics of muscular contraction and explains the cellular and molecular physiology of muscle contraction by using animation to illustrate the processes that occur in the sarcomere, the cellular contractile element of a muscle fiber. A Micro PLATO animation is used in this lesson to illustrate the intricacies of muscular contraction. After successfully completing this lesson, students are able to name and identify the neurotransmitters, ions, and cellular processes involved in the contraction of a muscle fiber.

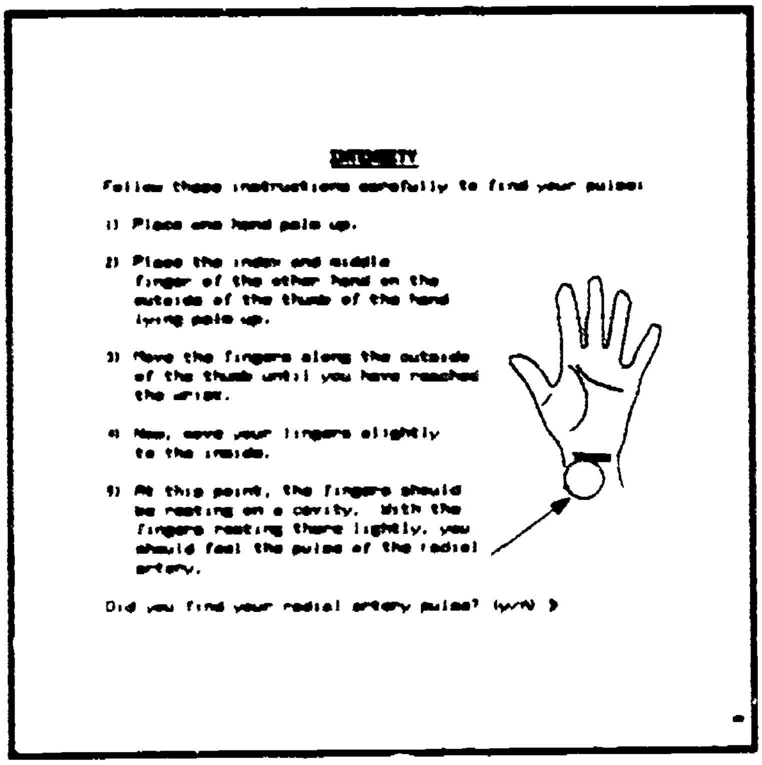

Figure 130. Fitness, Part 2: Ingredients of Fitness, by John O'Neill, Deborah E. Richards, Patricia Bayalis, and Sharon Correll. Copyright © 1981, 1982, 1983 by the University of Delaware.

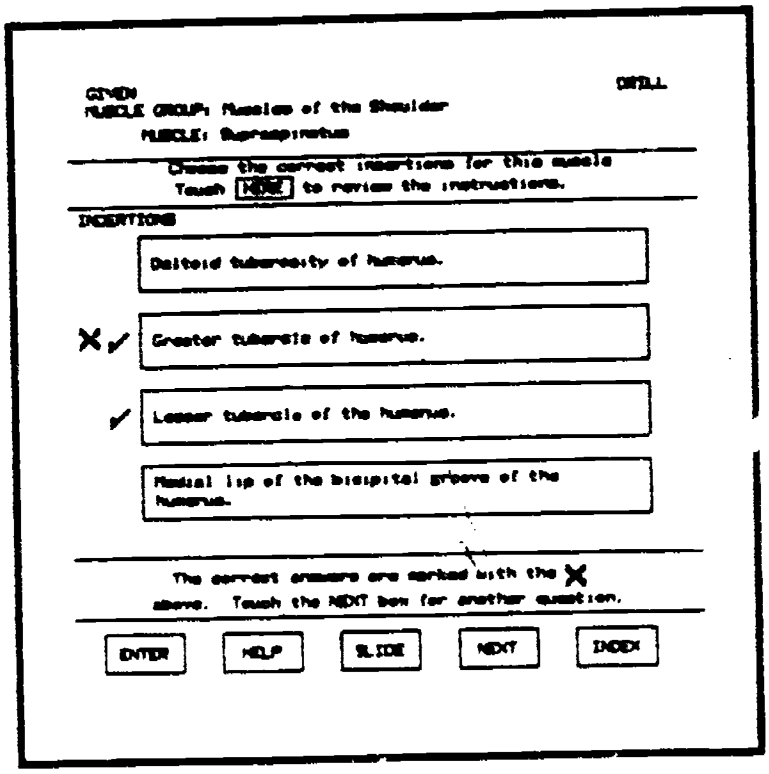

Figure 131. Muscle Identification, by Keith Handling, Shawn Hart, and Patricia Bayalis. Copyright © 1980, 1982, 1983 by the University of Delaware.

Physics

The Department of Physics participated in the development of Control Data Corporation's Lower Division Engineering Curriculum. Consultants in program development were Professors Richard Herr, Arthur Halprin, and S. B. Woo. Professor Herr also served on the editorial review board. The physics component of this program covers material in the two semesters of general physics that undergraduates normally take at the beginning of an engineering curriculum. The lessons consist mainly of problem-solving exercises, tutorials in how to do problem-solving, and drill-and-practice exercises on basic concepts. They are flexible enough to stand alone, to supplement a lecture course, or to replace the recitation sections that normally concentrate on homework problems. The laboratory experience included in the usual general physics course remains classroom-based and does not include PLATO lessons.

Physics students also use PLATO lessons in the department's Introduction to Astronomy course. Figure 132 is from an easily accessible table of the positions of the planets on any date, in right ascension and declination. This same course also uses microcomputers. The Department of Physics became involved with microcomputers as more and more faculty members and researchers began using personal computers for grading and numerical computation. The Commodore became especially popular. Instructional programs on the Commodore include an interactive problem-solving lesson on the luminosity of stars, several lessons on Kepler's laws, some astronomy terminology games, and several utility programs that students use to analyze laboratory data.

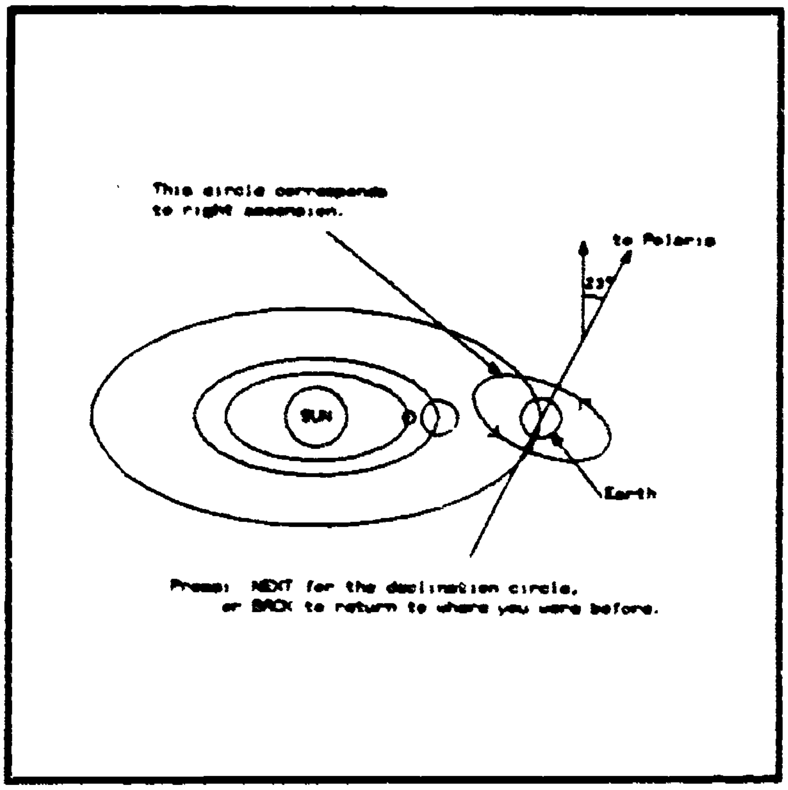

Figure 132. The Positions of the Planets, by Samuel Lamphier. Copyright © 1980, 1981 by the University of Delaware.

Political Science

Under a grant from the National Science Foundation, Dr. Richard Sylves of the Department of Political Science revised three PLATO simulations based on lessons originally developed on the Illinois PLATO system. These lessons allowed students to make strategic decisions in the policy process while assuming the role of a key actor in the policy subsystem.

In the first simulation, "State Budgeting Process," the students play the role of a state agency head for the Department of Mental Health. They complete budget forms for their departments and then shepherd the budgets through several stages in the state budgeting process, as shown in figure 133. The students must deal with pressures from the governor, hospital administrators, and key legislators whose districts are served by particular hospitals, and they must also be prepared to justify to the Bureau of the Budget any requested increases in their budgets.

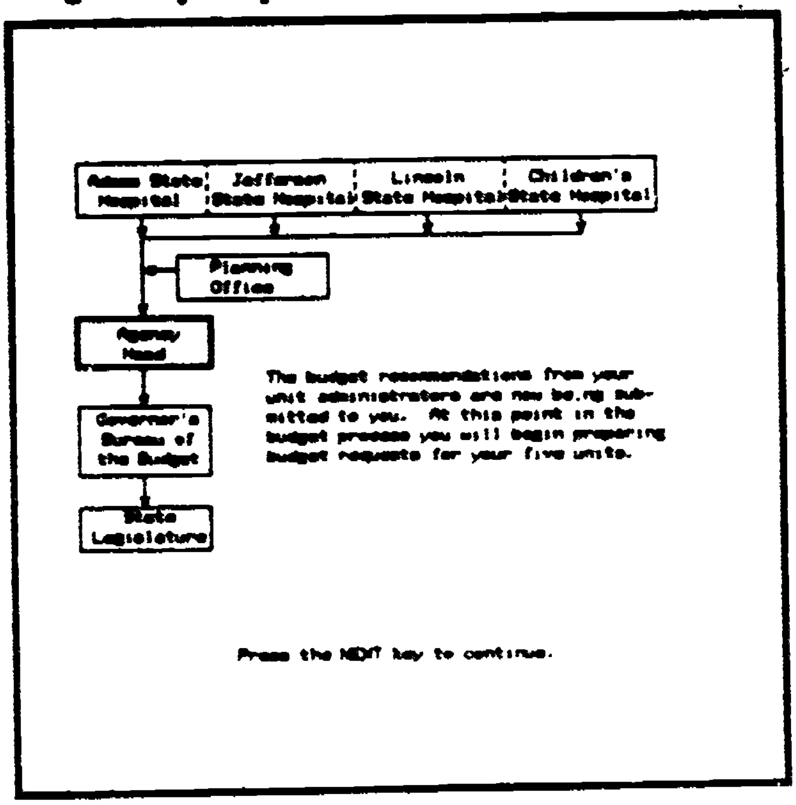

Figure 133. State Budgeting Process, by Fred Coombs, et al. Revised by Richard Sylves, Sue C. Garton and Kenneth Kahn. Copyright © 1977 by the Board of Trustees of the University of Illinois.

BEST

The second and third simulations are called "Political Districting" and "Committee Chairman," respectively. In "Political Districting," the students practice drawing district maps and learn about the political significance of gerrymandering, as shown in figure 134. "Committee Chairman" deals with politicking in the state House of Representatives. The object is to influence House members to vote a particular bill into law. One way to do this is to choose appropriate witnesses who will testify in favor of the proposed bill at a hearing, as shown in figure 135. Throughout the simulation the students are shown a vote count taken by informal polls. The number of votes in favor, opposed, and undecided are shown periodically to inform students of their progress. At the end of the lesson the students are shown the margin by which their bills passed or did not pass, and they are given examples of some of the good and poor decisions they made during the lesson.

Another lesson, "Organization Charts and Public Administration," introduces the common principles of organization in understanding the formal organization charts of public agencies. Charts of real and imaginary organizations are depicted in the lesson. Key terms and concepts that are commonly used in constructing formal administrative structures are introduced to the students. This lesson also discusses the advantages and disadvantages of different organizational structures.

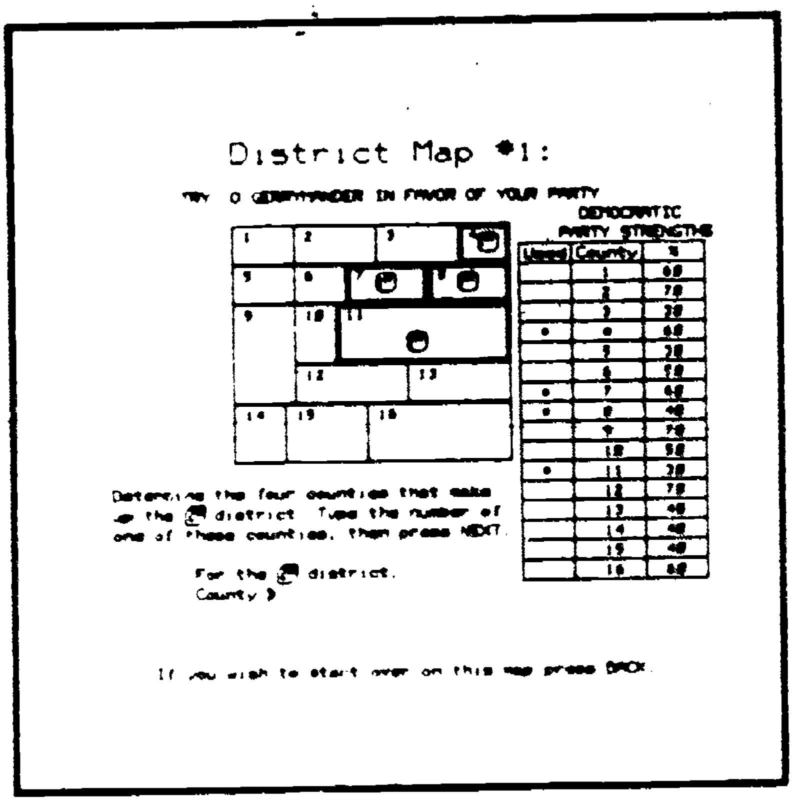

Figure 134. Political Districting, by Don Emerick. Revised by Richard Sylves, Sue C. Garton, and Susan Gill. Copyright © 1976 by the Board of Trustees of the University of Illinois.

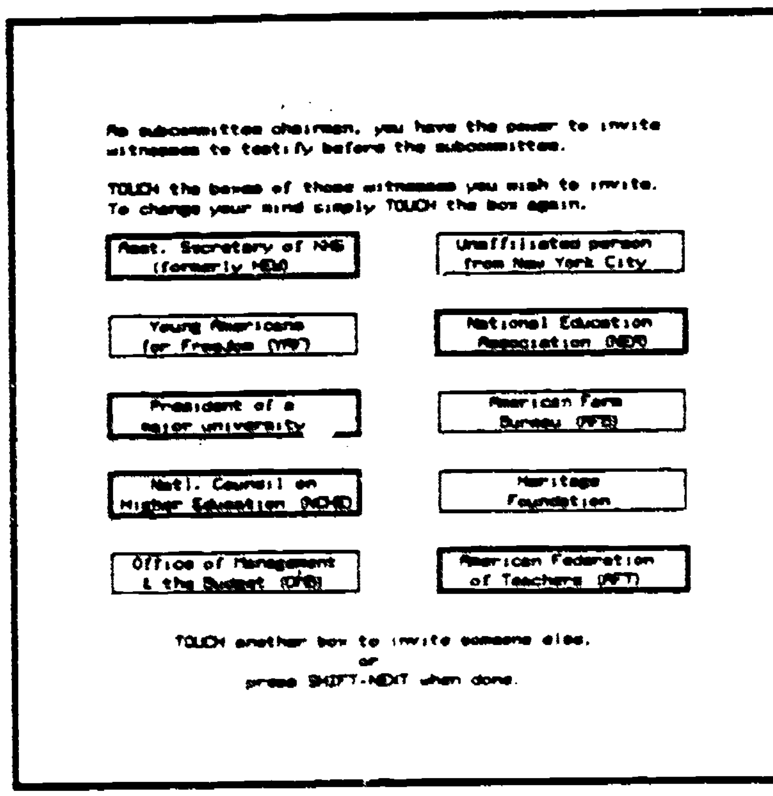

Figure 135. Committee Chariman, by Fred Coombs, et al. Revised by Richard Sylves, Sue C. Garton, Kenneth Kahn, and Randall Smith. Copyright © 1969 by the Board of Trustees of the University of Illinois.

Psychology

The Department of Psychology uses instructional computing for both teaching and research. In teaching, "Short-term Visual Memory Experiments," "Direct Scaling," and "Reaction Time" are a package of three lessons used as a requirement for psychology students at the University of Delaware. Other lessons used by psychology students examine various aspects of human sensation and perception, from the physiology of the eye to classic perceptual illusions. Figure 136 is a triangle magnitude experiment from "Direct Scaling." Data is collected as to how the student responds to a series of size comparison questions.

Figure 137 is the temporal integration experiment from "Short-term Visual Memory Experiments." An incomplete 4/4 matrix of asterisks is flashed on the screen and covered by a 4/4 matrix of letters. Students must identify the asterisk that was missing from the matrix by typing the letter that replaced it in the same location.

In psychological research, the PLATO system has played a crucial role in a three-year project on individual differences in cognitive abilities funded by the Office of Naval Research under the direction of Professor James Hoffman of the Psychology Department. This research is directed at measuring the ability of people to perform simultaneous mental activities with the long range goal of specifying selection and training procedures to maximize "time sharing" ability. The experiments require human subjects to perform difficult simultaneous visual discriminations. The microprocessor-based PLATO V terminal allows precise timing of visual displays as well as subjects' response times.

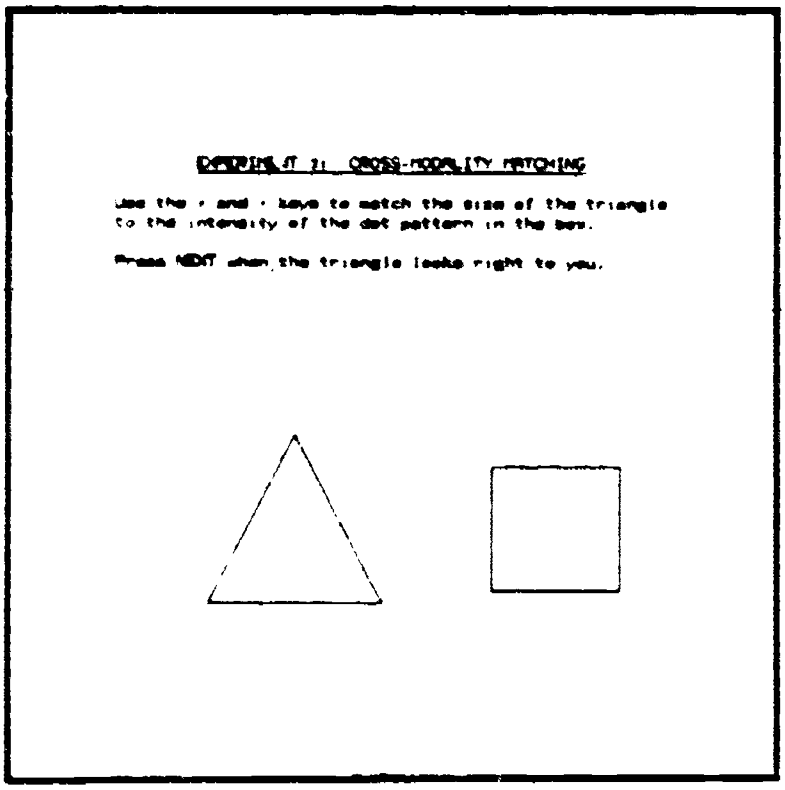

Figure 136. Direct Scaling, by James Hoffman, Jessica R. Weissman, Michael Frank, and Robert Krejci. Copyright © 1980, 1981, 1982 by the University of Delaware.

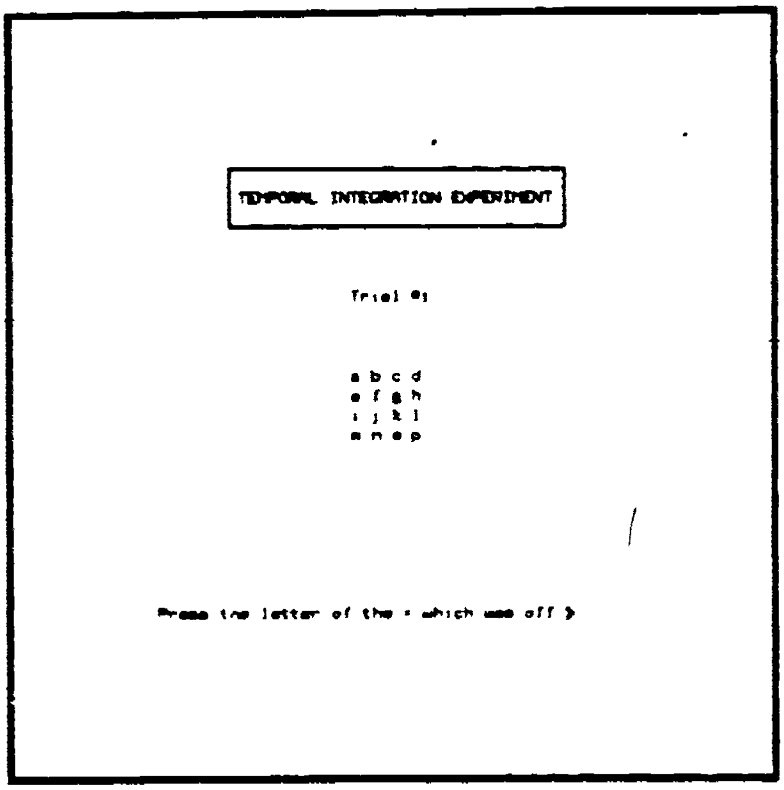

Figure 137. Short-Term Visual Memory Experiments, by James Hoffman, Jay Green, Cheinan Marks, and Robert Krejci. Copyright © 1979, 1981, 1982 by the University of Delaware.

A sound generator is currently being used in simultaneous auditory and visual discriminations with the PLATO system. This audio peripheral enables the precise selection of tone stimuli for sine, triangle and square waveforms over a wide range of frequencies and intensities. Also available and useful for tone masking is the superimposition of white noise of variable intensities.

Results collected to date indicate that even extensive training on visual discriminations resulting in "automatic" performance on these tasks does not eliminate between-task interference. Evidently even highly practiced and automatic tasks utilize a limited pool of "mental resources."

The work currently underway involving auditory as well as visual discriminations will help to determine if different modalities compete for the same pool of resources. Of special interest will be the comparison with trade-offs obtained when subjects perform two tasks in the same modality.

The PLATO system is currently being used in experiments involving evoked brain potential measurements. Electrical activity of the brain will be recorded from the scalp in response to computer-generated visual and auditory stimuli. The resulting "average evoked response" should reveal important clues concerning those brain structures involved in attention and learning.

Psychology department researchers are also using the PLATO system to present various performance tasks to groups who have been pretested for varying levels of depression, and to expose these human subjects to a mood induction technique called the Velten Technique. The goals of this project are to replicate theoretically similar studies and to explore cognitive styles that may predispose people to clinical depression and other mood disorders.

Statistics

A knowledge of statistics is needed by students in many departments. Each department has tailored its statistics course to provide training applicable to its discipline. OCBI supports these courses on two mainframe systems, namely, PLATO and the VAX 11/780.

The Delaware PLATO system provides users with statistical instruction and data service. A statistical worksheet lesson has been developed, taking advantage of PLATO's high resolution graphics. Figure 138 shows a linear regression plot from this lesson. The data, entered in a worksheet format of rows and columns, are conveniently indexed, cross-referenced, statistically tested, and compared. Students obtain a display of the values of a given column of data as a table of values, as a box plot, or, as shown here, as a scatter plot. Pertinent parameters are displayed along with the graphical display.

A complete library of instructional statistics lessons developed at the University of Illinois is available on the Delaware PLATO system. Interested students and faculty may use Illinois packages to perform analyses of their own data. Graduate students find the instructional lessons helpful for review of fundamentals of statistical analysis, while researchers appreciate the ease with which results are obtained for small amounts of data.

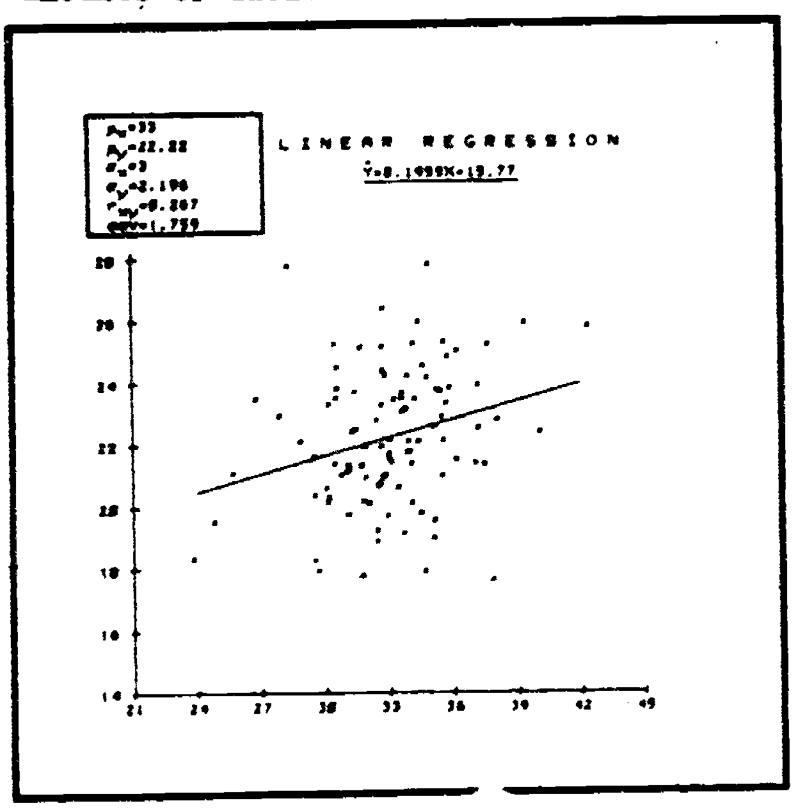

Figure 138. Statistics Worksheet, by Victor Martuza, Aart Olsen, Mary Jac Reed, and Gary A. Feurer. Copyright © 1980, 1981 by the University of Delaware.

Three integrated statistics projects are being developed on the VAX 11/780. Under a grant from the Digital Equipment Corporation, a one-semester, interdisciplinary statistics course is being developed for color graphics terminals. Professors Arthur Hoerl of Statistics, Victor Martuza of Educational Studies, and John Schuenemeyer of Statistics are authoring lessons on probability, descriptive statistics, and inference, respectively. Basic statistical concepts are taught in a tutorial mode, and many graphical procedures and dynamic databases are provided to illustrate concepts. Instructors may tailor these lessons by entering their own databases and by choosing statistical symbols that are familiar to their students. A glossary of statistical terms is available to the students at any point in the lessons.

The descriptive statistics lesson, "Looking at Data," shows in figure 139 a portion of a database containing data on the calorie content of thirty-five brands of beer. Students press the up-arrow key to reorder the data from low to high. Figure 140 shows how the concept of a complement is depicted graphically using both a Venn diagram and a branching tree structure in a probability lesson called "Events."

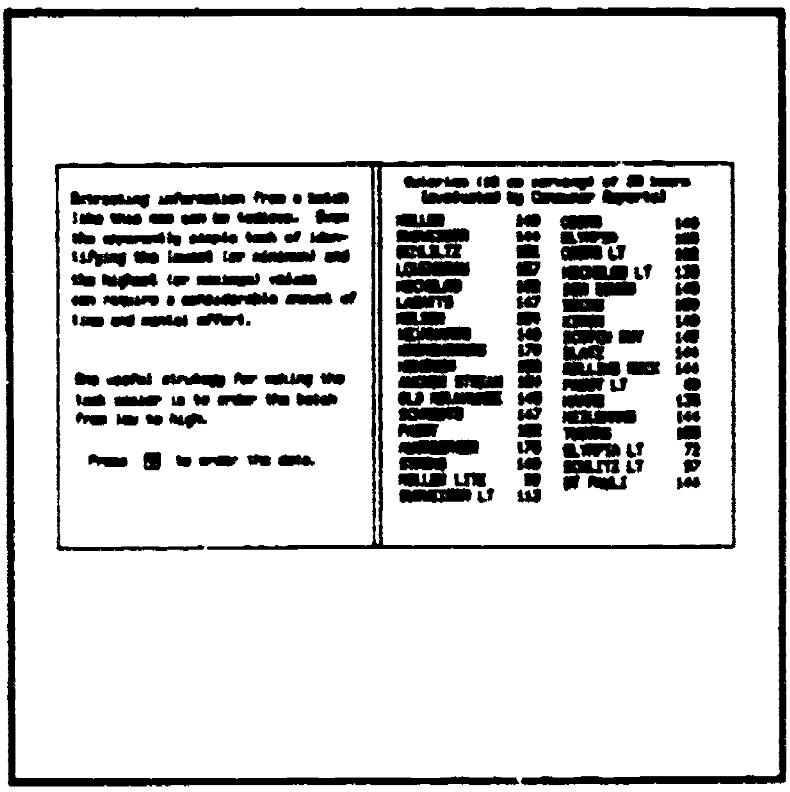

Figure 139. Looking at Data, by Victor Martuza, Mary Jac Reed, and Michael Porter. Copyright © 1983, 1984 by the University of Delaware.

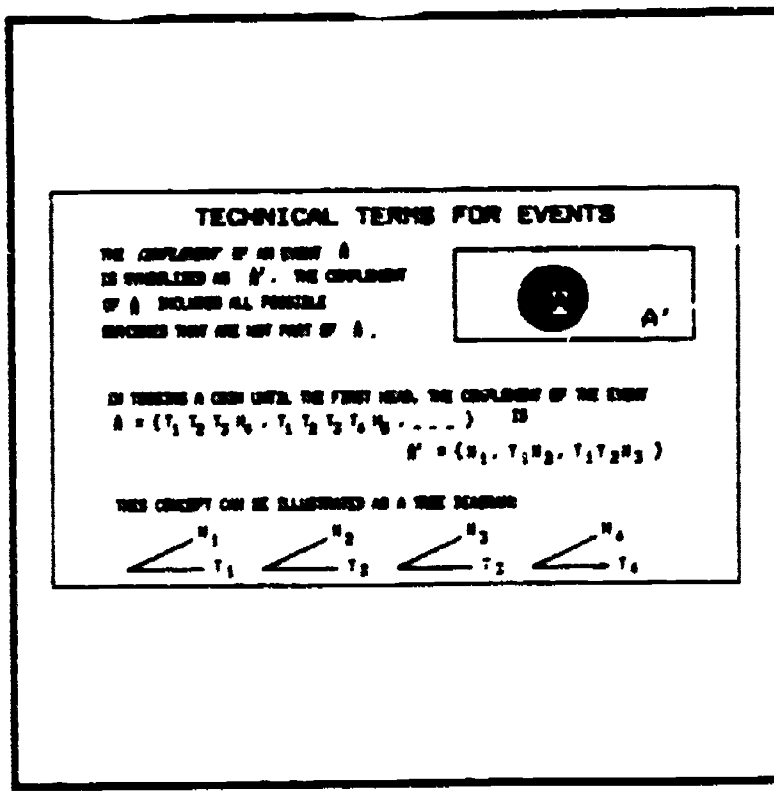

Figure 140. Events, by Arthur Hoerl, Mary Jac Reed, and Michael Porter. Copyright© 1983 by the University of Delaware.

Figure 141 demonstrates a boxplot of test failure rates in four geographical regions. Students can switch back and forth between logarithmic and linear scales to see how the distributions are affected by the transformations.

Two other projects are funded by RFP (Request for Proposal) grants from OCBI. Five faculty members from the Departments of Communication, Criminal Justice, Political Science and Sociology are developing a package of lessons to teach students how to collect research data, understand it, and critically evaluate it. Lessons scripted so far contain instructional information on scientific variables and the scientific method.

Finally, the APL programming language is being modified to use a friendlier, more understandable symbol notation with a faster terminal response time. Statistics students can construct programs from a library of APL functions and will eventually have graphical output from the functions. Tutorials in AMPL (A Modified Programming Language) are being developed to teach students how to use this powerful language for statistical analysis.

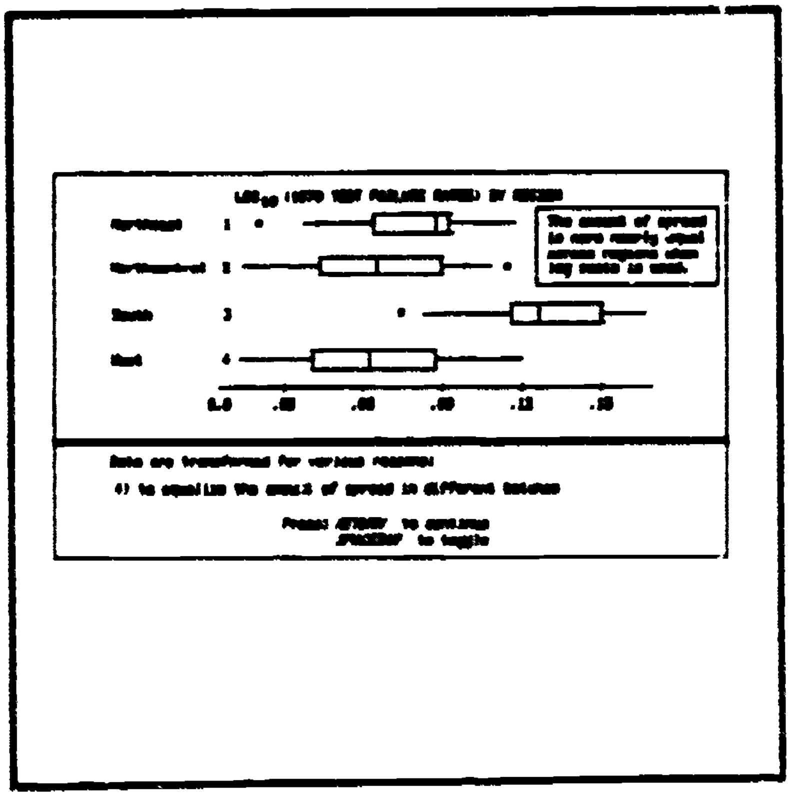

Figure 141. Transformations, by Victor Martuza, Mary Jac Reed, Michael Porter, and Clella Murray. Copyright © 1984 by the University of Delaware.

Student Organization and Activity Center (SOAC)

The SOAC project was established during 1980 to serve the needs of student organizations on campus. Development has occurred in two areas, namely, lessons and notesfiles. One lesson, "Choosing an Effective Leadership Style," deals with individual development. This lesson presents three instruments that help students evaluate their leadership styles. Students find it valuable to regularly refer to the self-paced exercises in this lesson to monitor their growth in leadership skills. Figures 142 and 143 show an explanation that is given to students after they complete one of the instruments.

The SOAC project has also established a notesfile called "SOAC Notes" in which each registered student organization may announce any meeting or activity that it is sponsoring. Students read this file to check on such activities as upcoming movies, dances, meetings, bus trips, and guest speakers.

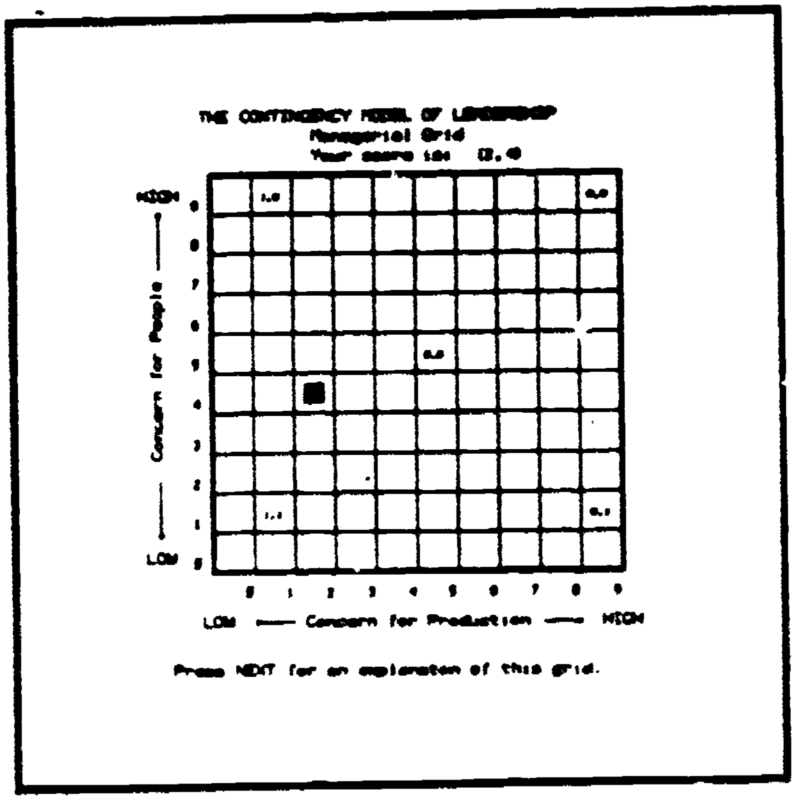

Figure 142. Individual Development: Choosing an Effective Leadership Style, by Marilyn Harper, Clare Berrang, and Patrick Mattera. Copyright © 1981, 1982 by the University of Delaware.

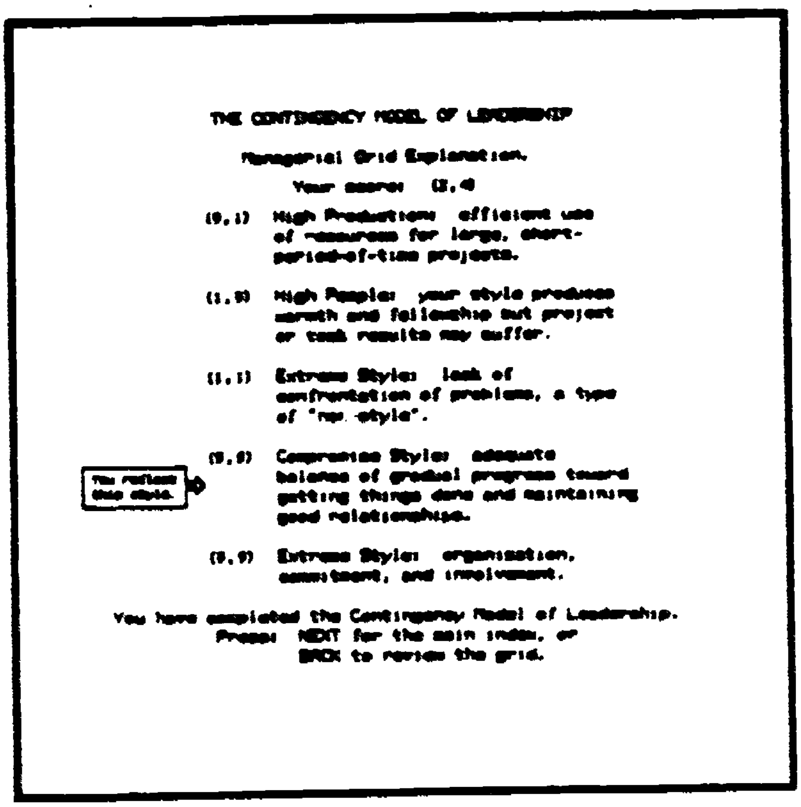

Figure 143. Individual Development: Choosing an Effective Leadership Style, by Marilyn Harper, Clare Berrang, and Patrick Mattera. Copyright © 1981, 1982 by the University of Delaware.

University of Delaware English Language Institute

The University of Delaware English Language Institute (UDELI) offers an extensive English program to sixty students each month from Panama, Japan, Brazil, Greece, Iran, Mexico, Jordan, China, Korea, Kuwait, Lebanon, Saudi Arabia, United Arab Emirates, Syria, Bolivia, Venezuela, Sri Lanka, Thailand, and Uruguay. Students are placed in one of five levels according to their language abilities.

At the core of the Institute's PLATO curriculum are "Basic Reading and Language Skills" for use by students at the lower levels and the "Index of English Lessons" for intermediate and advanced students. In the beginning sections, students work with the sounds of letters. In figure 144, the student learns whether the letter "c" is pronounced like "K" or like "S." In the advanced section, students are given PLATO assignments that help to develop skills which they will need in regular University courses. In figure 145, the student is presented with a verb stem, in this case "look," and is shown endings which change the verb to present tense, past tense, and present participle. Then the student is given new verb stems and is asked to add the correct endings to form other tenses. The institute also sponsors a group notesfile called "UDELI News" that students use with the stipulation that all notes must be written in English.

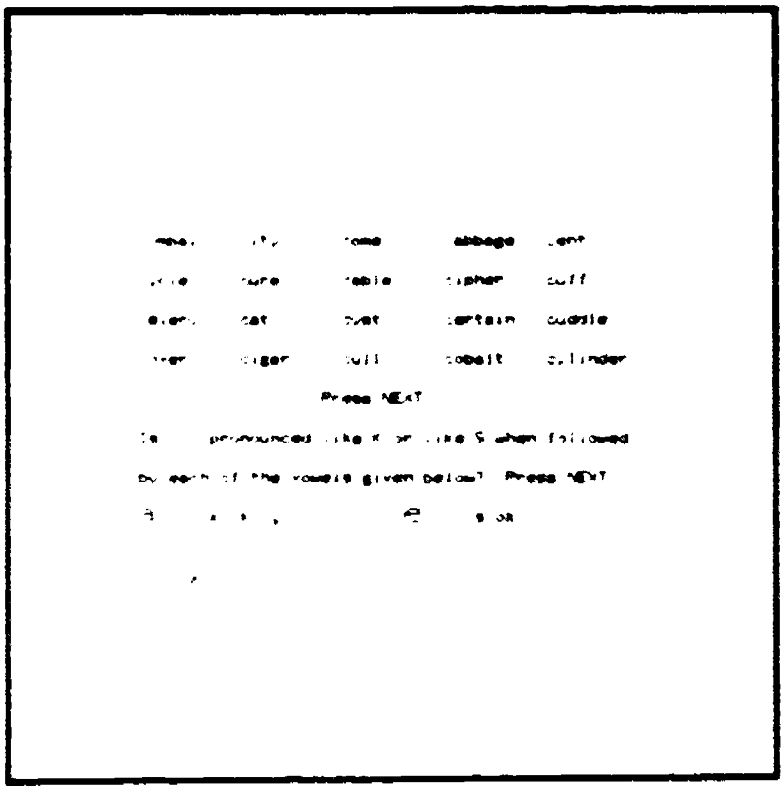

Figure 144. The Case of the Curious C, by Joan Sweany. Copyright © 1975 by Chicago City Colleges.

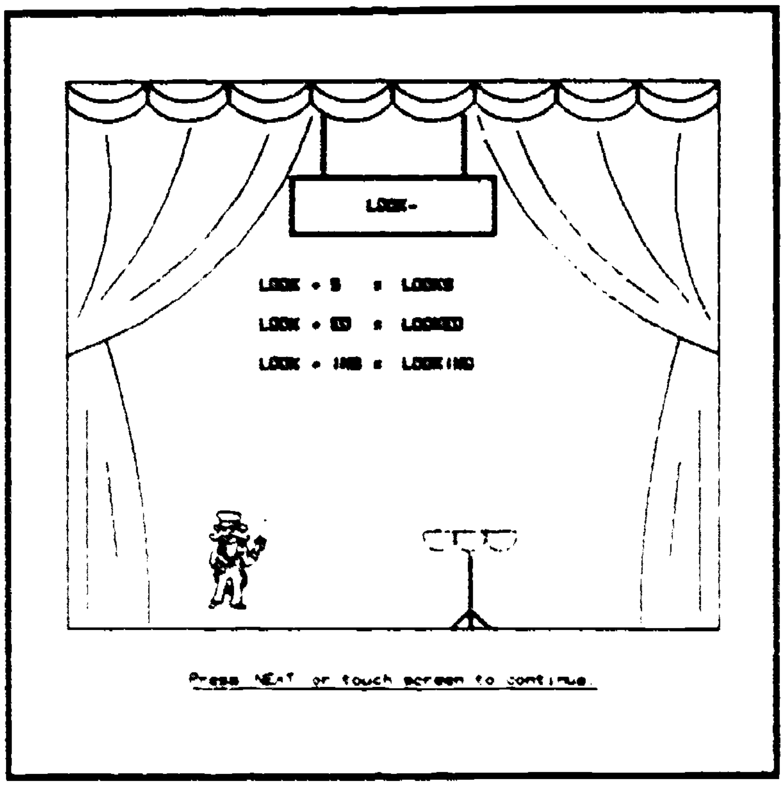

Figure 145. Simple Verb Endings, by Robert Caldwell and Research for Better Schools. Copyright © 1979 by Control Data Corporation.

University Parallel Program

Computer-based instruction began in the University Parallel Program when four PLATO terminals were installed at the Georgetown campus of Delaware Technical and Community College during the fall of 1980. Since that time, the use of PLATO lessons has been incorporated in forty-five courses. Four PLATO terminals were installed at the Wilmington campus to serve the students in the Parallel Program who have enrolled in courses that use the PLATO system.

In addition to using programs from the PLATO library, faculty members in the parallel program have begun to develop their own lessons. Figure 146 shows part of a lesson that deals with sociology as a science. Students are given a theory for which they must write testable hypotheses. They must also design a survey to test their hypotheses.

The Parallel Program's Department of Philosophy has developed a lesson that teaches categorical syllogisms in a logic course. Figure 147 shows how students are introduced to the concept of categorical syllogisms.

In the spring of 1982, a CBE classroom was built into the new library building at the Georgetown campus of Delaware Technical Community College. The eight terminals in this facility will provide greater access to CBE for students, faculty and community members in lower Delaware.

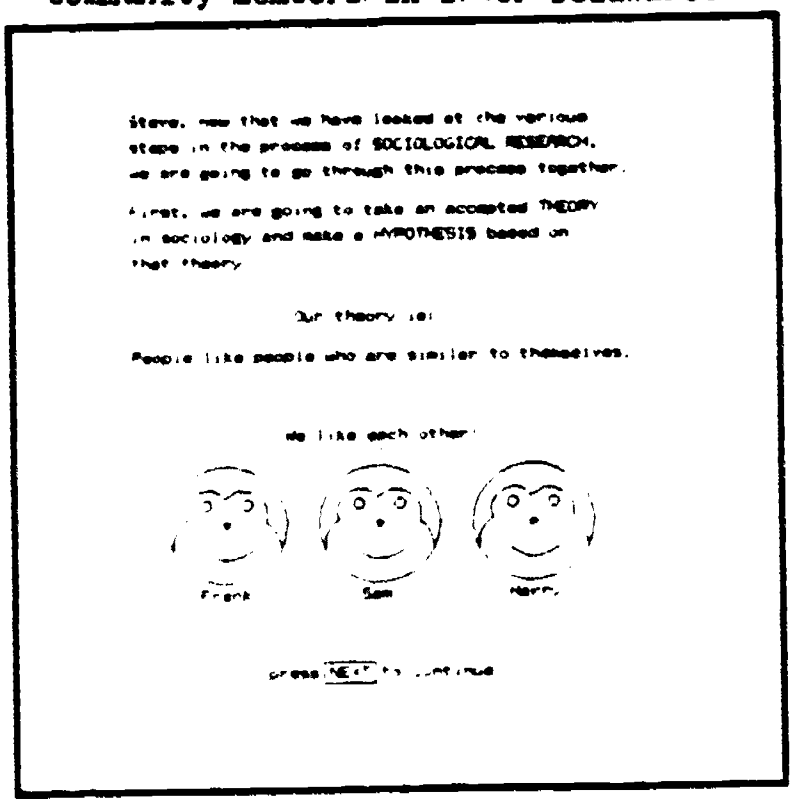

Figure 146. Sociology as a Science - Module 1, by Henry Nyce and Stephen Guerke. Copyright© 1981, 1982 by the University of Delaware.

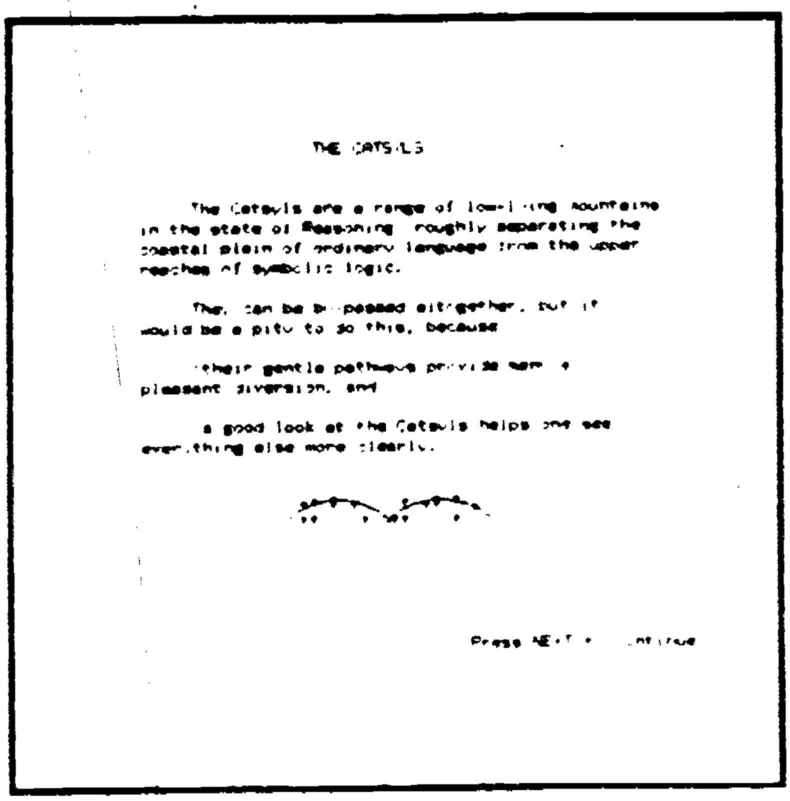

Figure 147. A Holiday in the Catsyls, by Joan West. Copyright© 1981, 1982 by the University of Delaware.

Urban Affairs

Students in the College of Urban Affairs are using lessons developed at the University of Illinois to further their understanding of a variety of subjects including statistics, population dynamics, decision making, and financial management.

Mathematics lessons give students an opportunity to learn and practice fundamental computations. These include working with matrices, eigenvalues, and eigenvectors, as well as statistical measures such as analysis of variance, Pearson product-moment correlations, and multivariate analysis.

The Population Dynamics Package provides students with data on demographic, social and economic variables for '30 countries. This information can be viewed separately or combined for comparison studies. The graphs display the data clearly, enabling the students to study trends and cycles.

The two displays shown below are from a lesson on population projection. Figure 148 shows how a student can change a population variable and observe the results in bar graphs. Following the student's instructions, the chart plotted on the left side of the display shows what the population of Japan would be in 1985 if a dramatic increase in the fertility rate were to occur, whereas the projection of the population of Japan given the present value of that parameter is shown on the right side of the display. Figure 149 shows how the student can compare the projections for two different countries. In this case, the student has asked to see the

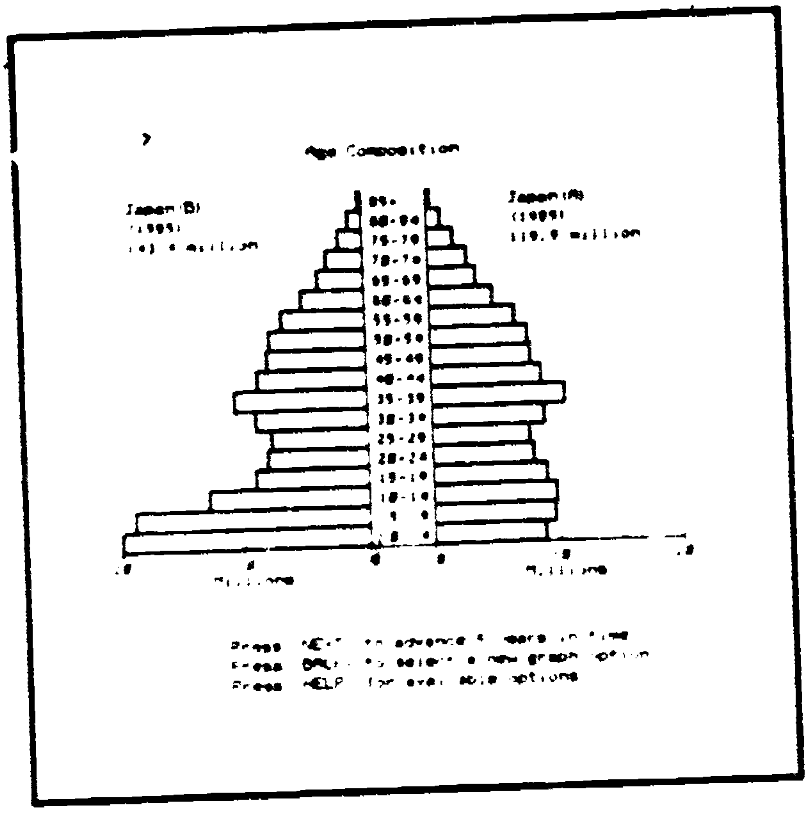

Figure 148. Population Projections, by the Population Dynamics Group. Copyright © 1975 by the Board of Trustees of the University of Illinois.

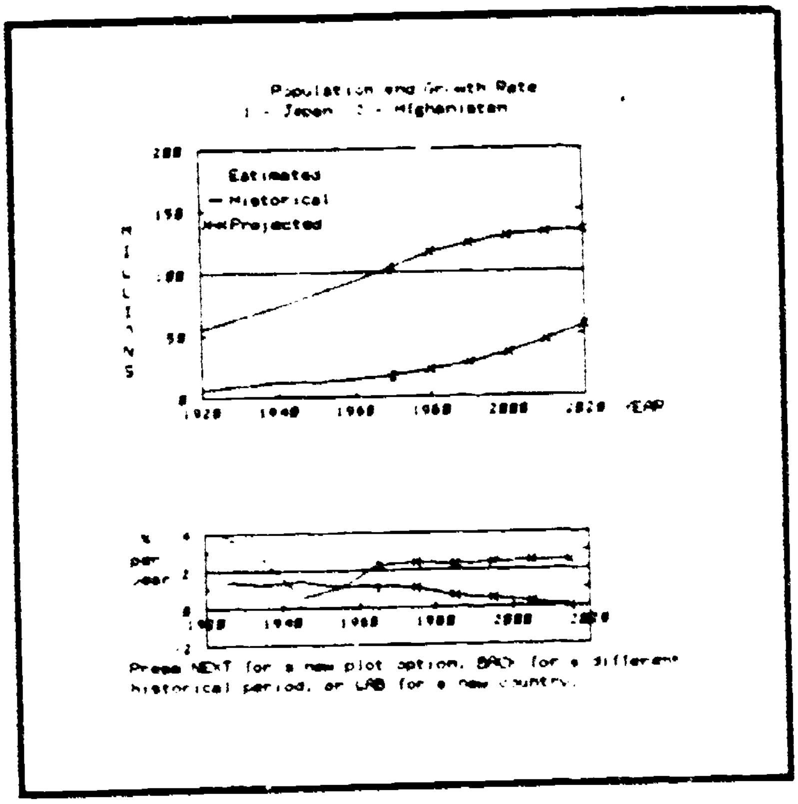

Figure 149. Historical Population Growth, by the Population Dynamics Group and R. Rutherford III. Copyright © 1976 by the Board of Trustees of the University of Illinois.

projections for the populations of Japan and Afghanistan using current demographic parameters. As with the previous example, the student can change the demographic parameters and observe how these changes affect the populations.

Many of the management and decision-making lessons present the student with a typical conflict that be resolved by a manager. These simulations help the student develop managem. skills. Topics include time management, women in the work environment, appropriate interaction and feedback for others, and dealing with people you supervise.

Students use a financial management package that enables them to learn and apply the fundamentals of accounting. Students are presented with information on the functions of accounting, cost analysis and reporting, planning and budget control, and financial analysis. They practice and apply these accounting principles in tests and review lessons. Figure 150 shows a typical question that tests the student's knowledge of entering transactions to a T-account. In figure 151, the student is learning how to interpret creditor analysis ratio results.

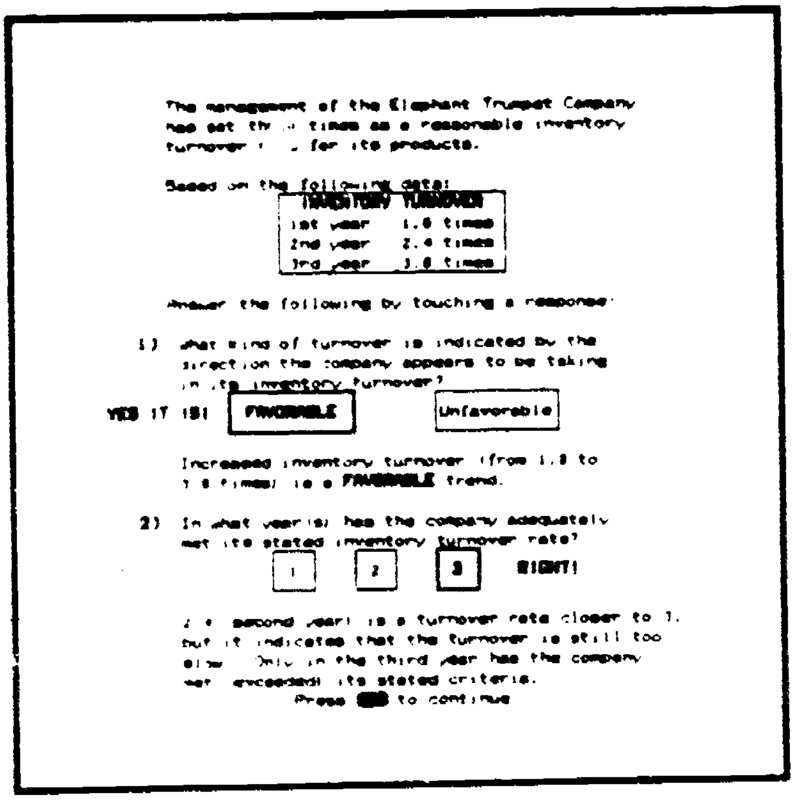

Figure 150. Financial Management Package. Copyright © 1977 by the Control Data Corporation.

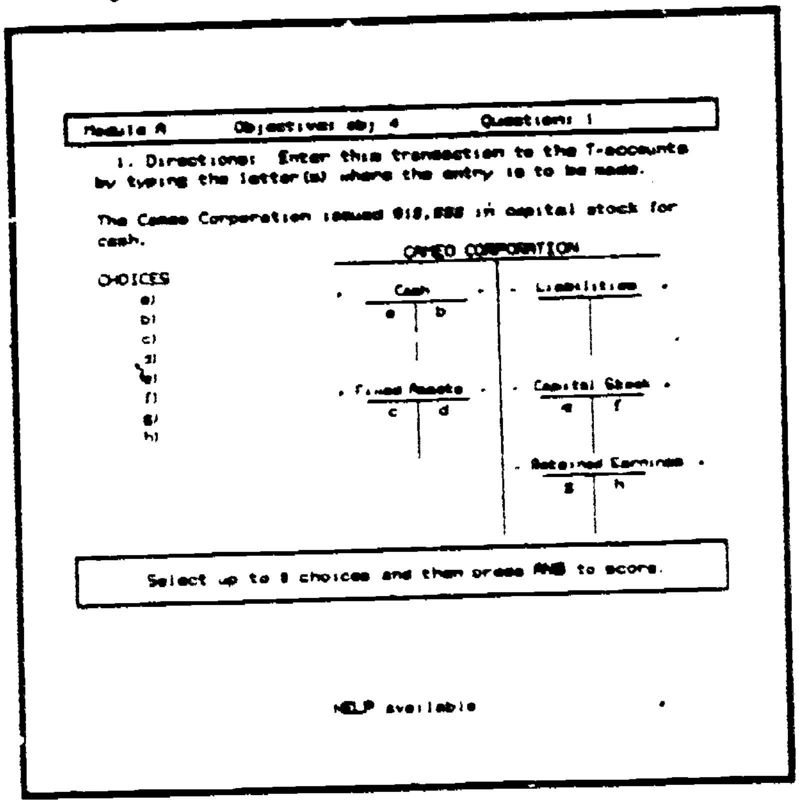

Figure 151. Financial Statement Analysis, by R. Schmidt and M. Zsuffa. Copyright © 1977 by the Control Data Corporation.

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Utilities

Since the beginning of OCBI, staff members have written lessons that are independent of specific academic disciplines and are in some cases not directly instructional in nature, but which provide a valuable service to University students, faculty, or staff. Seven such lessons, called utility lessons, are described here.

The first lesson has been very helpful both to faculty and to students who are new to the PLATO system. Entitled "How to Use PLATO," this lesson offers an interactive introduction to many features of the PLATO system, including the touch panel and the special function keys on the terminal keyset. Faculty members may select which sections of the lesson are appropriate for the students in their courses. A language professor, for example, would be interested in teaching students how to specify vowel and consonant markings in their responses, whereas a professor of mathematics would want students to learn how to type complex numerical expressions. Figure 152 shows a sample display from the lesson in which students are taught how to use the DATA and LAB special function keys.

The second utility lesson is the "Questionnaire System," which allows easy entry of survey items in both multiple-choice and open-ended formats. Questionnaires constructed and administered on the PLATO system typically ask students to evaluate specific instructional lessons or the appropriateness of incorporating lessons into course syllabi. Figure 153 shows how a student responds to an open-ended question that asks what was liked about using the PLATO system.

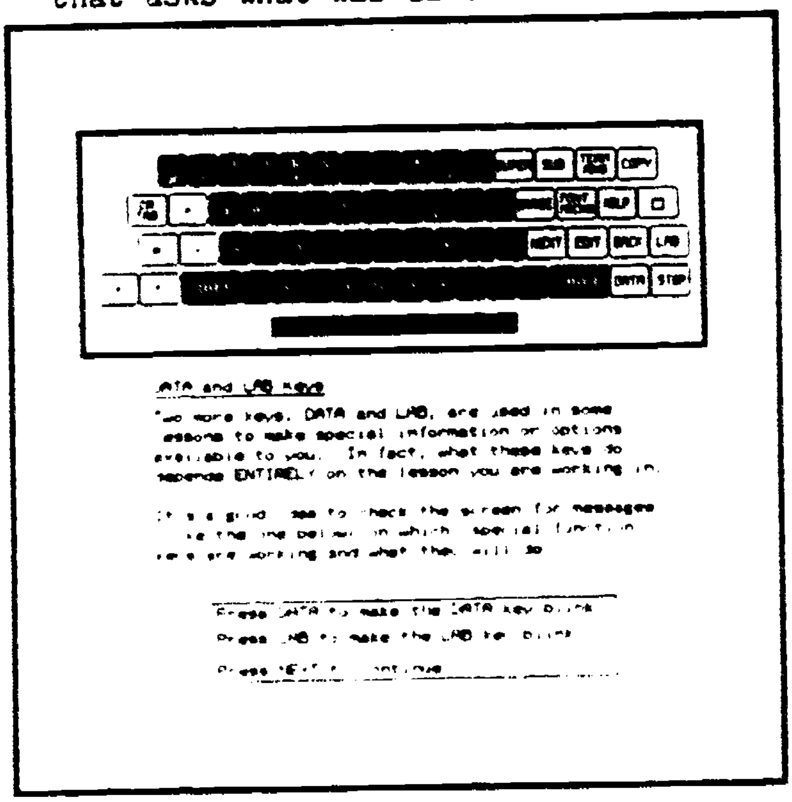

Figure 152. How to Use PLATO, by Jessica R. Weissman. Copyright © 1976, 1977, 1979 by the University of Delaware.

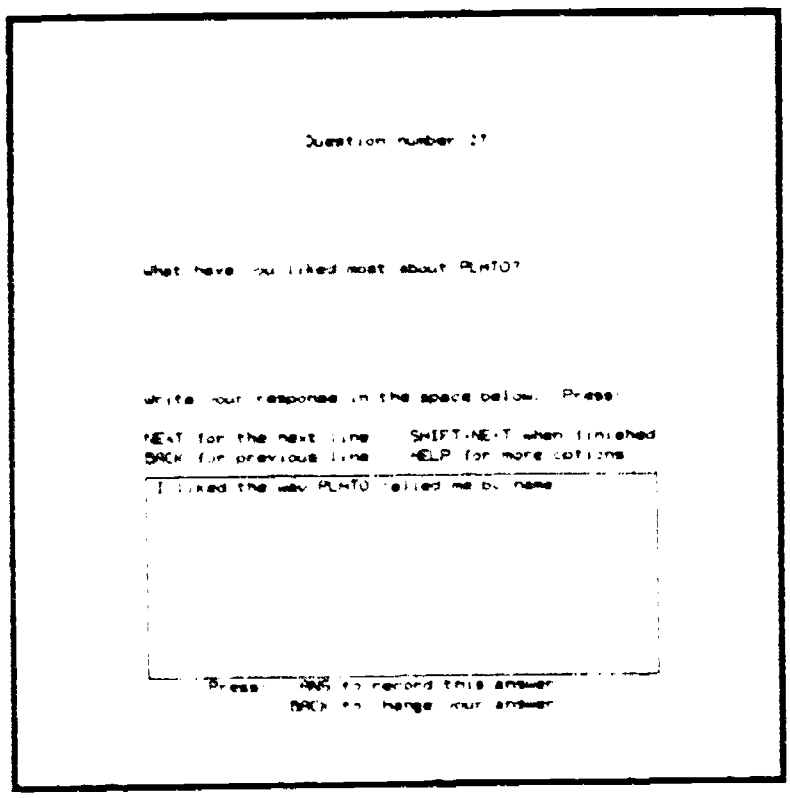

Figure 153. PLATO Users Question Survey Package, by Daniel Tripp and Bonnie A. Seiler. Copyright © 1978, 1979, 1980 by the University of Delaware.

After administering a questionnaire, a faculty member can look at all responses to open-ended questions and at summary data on multiple-choice format questions. Summary data includes for each question the total number of responses, the mean response, the standard deviation, the number of times each response was given, and the percentage of the total number of question responses represented by the number of times each response was given.

The third utility is a set of lessons developed at the University and used extensively by students, faculty, and staff. Entitled "The Lesson Catalog System," these lessons allow PLATO users to create, maintain, and use lesson catalogs. Each catalog can be a simple index of lessons or may contain a major index with several subindices, and multi-page descriptions of each lesson may also be included. These lessons provide the capability to format and print an off-line catalog as well. When a catalog is set up as a router for students, a menu of lesson choices from which students may freely choose is available, and a record is kept of student progress.

More than fifty catalogs that group lessons by subject matter have been compiled on the Delaware PLATO system to aid users in locating lessons they would like to use. Figure 154 shows the first page of a catalog that consists of lessons developed at the University. This catalog has been divided into several subindices called categories that make it easy to find lessons in a particular academic discipline. If users choose option "a," accounting lessons, they will be taken to an appropriate subindex where they may choose a particular accounting lesson.

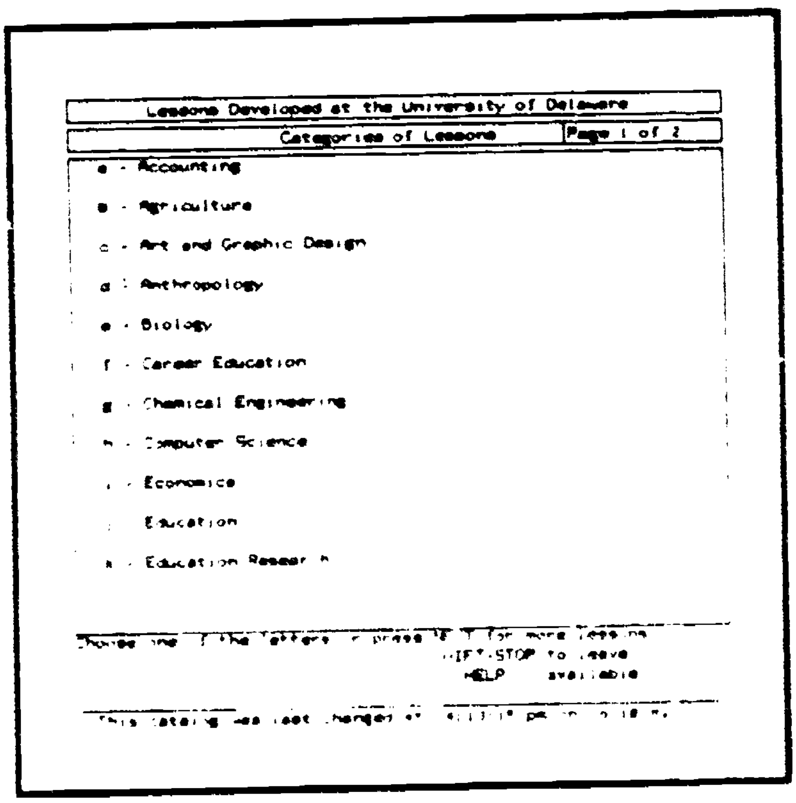

Figure 154. Lesson Catalog System, by David G. Anderer. Copyright © 1978, 1979, 1980, 1981 by the University of Delaware.

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The fourth utility is called "Classroom Scheduler System" and is a set of utility lessons used by OCBI staff to coordinate group and individual reservations to use terminals in the three major PLATO classrooms. These lessons help classroom site directors allocate terminal resources efficiently and ensure that a classroom is never over-booked. Several informative displays are available, including a daily schedule of reserved terminals, a list of available terminals, and a weekly schedule of classroom assistants.

A related fifth set of utility lessons collects data on the number of terminals used each hour at each PLATO site and the amount of computer memory used during that hour. This information is used in making decisions on placing terminals where they can be used most effectively and on optimizing scheduling arrangements. Figure 155 shows a sample display of terminals used, memory used (in thousands of computer words), and percentage use of computer resources on one day. This set of lessons interfaces with the classroom scheduling lessons to facilitate comparisons of scheduled usage and actual usage.

The sixth utility lesson was developed for Office use to allow part-time employees to record hours worked, broken down by work activity. At the end of each pay period, payroll report forms are printed and submitted to the University payroll office. The program keeps a record of hours and funds allocated to part-time employees, the total amount claimed from each authorized project account, and the work history for each pay period. Figure 156 shows information for a fictitious employee.

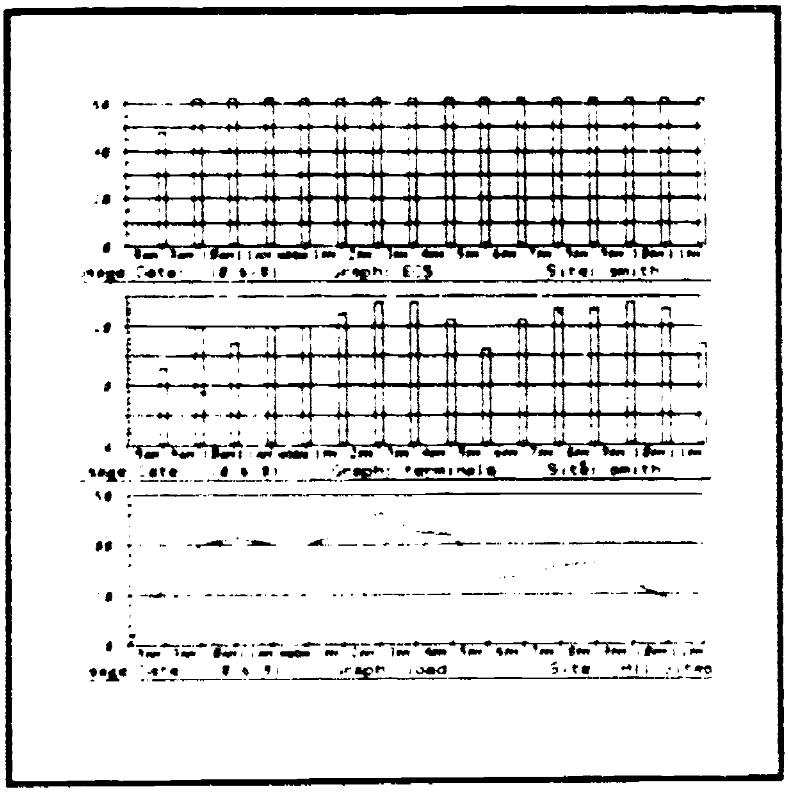


Figure 155. UD Usage Summaries, by James H. Wilson. Copyright © 1978, 1979 by the University of Delaware.

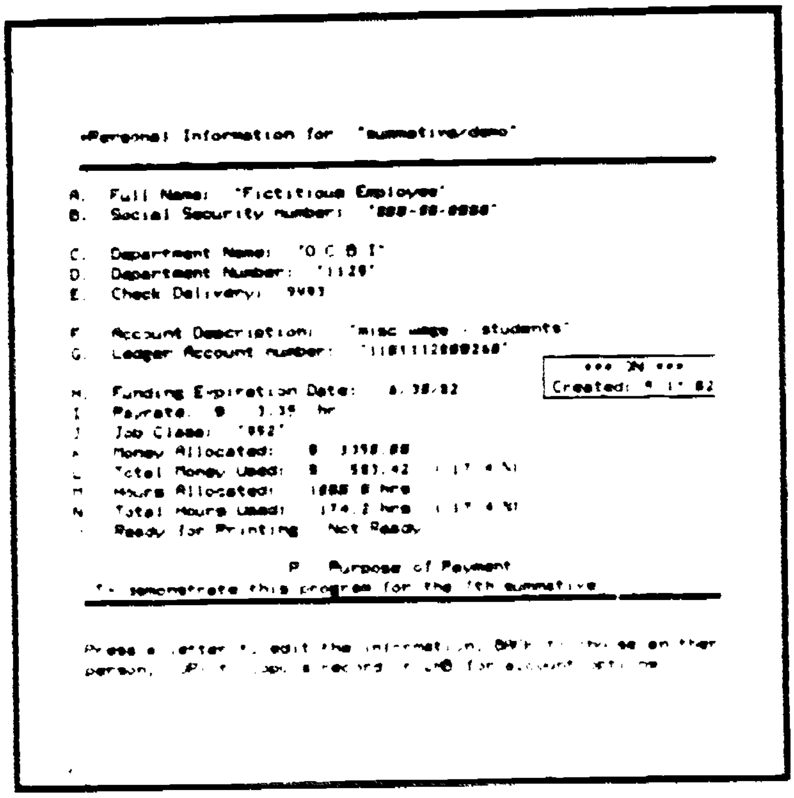


Figure 156. Time Reporting Forms, by Michael Porter. Copyright © 1980, 1981, 1982, 1983 by the University of Delaware.

The seventh utility lesson was also developed for Office use to allow administrators to prepare current and revised budgets in a detailed format reflecting Office purchasing patterns, to enter and track financial transactions, and to project total fiscal year expenditures based on year-to-date expenses and commitments. Figure 157 shows a new transaction that a manager is adding.

Several other utility lessons have been developed including a diagnostic test question driver, an equipment inventory, an appointment reminder, editors for memos and other short documents, and lessons that record the maintenance history of all CBI equipment.

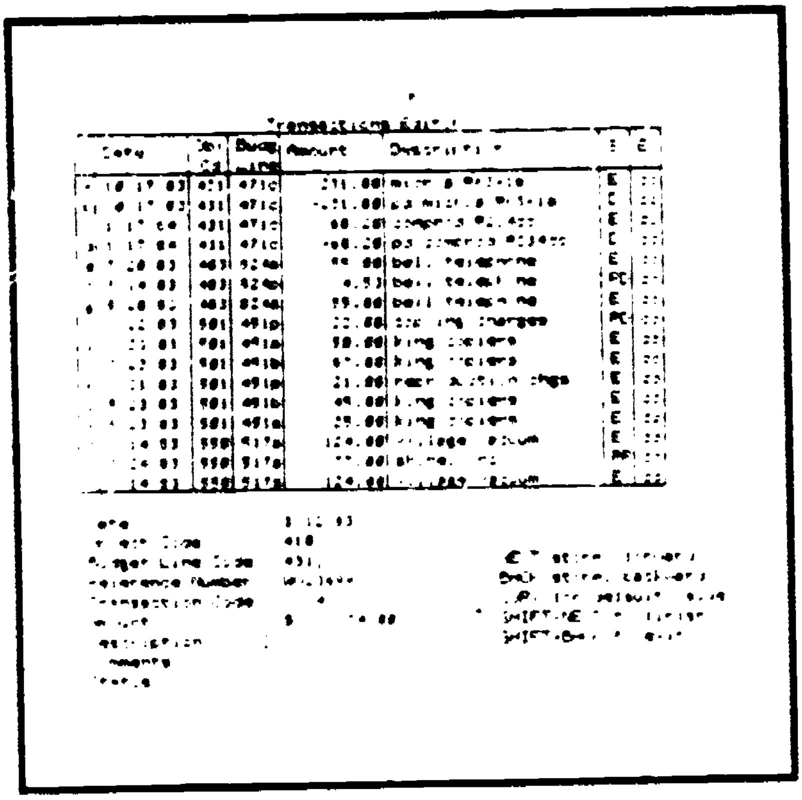


Figure 157. Budget Management Package, by Amy Sundermier, Bonnie A. Seiler, and Sharon Correll. Copyright © 1982, 1983, 1984 by the University of Delaware.

Water Resources

The Agricultural Engineering Project is developing a computer-based information program called "Stormwater Management Alternatives--A Computer-Based Program for the Selection of Techniques to Mitigate the Impacts of Urban Stormwater" on the IBM Personal Computer. The program will function as a technology transfer tool affording users the opportunity to explore alternatives by providing information on possible impacts of proposed land development plans, mitigation principles, and suitable practices. Potential users of the information base include public planning commissions, engineering consulting firms, colleges, universities, and public libraries.

Wellspring Health Education Project

The health education project officially started in November of 1979 by sponsoring a notesfile called "sexednotes" in which students can discuss sexually-related questions. Specially trained sex-education peer educators read and respond to these notes on a regular basis. A multiple sign-on allows easy student access to "sexednotes." Use of this file was so successful that a series of notesfiles has been established and is now being used. In 1980 two notesfiles were added. "Sexual Offense Notes" is monitored by S.O.S. members of the campus rape crisis group and "Interpersonal Relations Notes" is checked by peer educators. In 1981 two more notesfiles were added; student clinical dietitians oversee "Nutrition Notes," and an alcohol educator monitors "Alcohol Abuse Notes". Student use and demand necessitated the addition of three more files in 1984; "Stress Management" is monitored by professionals on campus, "Fitness Notes" is checked by trained peer fitness educators, and "Eating Disorder Notes" is under the supervision of professionals and peer educators. All eight of these files allow students to write notes anonymously, a feature that contributes greatly to their widespread use. In addition to notesfiles, a number of lessons are available from the student/sexed sig· on, some from existing courseware and others developed by the health education pr· ject as shown in figures 158 and 159.

The health education project has also completed a lengthy series of lessons on contraception that is currently in the evaluation stage. Over seventy comments have been collected from the students to help perfect the lessons. The index page for

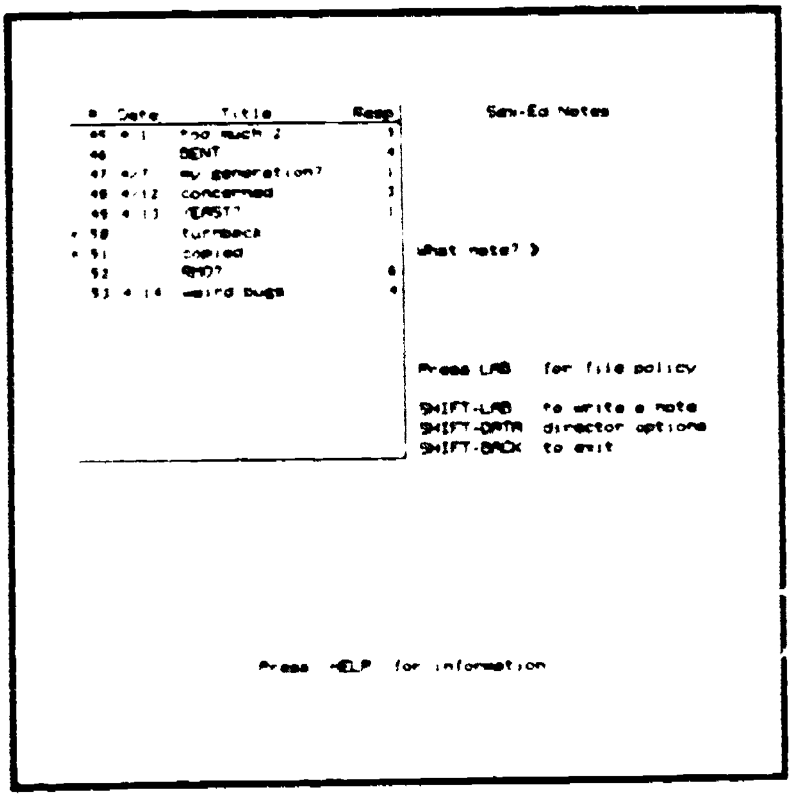


Figure 158. Sex Education Notes, by Anne Lomax and the Sex Education Peer Educators. Copyright © 1980 by the University of Delaware.

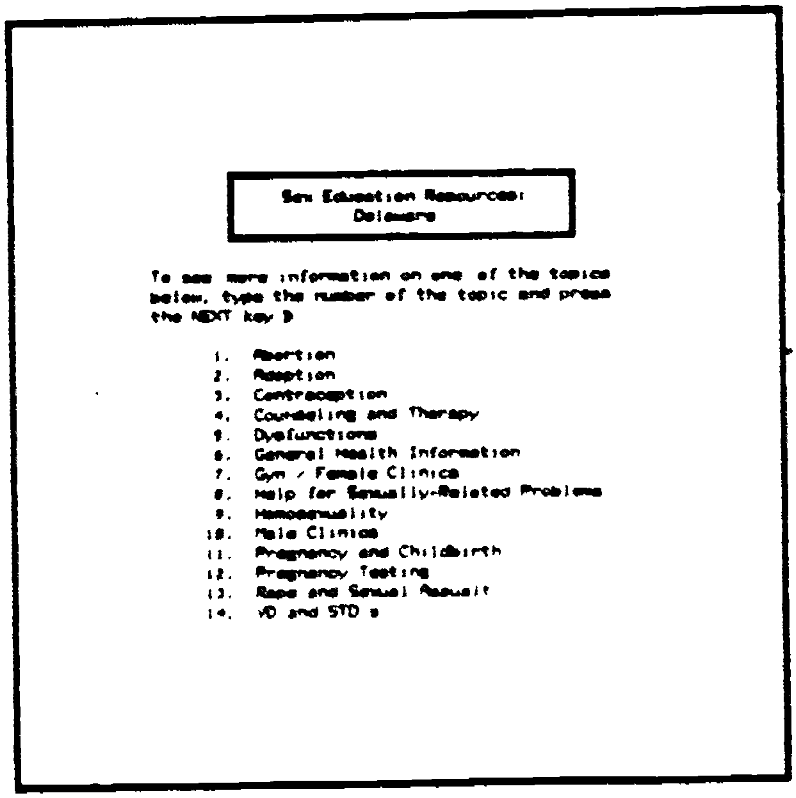


Figure 159. Sex Education Resource Network, by Anne Lomax, Mark Laubach, and Daniel Tripp. Copyright © 1980, 1982, 1983 by the University of Delaware.

these lessons and a sample display are shown in figures 160 and 161, respectively. Each lesson includes information on general points, methodology, effectiveness, advantages, disadvantages, and reversibility. Another lesson in the series, "Contraception: Choosing a Method That's Best for You," provides the user with information about the decision-making process involved in choosing a form of contraception.

A lesson on alcohol use and abuse is now under development. "Thinking About Drinking: a Compendium of Alcohol Information" provides factual information on alcohol and its effects on the human body.

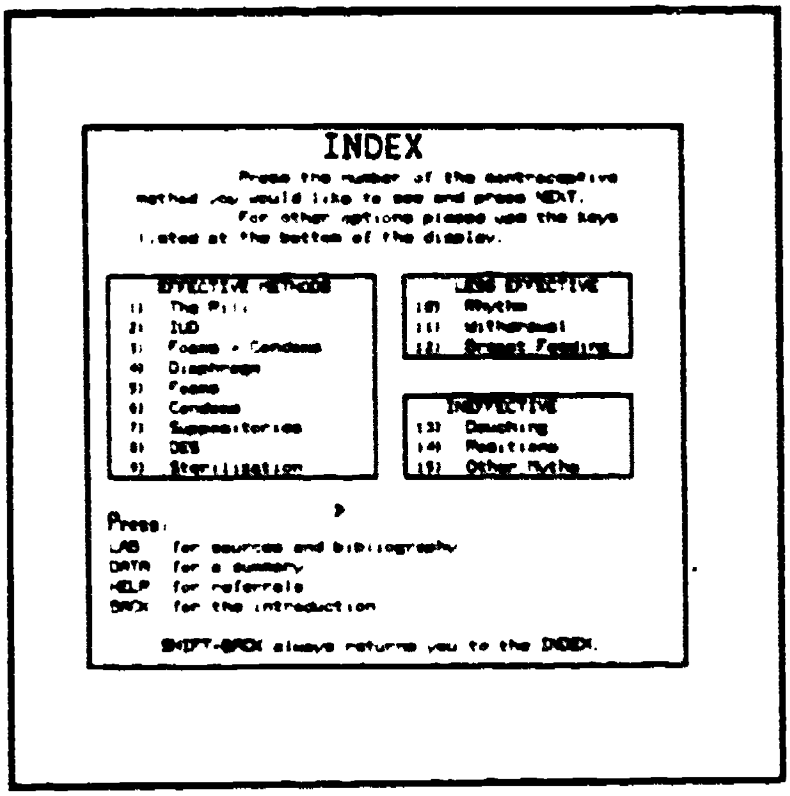


Figure 160. Contraception, by Ivo Dominguez, Jr. and Anne Lomax. Copyright © 1980, 1982, 1983 by the University of Delaware.

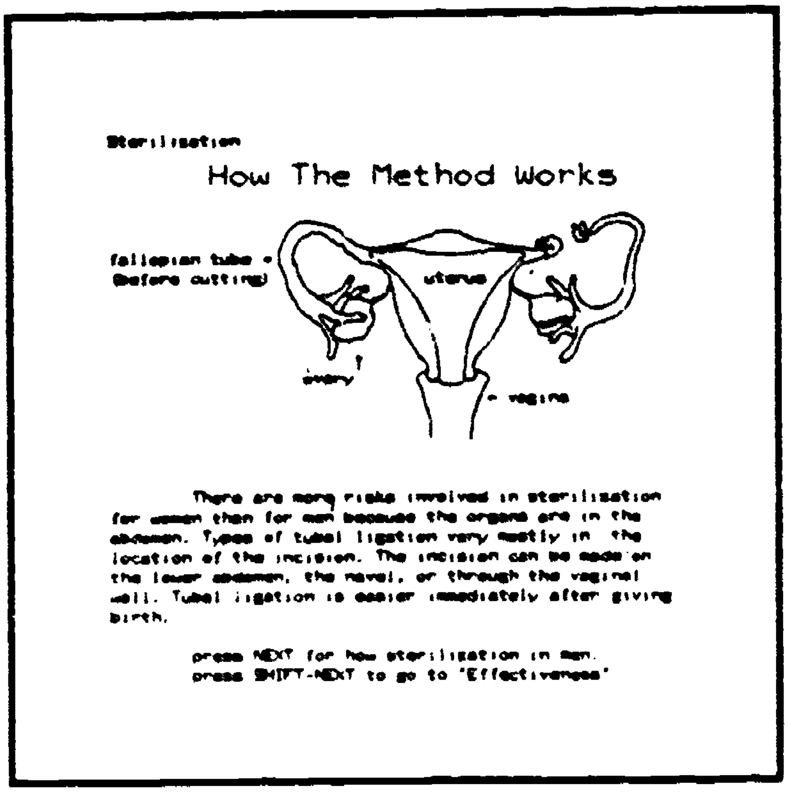


Figure 161. Contraception, by Ivo Dominguez, Jr. and Anne Lomax. Copyright © 1980, 1982, 1983 by the University of Delaware.

CHAPTER III. OUTSIDE USER APPLICATIONS

In addition to supporting campus use, the Office of Computer-Based Instruction offers a variety of services to users outside the University such as elementary and secondary schools, hospitals, government agencies, businesses, other universities and nearby communities and community agencies. These services include the following:

- Subscriptions for computer services
- Courseware development
- Workshops
- Consulting services
- Demonstrations
- Use of University classroom facilities
- Programming and design courses for junior and senior high school students
- Terminal loans

Detailed information about these services is contained in a brochure which can be obtained from our Customer Services Specialist by calling (302) 451-8161. Information about what some of the University's outside users have been doing with CBE is reported in this section as follows.

Pre-College Activities

Class Demonstrations and Public Use

During the 1983-84 academic year, teachers of more than one thousand pre-college students arranged to have their groups visit the University campus in order to use OCBI computer learning facilities. In addition to regular elementary and high school classes, students visited from science clubs, special education groups, gifted student programs, and nursery schools.

Many more students used the PLATO system on Friday evenings and on Saturdays, when the Willard Hall PLATO classroom is open to the general public (pre-college students must be accompanied by a parent). It was a common sight to see a parent and child sitting together in front of a terminal playing a math game.

New Castle County Vocational-Technical School District

The Howard Career Center's Academic Skills Center, under the direction of Ms. Vicki Gehrt, has been using the PLATO system since July of 1978. Because this program was so successful, Ms. Gehrt expanded it to include the Instructional Skills Lab at Delcastle Vocational School in September of 1980.

Students at both schools are using the Basic Skills Learning System as well as vocational lessons such as the group of lessons available in the package titled "How to Select and Get a Job." Figure 162 is a display from a lesson that teaches students how to fill out a job application. In this part of the lesson, the student is asked to identify the mistakes made on the application. In addition, gifted and talented students at both schools are using PLATO lessons for educational enrichment and exploration. Figure 163 shows a display from a lesson in the Basic Skills Learning System mathematics curriculum, in which students are able to proceed through the material at their own pace.

Pre-College Programming Courses

For the past seven years, summer programming courses have been held for high school students. During these four-week courses, each student plans and programs a lesson in an area of personal interest. Lessons have cover 1 such topics as algebraic equations, units of measurement, and music. Several games have been written, as well as a test grade averager.

An advanced course has also begun in which students who have completed beginning programming work on projects of their choice with the teacher serving as a consultant.

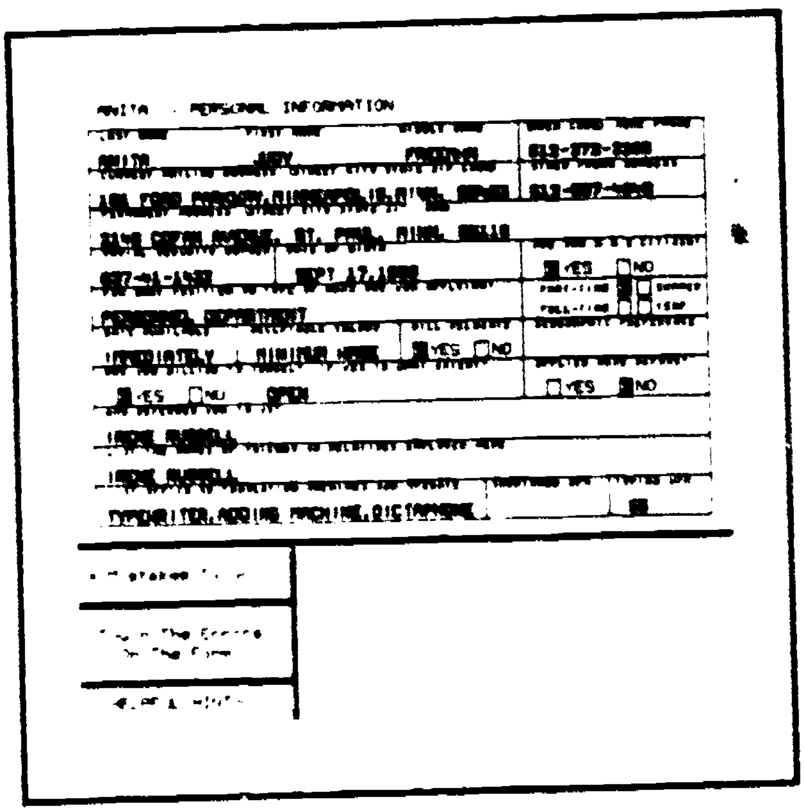


Figure 162. How to Select and Get a Job, by James Vetsch, Karen Newhams, Kenneth Burkhardt, et al. Copyright © 1978 by the Control Data Corporation.

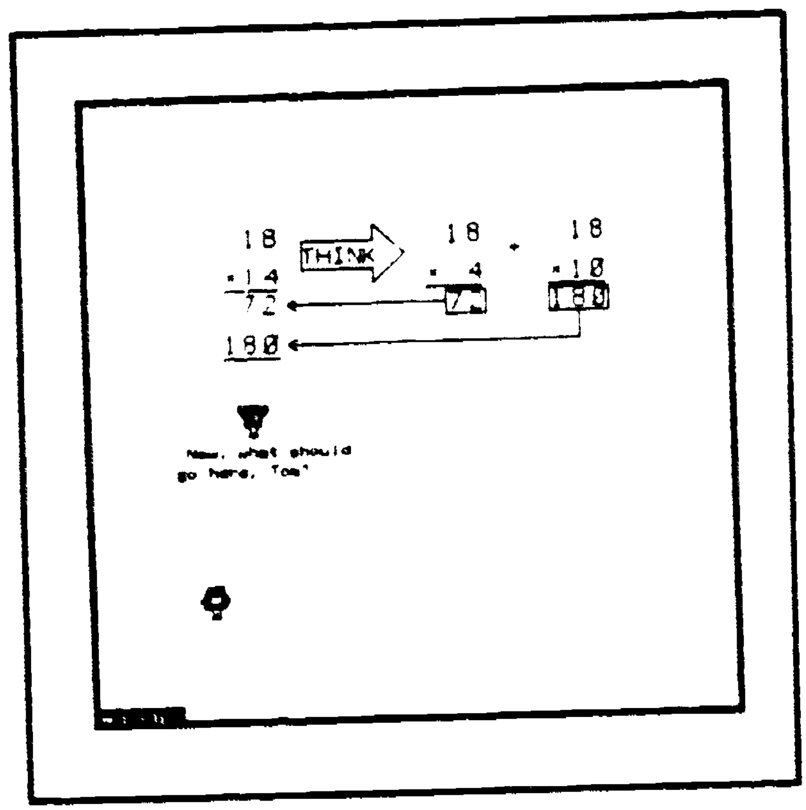


Figure 163. Basic Skills Learning System: Multiplication Skills, Part 7, Cluster 12, Tutorial, by Ralph Heimer. Copyright © 1978, 1979 by the Control Data Corporation.

Saturday Morning Math Program

The Saturday Morning Math Program continued to be offered during 1983-84 to students in grades five through eight. Sponsored by the Mathematical Sciences Teaching and Learning Center, the program permits students to work on a variety of math-related materials and activities and makes significant use of the University's educational computing facilities.

Emphasis is placed on sharpening students' problem-solving skills and on helping them enjoy mathematics. Students engage in both individual and group activities. Individual work corresponds to each student's current level of skill in whole numbers, fractions, decimals, percents, beginning algebra, and word problems. Group activities afford students the opportunity to share and compare a variety of problem-solving strategies.

The program is supervised by a steering committee consisting of Dr. Ronald H. Wenger, Director of the Mathematical Sciences Teaching and Learning Center, Dr. William B. Moody, Professor of Mathematics and Education, and Dr. James Hiebert, Assistant Professor, Educational Development. The program provides an opportunity for University students in mathematics education to gain practical experience in using technology for instruction.

Saturday Morning Music Program

The Saturday Morning Music program provides low-cost music instruction to the public. Sponsored by the Department of Music, all teaching is done by university music students. Saturday Morning Music uses two CBE sites located in the music building, namely, the Atari laboratory and the PLATO classroom. The former is used to deliver the Atari Music Learning System to younger students aged 9 to 13. The PLATO classroom is used for adults.

Upward Bound

Since the summer of 1980, the University's Upward Bound program has made individualized instruction via the PLATO system a regular part of its concentrated on-campus program for academically promising urban high school students. Students use terminals on campus to study lessons in mathematics, English, science, and career counseling.

The objectives of the Upward Bound PLATO project include the following:

- Exposure to computers as a learning tool
- Extensive individualized instruction via the PLATO system
- Orientation and training of Upward Bound teacher aides in the capabilities of computers for instruction, record keeping, and motivation

The Du Pont Engineering Design Division

The Process Control Computer Group of the Engineering Design Division worked with OCBI's Customer Courseware Group to put its software standards on-line. The process control group develops software that drives a large number of process control computers located in Du Pont and non-Du Pont plants. It has a high turnover of programmers and a strong need for standardization of coding practices. At present, it relies on one of the heads of the group and on a printed manual to teach software standards. By putting the software standards on the PLATO system, the group hopes to meet three goals:

1. To teach the standards in a more uniform and effective manner;
2. To be able to update the standards easily, since they will be on-line; and
3. To free the time of the employee who is currently doing the bulk of the teaching

The Design Division Training Committee has completed its work with OCBI's Customer Courseware Group to adapt the Project System HOW reference manual to be used on the PLATO system. This manual introduces new employees to Project System procedures and is used to update veteran employees. Because the manual is revised frequently, the PLATO program is designed to allow Du Pont employees to enter content changes easily.

The Design Division has also completed a one-hour project with OCBI's Customer Courseware Group to introduce their Process Piping Evaluation Program (PROPEP) to new employees as well as update veteran employees. PROPEP is designed to determine pressures, flows and temperatures for liquids, gases and steam in piping networks. Because PROPEP is so extensive, the PLATO program was developed to provide a non-threatening and painless guide for the employee.

In addition, the Design Division is working with the Customer Courseware Group in developing an hour-and-a-half PLATO program on Pressure Relief Valves. There are industry standards pertaining to pressure relief valves that are continually undergoing revision. This program is designed to provide a convenient reference source to inform and update engineers of these revisions and to train engineers in the skills required for relief valve installation.

The Du Pont Engineering Services Division

The Occupational Environmental Control Group is currently working with OCBI to develop a one-hour introduction to its Fundamentals of Industrial Hygiene course. This overview will be used both in plants around the country as preparation for the course and with students taking the Fundamentals course itself. Student response to the one-hour course will be used to evaluate the PLATO system for further use in industrial hygiene training programs.

The Du Pont Experimental Station

The Du Pont Experimental Station has made the PLATO system an integral part of a newly developed Laboratory Technician Training Program. The PLATO system was chosen not only because of its innovative teaching qualities, but also for its PLATO Learning Management (PLM) capabilities. Currently forty-one PLATO terminals connected to the Delaware PLATO system are used by the trainees in this program. PLM is used to manage and record trainee study and testing results. The University PLATO consulting services are being used on an as-needed basis.

The Du Pont Engineering and Mechanical Crafts Division

Also located at the Experimental Station, Du Pont's Engineering and Mechanical Crafts Division is using three terminals to manage trainees in eight crafts. Functions of the management package, developed for Du Pont by OCBI's Customer Courseware Group, include storing basic training information about each trainee (such as source of hire and supervisor's name), tracking trainee progress through the curriculum and recording test scores, keeping trainee attendance records, scheduling testing, and preparing testing notices for both the trainee and the supervisor. OCBI also developed a package for the Crafts Training Group that allows trainees to take tests on-line. Eventually, the testing package will be linked directly to the management package so that scores can be recorded directly.

Mary Campbell Center Project

In the fall of 1982, OCBI, working with instructors from the University's Writing Center, placed a PLATO terminal as a public service in the Mary Campbell Center in Wilmington. This is a residential facility for multiple handicapped adults.

The objectives of this project are listed as follows:

1. To make computer-based instruction available to the multiply handicapped
2. To bring PLATO to students who would have great difficulty in coming to the University
3. To increase the skill levels of the handicapped (motor, cognitive, and content)
4. To enable students to work toward the GED (General Education Degree)
5. To decrease cultural isolation on the part of the handicapped by making them part of the computer age

All of the residents have taken motor and cognitive skill tests, and appropriate materials were chosen to develop a computer-based instructional curriculum for four levels of competency. At some of these levels, a specific assignment is made in basic skills math or reading. When this assignment is completed, the resident may choose to work on an instructional game.

Two of the residents became so confident in using the terminal that they have volunteered to assist other residents in using it. Through this work, one has earned the final credits required to complete his GED program.

This project has been continued through the 1983-1984 academic year, and it has expanded to include microcomputers. The Mary Campbell Center has purchased an Apple IIe computer system and a CONRAC large screen monitor which is invaluable to residents with visual impairment.

Donors have contributed an Apple III computer system, a laser disk player, and numerous software packages. A computer room is included in the plans for a new wing to the existing building. These additions emphasize the importance that is placed upon this project by the residents and staff of the Mary Campbell Center and its supporters.

NASA-Lewis Research Center

The User Support Group of the NASA-Lewis Research Center is using its one PLATO terminal to review available courseware, which will be used for computer training and orientation of new employees. Currently, users receive instruction in mathematics, FORTRAN, chemical engineering, physics, art, graphic design, and statistics.

New Castle County Learning Center

The New Castle County Learning Center, sponsored by the Christina School District, began using the PLATO system in December of 1980. Under the direction of Laura Anderson, the Center's ten terminals are used to deliver lessons in the Basic Skills and General Educational Development (GED) Learning Systems and job seeking skills to participants in its adult education program. The GED package is designed to help students prepare for and pass high school equivalency exams. Figure 164 is an example taken from a learning activity in the general reading curriculum. This activity is taken after the students have completed an inventory test to reinforce learning about implied main ideas.

Newark Free Library

In July of 1983 the Newark Free Library installed its first PLATO terminal under a grant from OCBI. The terminal serves a twofold purpose. First, it provides educational service to the community, and second, it supports a faculty research project.

OCBI personnel trained Library staff in use of the terminal and methods of assisting

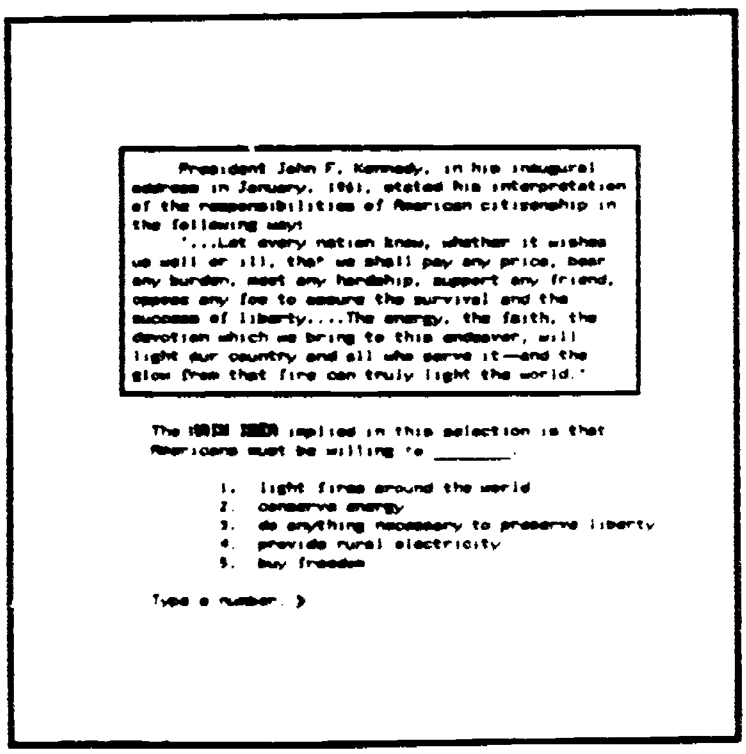


Figure 164. Identifying the Main Idea When It Is Implied, by Robert Caldwell. Copyright © 1979 by the Control Data Corporation.

new users. Patrons also have access to printed and electronic instructions. Reservations for terminals are made in person for one hour sessions. Non-scheduled time is available on a first come, first served basis.

Professor James Morrison is conducting research on public use of the Newark Free Library terminal. Data on terminal usage is collected from the PLATO network and from a questionnaire prepared by Dr. Morrison. Data collected so far shows heavy usage; the public uses the terminal for an average of 51 hours per week. The data also shows that users are a heterogeneous group, most of whom have no problems using the computer terminal.

The installation of PLATO in the library initiated a great deal of newspaper and radio publicity and has been symbiotic.

Philadelphia Prisons

The Computer-Based Education Program at the Philadelphia Prisons uses seventeen PLATO terminals to deliver the Basic Skills and General Educational Development Learning Systems to approximately one hundred inmates on a daily basis. Nine terminals are located at the House of Correction -- eight in the male division and one in the female division. Eight terminals are located at Holmesburg.

Inmates desiring to enter the program must have a fourth-grade minimum reading ability and at least two months of incarceration remaining. Figure 165 shows the typical sequence a student follows after applying for admission to the program.

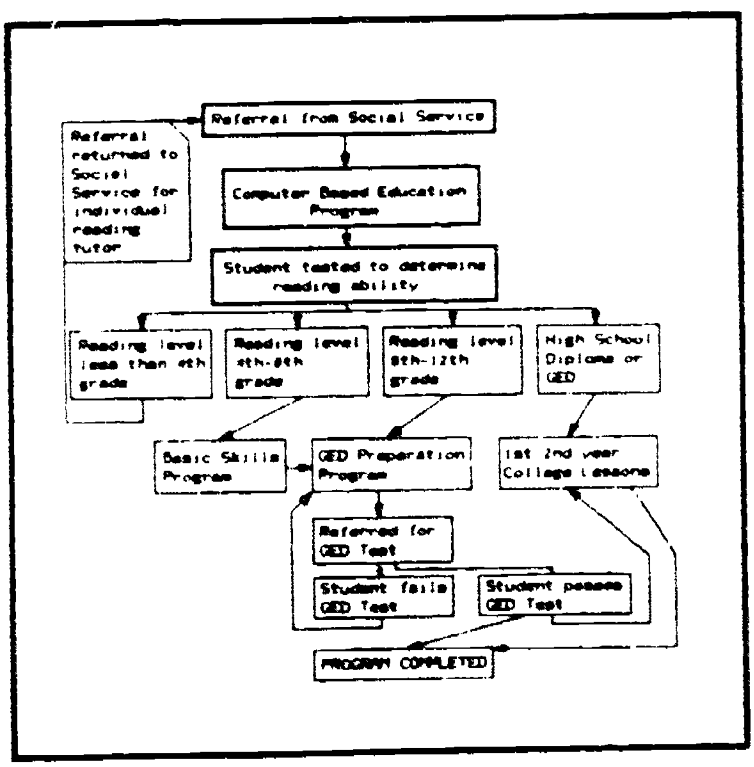


Figure 165. Computer-Based Education Procedure Manual--Philadelphia Prisons, by Edward Szymanski. Copyright © 1982 by the City of Philadelphia.

OCBI's Customer Courseware Group is working with the Philadelphia Prisons to develop a sixty-minute PLATO program on computer literacy. This program will inform inmates about the developmental history of computers, computer terminology, peripherals, computer applications, computing languages, and careers in computing.

PSE & G

In 1983, the Public Service Electric and Gas Nuclear Training Center in Salem, New Jersey began using eight PLATO terminals and two Micro PLATO stations to provide computer-based instruction in nuclear plant operation.

PLATO lessons are also being used in computer literacy, management skills, thermodynamics and health physics. PSE&G plans to develop original lesson materials and PLATO Learning Management modules during 1984-85.

Small Business Development Center

In September of 1982, John Stapleford, Director of the Bureau of Economic and Business Research, received a grant from the Small Business Administration to start the Small Business Development Center. The Office of Computer-Based Instruction was involved in this grant in two ways. First, PLATO training courses were offered to owners of small businesses, and second, seminars on how to use microcomputers as business tools were offered.

The PLATO courses covered management, sales, marketing, accounting, personnel, and computers. During the first five months of the program, one hundred clients took these courses, which were offered free of charge under the grant using terminals in Newark, Wilmington, and Georgetown.

OCBI also offered a seminar in how to use microcomputers as business tools. This seminar was presented five times in OCBI's Apple classroom. The cost to SBDC clients was minimal since part of the tuition was paid by the grant. Response to this seminar was extremely positive. One hundred and four clients registered, and many others had to be turned away due to the lack of available seats. In September of 1983, the Small Business Development Center grant was renewed, and OCBI continues to deliver the PLATO training courses.

The Urban Coalition of Metropolitan Wilmington

In January of 1980, the University of Delaware placed PLATO terminals in three of the ten Urban Coalition Community Centers in Wilmington. The Urban Coalition offers many different kinds of services to minority group members such as basic skills instruction, job placement and counseling. People of all ages go to the community centers that have a PLATO terminal for basic skills training and access to the other program libraries. They are also using the General Educational Development Learning System that became available to them in 1981.

In September of 1980, the Urban Coalition obtained out-of-school basic skills funding from the U. S. Department of Education which enabled two additional PLATO terminals to be placed in two more centers. The coalition is continuing to seek funds to further expand its PLATO project.

Westinghouse Nuclear Training Services

In 1980, Westinghouse did a study of the potential benefits of computer-aided instruction for the training of nuclear reactor operators. This study recommended that a pilot program be established for further evaluation of CBI. The following year two PLATO subscriptions were purchased, and a survey of other available computer-based training systems was performed. The PLATO system was selected for a more extensive pilot program, and the development of lesson material for Westinghouse-specific purposes started in 1982. To extend delivery capability to multiple sites, Westinghouse acquired eight more terminals equipped with long distance modems. These terminals are now in daily use to deliver nuclear reactor operator training programs at Westinghouse training centers in Pittsburgh and Chicago. To date, Westinghouse has developed lessons on nuclear reactor safety systems, plant electrical systems, and special subjects for reactor operators.

CHAPTER IV. RESEARCH AND EVALUATION

Because of its developmental nature, the Office of Computer-Based Instruction regularly conducts a rigorous internal evaluation. Student opinions are highly valued and are collected in a systematic manner. Controlled experiments are conducted to test the effectiveness of new lesson materials. Project leaders prepare bi-monthly project reports that are used in monitoring program development throughout the year, and a list of the principal values that CBE has for the University is maintained. The manner in which these components interact is explained in the model for project evaluation.

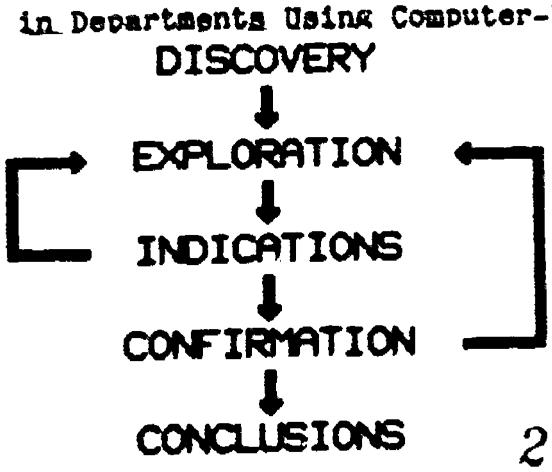
Model for Project Evaluation

At our College of Education's learning symposium on evaluation, Herbert J. Walberg maintained that the process of inquiry contains five main stages, namely, discovery, exploration, indications, confirmation, and conclusions. Every event in the history of CBE at our University fits into one of these categories, both at the overall Office level and within each individual department. At the Office level, PLATO was discovered by our Computer-Assisted Instruction Committee during the fall of 1974. The University explored the potential of PLATO during the trial period in the spring of 1975. Indications were summarized in the report of the summer of 1975. Confirmation that PLATO has potential for the University was obtained during the 1975-76 and 1976-77 academic years, based on the successful implementation of PLATO in so many departments. The conclusion that PLATO is a worthwhile long-term activity led to the installation of Delaware's own PLATO system during the 1977-78 academic year. Additional systems are now being discovered and explored.

Each department goes through these stages individually when it begins a CBE project. Discovery usually takes place at one of the periodic demonstrations or through a colleague who personally shows his work to a new person. Exploration consists of reviewing existing lessons, learning about the capabilities of various systems, and reading literature about uses of CBE. This phase is facilitated by the orientation seminar (above, p. 48), the lesson review process, (above, p. 53), and OCBI reference materials (above, p. 37). Indications are discussed and codified in meetings with peers, OCBI staff members and departmental chairpersons. Confirmation is attained through repeated success of the program in its academic environment. Success is measured through administration of student questionnaires, and through controlled studies of educational effectiveness. A continuous cycle of exploration, indications, and confirmation occurs in most departments, as is shown in figure 166.

Figure 166.

Process of Inquiry in Departments Using Computer-Based Instruction



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Student Questionnaires

A very important component in the evaluation of OCBI is the opinion of the students. The instructor of every CBE course is required to have students complete a questionnaire. Figure 67 shows a standard questionnaire that is given to each instructor as a model for evaluation of PLATO. The instructors can administer the questionnaire as it stands, or they can change, delete, and add items peculiar to their specific courses.

Over the years, student response to PLATO has been very positive. Perhaps the two most representative items concerned whether students felt PLATO was an enjoyable learning experience, and whether they felt PLATO was worth the effort. Overall, eighty-nine percent of the students felt PLATO was enjoyable, and eighty-six percent of the students felt it was worth the effort.

Student comments dealt with a variety of topics. They requested more versatility in signing up for time on PLATO, more terminals, and more programs. They asked that lessons developed at other universities be modified to use Delaware terminologies when different terms are used. They wanted more exercises to practice in preparation for regular hourly exams. They asked that PLATO be used for a greater percentage of their courses. Students commented about PLATO's patience, stating how they were glad that the computer never gets tired of helping them. The most frequent comment concerned the self-paced, individualized learning format. Students felt that PLATO helped them most by providing individualized, immediate feedback to their answers.

SHORT RESPONSE FORM Figure 167

STUDENT EVALUATION OF PLATO ®

Course ______________________ Instructor ______________________ Date __________

Please answer the following questions about your experiences with the PLATO system and the lessons which you have seen. Your responses will provide valuable information for evaluating and improving PLATO. Thank you for your cooperation.

Indicate your degree of agreement with each of the following statements by marking:

A = Strongly Agree
B = Agree
C = Neutral
D = Disagree
E = Strongly Disagree

1. Using PLATO was an enjoyable learning experience.
2. The mechanics of using the PLATO terminal distracted me from learning.
3. The major points of the lesson were made clear.
4. The lessons on PLATO were too advanced for our level.
5. I learned what the lessons tried to teach.
6. I already knew the material covered in the lessons.
7. Most of the time the work on PLATO was too easy for me.
8. I was frequently frustrated while working on PLATO.
9. The lessons progressed too slowly.
10. The PLATO lessons were unnecessarily picky about the form of the correct answer.
11. The pace of the lessons was too fast.
12. PLATO is an efficient use of the student's time.
13. PLATO is well suited to presenting instructional material in this subject.
14. PLATO gives the student more feedback than other forms of instruction do.
15. The PLATO lessons helped me learn the material more thoroughly than with other forms of instruction.
16. The lessons made allowances for students with different levels of understanding.
17. A lesson on PLATO is more interesting than traditional instruction.
18. I found myself just trying to get through the material rather than trying to learn.
19. In view of the effort I put into it, I was satisfied with what I learned while using PLATO.
20. Too much class time was spent using PLATO.
21. I would like to spend more class time using PLATO.
22. I would like to take another course which uses PLATO.
23. I was able to schedule enough time each week in which to work.

PLEASE SEE OTHER SIDE.

DO NOT WRITE IN MARGINS

INSTRUCTIONS

Use No. 2 pencil.
A correct mark should cover the complete outline.

IDENTIFICATION NUMBER

Figure 167 (continued)

24. How many hours have you spent on PLATO in this course? (Mark your answer in the appropriate grid on the first side).

    (a) 2 or less (b) 3-5 (c) 6-10 (d) 11-15 (e) 16 or more

25. Have you used PLATO in any other courses? (Mark your answer in the appropriate grid on the first side).

    (a) Yes (b) No

26. Have you ever used a computer (other than PLATO) before? (Mark your answer in the appropriate grid on the first side).

    (a) Yes (b) No

    If so, in what ways is PLATO different from other computers? (Answer below).

27. What have you liked most about PLATO?

28. What have you liked least about PLATO?

29. What aspects of the PLATO classroom (acoustics, lighting, noise level, policies, staff, etc.) were distracting to learning?

30. What aspects of the PLATO classroom were helpful or conducive to learning?

31. What comments, criticism or suggestions do you have for making more effective use of PLATO in this course?

CIRCLe

An important addition to the research component of OCBI was the founding of the Center for Interdisciplinary Research in Computer-Based Learning (CIRCLe) in 1980. CIRCLe, which is funded by OCBI, serves as a center within the College of Education to fulfill four primary functions:

1. to help faculty and staff with design and analysis in CBE research projects;
2. to establish an up-to-date database of CBE research materials;
3. to help promote the communication of CBE research ideas and techniques both within the University community and with other universities and research institutions;
4. to assist in the writing of grant proposals in CBE research areas.

CIRCLe is governed by a board of directors consisting of two faculty members from the College of Education and three from other colleges. During 1983-84, the advisory board was constituted as follows:

Gerald R. Culley, Languages and Literature
Sylvia Farnham-Diggory, Educational Studies
James E. Hoffman, Psychology
Fred T. Hofstetter, Music and Educational Development, Chairperson
C. Julius Meisel, Educational Studies
Ronald H. Wenger, Mathematics

CIRCLe has provided assistance with research design and statistical analysis of CBE research data in departments such as languages, education, consumer economics, nursing, music, math, the Writing Center, counseling and the library. An on-line document is available providing information on CBE research design.

The CIRCLe Reference Collection has been reorganized, systematized, and expanded. An on-line catalog is now available which allows searches of research material by author name, title, or publisher. This search system includes those portions of the ERIC database that pertain to CBE research. A keyword and author search system has also been developed for the ERIC database.

In order to assist faculty and staff in writing grant proposals, CIRCLe has worked closely with the Office of Research and Patents, the Office of Contracts and Grants, and the Office of Research and Evaluation of the College of Education. Publications that list available project funds are reviewed periodically. Information gathered from these sources is available on-line.

The major event during CIRCLe's first year was a Research Retreat held at the Red Fox Inn in Toughkenamon, Pennsylvania, on February 9, 1981. In addition to papers by several members of the University of Delaware faculty, Dr. Eric McWilliams of the National Science Foundation presented a paper on "Computer-Based Experimentation Into Computer-Based Problem Solving."

1982 was highlighted by a major international conference on CBE research entitled "CBE Research: Past, Present, and Future." This conference, which was sponsored by the College of Education, was held at the Radisson Wilmington Hotel on June 3-4. Dr. Robert Glaser, director of the LRDC at the University of Pittsburgh, was the keynote speaker. Other invited speakers were Dr. John Sealy Brown from Xerox PARC, who spoke on Intelligent CAI; Dr. Steve Hunka from the University of Alberta, who spoke on Evaluation and CAI; and Dr. Patricia Wright from the Medical Research Council in Cambridge, England, who spoke on Human Factors in Delivering CAI.

Representatives from industry and the military demonstrated recent advances in intelligent CAI hardware and software. In addition, several refereed papers were presented in the areas of evaluation and human factors. The conference was an attempt to sum up the state of the art in CBE research and to provide a stimulus for the encouragement of further research. Proceedings of this conference are available from CIRCLe.

The second biennial Research Retreat was held February 7, 1983, in Clayton Hall. Despite inclement weather, approximately one hundred faculty and staff attended. Victor R. Martuza delivered the keynote address on modern techniques for exploratory data analysis. Other speakers included Drs. C. Julius Meisel, George A. Smith, Michael A. Arenson, Ronald H. Wenger, James E. Hoffman, Gerald R. Culley, Clifford W. Sloyer, Sylvia Farnham-Diggory, William S. Bregar, and Fred T. Hofstetter. Dr. Carol J. Blumberg acted as discussant. Dr. Frank B. Murray, Dean of the College of Education, provided the closing remarks.

During the Spring of 1983, Dr. William S. Bregar, visiting professor from Oregon State University, gave a series of colloquia for faculty and staff. These talks centered on Intelligent CAI, including his own work on an intelligent algebra tutor.

The emphasis on ICAI continued into the 1983-84 academic year. Three of the proposals funded by OCBI came under the general heading of Intelligent CAI. These projects are in the fields of reading, music, and research in programming using LOGO. CIRCLe helps coordinate these projects and provides resources necessary for their completion.

To extend its outreach activities, CIRCLe assumed responsibility for coordinating the Summer Institute in Computer-Based Education during the summer of 1983. CIRCLe also organized the program for the first annual conference of the Greater Delaware Chapter of the Association for Eductional Data Systems, held in Dover on March 17, 1984.

The CIRCLe reference collection contains more than 1700 titles. Over fifty of these are periodicals, many of which have back issues available on microfiche. CIRCLe developed a PLATO program that allows a substantial portion of the ERIC educational database to be searched both by ERIC descriptor and by author.

Experimentation

Experimentation in the Office of Computer-Based Instruction has taken five directions. First, faculty members have conducted controlled experiments comparing the use of CBE to more traditional forms of instruction. Second, they have conducted perceptual research, where the computer serves as a multi-faceted stimulus presentation and response recording device. Third, experiments have been conducted into the effects of alternate learning strategies upon student achievement and student attitudes. Fourth, faculty members have used computers to acquire accurate data to be used in research. Fifth, senior staff members have been conducting a systematic examination of the problems involved in the administration and organization of computer-based education. The remainder of this section presents abstracts from articles dealing with student achievement, perceptual research, alternative learning strategies, the development of research tools, and organizational research, respectively. These are followed by abstracts that are not research oriented but which describe various aspects of computer-based education.

Student Achievement

Arenson, Michael. 1982. The Effect of a Competency-Based Computer Program on the Learning of Fundamental Skills in a Music Theory Course for Non-Majors. Journal of Computer-Based Instruction, Vol. 9, No. 2, pp. 55-58.

A study was undertaken in the Spring of 1980 to examine the effect of a competency-based education program on the learning of fundamental music theory skills by non-music majors. Students enrolled in an introductory music theory course participated in this experiment with students in the control group receiving traditional homework assignments and students in the experimental group receiving a competency-based education program on the PLATO system. A comparison of pre-test and post-test results indicates that competency-based techniques are superior to more traditional homework assignments in providing drill-and-practice necessary for success in learning music fundamentals.

Boettcher, Elaine G., Alderson, Sylvia F., and Saccucci, Michael S. 1981. A Comparison of the Effects of Computer-Assisted Instruction Versus Printed Instruction on Student Learning in the Cognitive Categories of Knowledge and Application. Journal of Computer-Based Instruction, Vol. 8, No. 1, pp. 13-17.

The use of computer-assisted instruction (CAI) in nursing education may become more widespread as education costs soar while CAI technology costs continue to decline. Nurse educators need to know if this instructional mode can be used with the same confidence as the more traditional teaching methods in each cognitive category of learning. This study investigated the learning outcomes of 83 baccalaureate nursing students randomly assigned to a CAI group or to a group taught with printed programmed instruction (PI). Lessons in psychopharmacological nursing were developed which presented the same learning material for both teaching modalities in the cognitive categories of knowledge and application. Through the use of a pretest-posttest control groups design, the evaluation of learning outcomes in these two categories was undertaken. While results of the investigation revealed no significant differences between the groups in posttest scores related to either cognitive category, both groups of subjects made equally significant gains in the amount of knowledge and application learned. This finding suggests that CAI can be as effective as a more traditional instructional modality in teaching both factual content and application of learned material when both media use the same instructional approach.

Hofstetter, Fred T. 1980. Computer-Based Recognition of Perceptual Patterns in Chord Quality Dictation Exercises. Journal of Research in Music Education, Vol. 28, No. 2, pp. 83-91.

During the 1977-78 academic year an experiment was conducted with eighteen freshman music majors for the dual purpose of measuring student achievement in the GUIDO chord quality program and of determining the overall pattern of student responses to chord quality dictation exercises. A two-part test was developed to measure student achievement on chords in close position and on chords in open position. This test was administered three times: first, at the beginning of the first semester before training began; second, at the end of the first semester after training on chords in close position but before training in open position; thi d, at the end of the second semester after training on chords in open position. As one would expect, correlated t-test comparisons of scores on these tests showed that significant learning gains occurred on the basis of chords in close position during the first semester and on the basis of chords in open position during the second semester. However, additional significant increases were noted on the basis of chords in open position during the second semester. An important transfer mechanism might exist between training on chords in open and close positions. Analysis of student responses made on the third set of tests led to the identification of five principles of chord-quality confusions. First, there are three main clusters of student responses which were due to the almost exclusive confusion of chords by their inversions. Second, the augmented and diminished chords were almost always confused with each other, and they were rarely confused with major and minor chords. Third, the role of expectations in student perception was demonstrated with regard to the root position diminished chord which was almost always confused with its more common first inversion. Fourth, the major chord in root position was found to be much more difficult to identify than is generally believed. In close position five other chords were easier to hear, and in open position three chords were easier to hear. Fifth, the most difficult chord to hear was shown to be the minor chord in first inversion, which in open position is confused only by inversions, but which in close position is confused with augmented and diminished chords. Given the small sample size used in this study (N=18), independently administered replications of this experiment should seek to determine whether the perceptual patterns found in this sample will also occur in other groups.

Barlow, David A., Markham, Jr., A. Stuart, and Richards, James G. 1979. PLATO Facilitation of Precision Motor Analysis in Biomechanics. Proceedings, ADCIS Conference, San Diego, California, February 27-March 1, pp. 1005-1012.

Programmed Logic for Automatic Teaching Operations (PLATO) was developed at the University of Illinois in the 1960's. PLATO was designed to provide computer-assisted instruction (CAI) in teaching a variety of subject matters on many campuses. Recognized as one of the leading systems of teaching by computer, PLATO has the capability of individually instructing several hundred students at one time while carrying on two-way communications. This system enables the student to receive visual information in words, figures, graphs, pictures, and sounds. PLATO is therefore concerned with on-line use of computers by students to further individual learning, by teachers to supervise instruction, by programmers to prepare instructional material, and by researchers to study the optimization of learning.

The purpose of this investigation was to explore a single additional application for PLATO in the realm of undergraduate research projects conducted in the sport science of biomechanics. More specifically, an effort was made to determine the feasibility and value of utilizing PLATO in the precision motion analysis (quantification) of high speed cinematographical data. Parameters measured included: 1. Time required to conduct a complete analysis; 2. Accuracy/quality of film data reduction; and 3. Knowledge or understanding of biomechanical principles affecting human movement.

All undergraduate students (N=92) in Biomechanics at the University of Delaware during 1977 and 1978 were randomly assigned to two research project groups. A control group performed all mechanical calculations without the aid of an on-line computer system. An experimental group was assigned to the PLATO system in order to use appropriate software developed by the investigators for motion analysis of film data. Both groups were required to complete the exact same specific objectives for this research project.

A 16 mm Locam Camera operating at 100 frames/second was used to photograph all students in the performance of a selected sport skill technique. Appropriate cinematographical techniques and procedures were followed to enable the quantified assessment of selected kinematic factors of human performance. Initial film measurements including coordinates of 19 segmental end points of the human body were acquired with the utilization of various manual and automatic digitizers. The PLATO terminals were then used to determine the specific measurement of centers of gravity, joint angles, velocities and accelerations.

In order to compare selected variables measured for the control and experimental groups, a multivariate analysis of variance (MANOVA) was conducted at the conclusion of all projects. Significant F-ratios were obtained for all comparisons.

Within the limitations of this investigation, the simplistic application of PLATO using CAI techniques (as compared to longhand manual procedures) resulted in the following measurable benefits: 1. Considerable decrease in overall data reduction time; 2. Increased accuracy of data reduction; 3. Tremendous increase in quantity of quantified film data; and 4. Increased excitement in the conduct and understanding of biomechanical research. PLATO facilitation techniques obviously enhanced the quality of all research projects involving film analysis of human movement in biomechanics.

Culley, Gerald R. 1979. Computer-Assisted Instruction and Latin: Beyond Flashcards. Classical World, Vol. 72, No. 7, pp. 393-401.

CAI in languages has usually been limited to rigid drills in vocabulary or forms. This article uses two Latin verb lessons developed by the author to show how computer instruction can be made much more versatile and powerful. Routines which conjugate the verb permit a diagnostic lesson to analyze student-typed Latin verbs and localize errors to stem, tense/mood sign or personal ending, providing corrective comments as appropriate; to determine when a student has typed some genuine -- but incorrect -- verb form; and to lead a confused student through a series of grammatical questions about a given item to the correct answer. A companion lesson which gives practice in generating or recognizing verb forms in a gaming format can be tailored in content and difficulty by the student. Thus students may use the same lesson throughout the school year, increasing the number of conjugations, tenses, etc. in use so as to maintain interest and challenge. Finally, the lessons are capable of collecting data on student error patterns which can provide the basis for improved classroom instruction.

Hofstetter, Fred T. 1975. GUIDO: An Interactive Computer-Based System for Improvement of Instruction and Research in Ear-Training. Journal of Computer-Based Instruction, Vol. 1, No. 4, pp. 100-106.

The University of Delaware has established a center for computational musicology for improvement of instruction in music courses and investigation of the nature of musical skills. During its first year the center has developed an interactive computing system (named GUIDO for Graded Units for Interactive Dictation Operations) for recording student learning patterns in ear-training courses. Learning stations consist of a graphics terminal with keyboard, which is used for displaying musical notation and recording student responses, and a synthesizer through which the computer generates aural stimuli. Interactive learning programs have been written in two modes: 1. drill-and-practice mode, in which students hear dictation exercises and are asked questions about what they hear; and 2. touch-sensitive playing mode, in which students can make up their own ear-training examples, examples which they would otherwise not be able to play. By means of these programs each student receives individualized practice in ear-training, and each student's learning patterns are recorded for further study.

The experiment reported was conducted with a freshman ear-training class to determine GUIDO's impact on student achievement in harmonic dictation. During the first semester, all thirty-three students received the same course of instruction in ear-training, with all drill-and-practice done in the tape laboratory. At the beginning of the second semester, the class was randomly split into two groups; seventeen students were assigned to an experimental GUIDO group which practiced ear-training at the computer terminals, and sixteen students were assigned to a control TAPE group which practiced in the tape laboratory. At the end of the first semester (before the implementation of GUIDO), the mean harmonic dictation scores of the GUIDO and TAPE groups were seventy-seven percent and seventy-six percent, respectively. At the end of the experiment the mean scores were eighty-six percent for the GUIDO group and seventy-five percent for the TAPE group. The results of a t-test applied to the GUIDO and TAPE scores at the end of the experiment indicate that the difference between the two groups is significant at the .05 level.

Perceptual Research

Hoffman, James E., and Nelson, Billie. 1981. The Role of Attentional Resources in Automatic Detection. University of Delaware, Department of Psychology, Research Report No. 8101.

A series of experiments investigated the question of whether automatic detection of visual targets requires the investment of attentional resources. Subjects were required to perform an automatic target detection task in conjunction with three different concurrent visual discriminations. Subjects were only able to increase their accuracy on the concurrent task at the expense of decreasing performance on the automatic task, indicating that automatic detection requires the voluntary investment of a limited resource.

One component of the limited resource required by the automatic detection process is the spatial attention system. When attention was in a "distributed state," automatic targets were able to capture the spatial attention system resulting in decreased performance on the concurrent task (the intrusion effect) and increased acuity for forms occurring near the automatic target. In contrast, when attention was "focused" on a display area removed from the automatic target, the intrusion effect was eliminated and automatic detection accuracy decline.

Automatic detection is a process that requires the use of limited mental resources. Its speed and apparent lack of flexibility reflect the ability of automatic targets to capture a share of those resources which are unused by other concurrent mental activities.

Hofstetter, Fred T. 1981. Computer-Based Recognition of Perceptual Patterns in Rhythmic Dictation Exercises. Journal of Research in Music Education, Vol. 29, No. 4, pp. 265-277.

During the 1978-79 academic year sixteen freshman music majors participated in an experiment in which student response data was saved as they worked through twenty-four units of rhythmic dictation exercises in the University of Delaware's GUIDO system. Analysis of the student database led to the discovery of perceptual patterns and learning styles common to exercises in both simple and compound meters. First, it was found that basic undotted, nonduplet, nontriplet notes are confused exclusively with themselves and never with dotted notes, duplets, or triplets, and the same exclusive confusion pattern is seen for dotted notes, duplets, and triplets, except that they are also confused with their unmodified basic counterparts. By varying the time signatures used in the experiment it was found that significantly more exercises are correctly answered in simple meter when a four is on the bottom, and the same pattern was found when an eight is on the bottom in compound meter. Randomly varying the pitch of the monotone stimulus between c and c2 had no effect on student achievement.

As the level of difficulty increased in the twenty-four units, so also did the average student response time and the number of times students asked for the stimulus to be replayed, whereas the average speed at which students played the stimulus decreased. Students who used high average dictation speeds tended to request fewer repetitions of the stimulus, as did students who used the metronome. However, neither speed of dictation, use of the metronome, nor number of repetitions had a high correlation with student achievement.

Meisel, C. Julius, and Smith, George A. 1981. A Comparison of Recall Patterns Among Autistic and Retarded Learners. Presented at the Region XIII Meeting of the American Association on Mental Deficiency (AAMD), October.

Autistic and mentally retarded children matched for age and IQ were shown three visually displayed digits. The digits were presented on the screen of an IST-1 remote terminal connected to the University's PLATO system. Digits were exhibited successively in three "windows" in such a way that the left-to-right (spatial) order never coincided with the temporal (sequential) order. It was hypothesized that there would be no significant differences between the two groups in their ability to recall digits. It was also hypothesized that children with limited or no language abilities would recall the digits in a left-to-right (spatial) manner, whereas children with language ability (a functional use of language) would exhibit a temporal (sequential) pattern. Data is currently being analyzed further. Preliminary findings indicate that the better the verbal ability, the more likely the individual will recall digits spatially.

Hoffman, James E., and Nelson, Billie. 1980. Spatial Selectivity in Visual Search. University of Delaware, Department of Psychology, Research Report No. 8002 (also Perception and Psychophysics, in press). Portions of these data were presented at the 21st annual meeting of the Psychonomic Society, St. Louis, Missouri, November.

To what extent does successful search for a target letter in a visual display depend on the allocation of attention to the target's spatial position? To investigate this question, we required subjects to discriminate the orientation of a briefly flashed u-shaped form while searching for a target letter. Performance operating characteristics (POC's) were derived by varying the relative amounts of attention subjects were to devote to each task. Extensive trade-offs in performance were observed when the orientation form and target letter occurred in nonadjacent display positions. In contrast, the trade-off was much more restricted when the two targets occurred in adjacent positions. These results suggest that the interference between simultaneous visual discriminations depends critically on their separation in visual space. Both visual search and form discrimination require a common limited capacity visual resource.

Hoffman, James E., and Laubach, Mark. 1980. Examination of a PLATO-Based Psychology Research Laboratory for Visual Perception. Proceedings, ADCIS Conference, Washington, D.C., March 31-April 3, pp. 232-234.

The conduct of experiments investigating perceptual and attentional processes in human subjects requires a computer system with two characteristics. First, precise timing of visual displays and human responses demands a dedicated microprocessor. Second, the quantity and complexity of the resulting database require the facilities of a large time-sharing system. The PLATO IV system with the PLATO V microprocessor-based terminal provides both of these elements. Software was developed which allowed effective communications between the terminal and the mainframe. This system proved to be an ideal tool for the study of human perceptual and attentional processes.

▶ Hoffman, James E., Nelson, Billie, and Laubach, Mark. 1980. Controlled and Automatic Detection. Office of Naval Research Report No. 8001.

The secondary task methodology was used to measure the resource demands of controlled and automatic detection. Subjects were required to perform a secondary task of locating a flickering light together with a primary task of visual letter detection. Secondary task performance was lower when combined with the search task than in corresponding single channel control conditions. In addition, this decrement was approximately the same for both controlled and automatic detection. Similarly, both controlled and automatic detection latencies were increased in the presence of the secondary task and by the same amount. Controlled and automatic detections evidently share common resource demanding components.

▶ Hoffman, James E., Nelson, Billie, and Laubach, Mark. 1979. A Dual Task Analysis of Controlled and Automatic Detection. Presented at the 20th annual meeting of the Psychonomic Society, Phoenix, Arizona.

Extensive practice in looking for the same set of targets in a visual search task eventually results in the task becoming "automatic," i.e., search time is independent of the number of characters in both the target set and visual display. In contrast, when the target and distractor characters periodically change roles, subjects use a "controlled" search in which each element of the visual display is compared to the target set in a serial fashion.

The goal of the present research was to measure the attention demands of controlled and automatic search by pairing a primary search task with a secondary task of detecting which of several points of light located next to each display letter was briefly extinguished (flicker task). Results indicated that neither of the two tasks were performed together as well as they could be performed separately. There were two components to the loss in flicker location accuracy that occurred when it was paired with visual search. The largest component was independent of the processing load of the search task and whether search was in controlled or automatic mode. The second, smaller component did reflect processing load, even in the case of automatic detection. Continued training in the automatic detection task eventually eliminated the dependence of secondary task accuracy on search load.

These two components are presumed to reflect two different sources of interference in the dual task situation. The first component reflects competition between tasks in encoding information into short-term memory. Evidently, even highly practiced and presumably automatic tasks require this processing resource. The second component reflects preparation and rehearsal carried out prior to onset of the visual display. Extensive training can eliminate the need for active rehearsal of the target set.

▶Tobin, Aileen W., and Venezky, Richard L. 1979. The Effect of Orthographic Structure on Letter Search: An Attempt to Replicate and Extend Previous Findings. Presented at the Annual Meeting of the American Educational Research Association, San Francisco, California, April 8.

This study attempted (a) to compare the relative effects of experimental design and orthographic structure on the speed of letter search and (b) to determine the psychological reality of the differences in the structure of the four types of letter strings presented in the search displays, based on a rating procedure similar to that described by Underwood and Schulz. Replicating the results of previous research, differences in orthographic structure had no effect (p .05) on the mean rate of search when a between-subjects design was adopted, but a significant effect (p .01) when the paradigm was expanded to permit a within-subject analysis of the data. However, all post hoc comparisons of the mean subjective ratings were highly significant (p .01), suggesting that subjects can clearly distinguish between strings of letters having different amounts of local orthographic structure.

▶Hofstetter, Fred T. 1978. Computer-Based Recognition of Perceptual Patterns in Harmonic Dictation Exercises. Journal of Research in Music Education, Vol. 26, No. 2, pp. 111-119.

During the 1975-76 academic year, student response data was saved for a group of seventeen freshman music majors as they worked through fifteen units of harmonic dictation exercises delivered on the University of Delaware's GUIDO system. Analysis of the student database led to the identification of seven confusion tendencies that affect the perception of harmonies: bass line confusions, confusions of inversion, confusions of chord function, confusions of chord quality, unperceived seventns, unperceived roots, and favorite response confusions. The level of student achievement on individual harmonies was found to be highly correlated with the percentage of times these harmonies were asked in the curriculum.

▶Mahler, William A., and Sharf, Richard S. 1977. CAREERS: A Computer-Based Career Guidance System. Proceedings, ADCIS Winter Conference, Wilmington, Delaware, February 21-24.

This paper reports on a new system which has two major parts. The first part is a computerized version of John Holland's inventory of interests and self-determined competencies, which is called The Self-Directed Search (1974). The individual's responses to the 228 items of this inventory determine the sequence in which various occupations are presented in the second part of the system. The person is able to request and receive various kinds of information about each occupation as it is presented.

This project differs from other computerized guidance projects in several ways: First of all, it was developed at relatively little expense, aided by a small internal grant from the Division of Continuing Education at the University of Delaware. Secondly, it begins with an assessment of the individual's interests and abilities using a well validated inventory, rather than simply having the person explore a large database of job information without any direction. Another difference is that the database is designed to include occupations of interest to college students and adults who might be returning for further education. Access to and use of the system is simple so that people who have never used a computer terminal can use the system. Finally, in addition to providing career guidance services, the system is used to develop a database of information on how people make career choices.

Alternative Learning Strategies

▶ Culley, Gerald R. 1984. Developing "Smart" Language Lessons. To appear in Proceedings of the Fourth Delaware Symposium on Language Studies, ed. by Stephanie Williams (Norwood, NJ: Ablex Publishing).

Essential to effective computer-assisted instruction in foreign languages is the development of "smart" lessons, ones which are in some sense capable of understanding a student's typed response. True artificial intelligence is not meant here, but routines that can do some analysis of the response and comment on it in terms that give the appearance that it has been understood. For example, a program dealing with verbs should not only be able to tell that a student-typed form is wrong, but should be able to say in what way--the tense is wrong, or the form is singular rather than plural, etc. This of course requires the computer to identify just which (if any) of the forms of a verb the student may have typed. This paper illustrates the use of that technique by a series of Latin lessons on the PLATO system. Utilizing a set of routines that inflect the variable parts of speech as required, the lessons demonstrate the following:

1. Ability to generate a vast quantity of exercise items from a very small database of stems
2. Ability to accept and use vocabulary other than that originally provided by the author
3. Ability to comment "intelligently" on student errors, e.g., "That's the nominative singular of that phrase, not the dative singular"
4. Ability to provide review items for a student that are uniquely suited to his error pattern, e.g., presentation of more questions on dative singulars of third declension nouns after one error in that category
5. Ability to collect data by grammatical category for later analysis, e.g., percentages of student errors which involved the accusative plural of third declension nouns

The use of such "smart" lessons can provide something approximating the service of a living tutor for the foreign language student.

▶ Arenson, Michael, and Hofstetter, Fred T. 1983. High-Tech Models for Music Learning: The GUIDO System and the PLATO Project. Music Educators Journal, January, Vol. 69, No. 5, pp. 46-51.

The GUIDO system offers instruction in ear training and music theory at the University of Delaware on the PLATO system. The key to GUIDO's flexibility is its table-driven design, whereby each GUIDO lesson reads a set of instructional variables from a master table. These variables tell the program which questions to ask, how to ask them, and what actions to take based on student performance. This table can easily be changed by the instructor. There are five ear-training and twelve theory lessons in the GUIDO system. New developments in GUIDO include a fundamental pitch detector for sight-singing and a music keyboard to be used for keyboard harmony and keyboard input for ear-training. The GUIDO lessons are now available on floppy disk for use with a micro PLATO station.

Morrison, James L. 1983. Utilizing Computer Technology in Consumer and Business Education. Delaware Business Journal, Vol III, No. 2, pp. 17-21.

This article describes lessons that use a multi-level instructional model which merges economic theory and the "how to" methodology emphasized in consumer education into a "life adjustment" agenda which is delivered by the PLATO system. Resulting from the merger is a conceptual approach to consumer and business education which provides a structure for delivering computerized lessons to four target groups: (1) students enrolled at the collegiate level; (2) students enrolled in secondary schools; (3) adults who are not actively involved in a formal educational process and (4) teachers who are either presently having consumer and/or general business education responsibilities at a variety of levels of education (e.g. elementary, secondary, and post-secondary)--or those who may be in the process of preparing for careers in teaching.

The computerized lessons in the multi-level instructional model blend tutorial, discovery, simulation, and gaming techniques into a flexible instructional strategy. The emphasis is upon incorporating individual values into the decision-making process via varied learning activities. Therefore the concepts presented throughout the program require the individual to make decisions based upon individual preferences like personal beliefs and value structure. As part of this approach, each decision is analyzed in terms of its impact upon not only the individual but the family, community, and society as a whole.

Sloyer, Clifford, and Smith, Lynn H. 1983. Applied Mathematics via Student Created Computer Graphics. Journal of Computers in Mathematics and Science Teaching. In press.

Several techiques of making graphic displays interactive for student use are described. These include:

1. allowing students to create a display, e.g. connecting vertices to create a graph,
2. allowing students to manipulate data and see resultant changes in the display, e.g. curve fitting, and
3. allowing students to stipulate parameters and explore possible variations in a display before being asked to solve a problem using the display, such as finding the optimal set of gray levels for sending a digitized photograph

Arenson, Michael. 1982. The Use of A Table Driver for Individualized Design of Computer-Based Instruction Materials in Music Theory. Proceedings, ADCIS Conference, Vancouver, British Columbia, Canada, pp. 228-230.

Within the last year, a table driver design has become the framework of the music theory lessons developed on the PLATO system at the University of Delaware. In the lesson table driver, the instructor is given a skeletal framework within which to construct the lesson. Variables such as competency level can be set by the instructor so that the instructional needs of his/her student group can be met. It is hoped that this new design will allow the music theory lessons to be useful to a wide variety of instructors and students.

Hofstetter, Fred T. 1982. The Micro GUIDO Ear-Training System. In: The Educator's Guide to Computers. Carrollton: Association for Supervision and Curriculum Development.

The Micro GUIDO Ear-Training System is an example of computer-based music instruction. With complete programming in intervals, melodies, chords, harmonies, and rhythms, GUIDO uses high-resolution graphics, touch input, and a fully programmable sound synthesizer to provide a rich music learning environment. A comprehensive set of instructor options allows teachers to adjust the GUIDO system to their own needs, and records are kept that indicate student progress in the curriculum. A careful process of research and evaluation has documented the effectiveness of the system, and recent advances in microelectronics now make it available at an affordable price.

Culley, Gerald R. 1981. Learning How They Learn: Computer Analysis of Latin Students' Errors. Spring meeting of the Classical Association of the Atlantic States, Newark, Delaware, May 1-2.

The high attrition rate in elementary language study reveals an urgent need for analysis of the language learning process. If areas of difficulty can be identified, corrective strategies can be devised. To this end the Delaware PLATO Latin Curriculum has been used to collect data on student errors and to construct confusion matrices. One concerned verb forms; a second, noun-adjective phrases; and a third, parts of speech. The verb matrix indicated that students frequently confused present and future forms, especially the third person plural, though all persons showed this difficulty. The noun-adjective matrix reveals several problem areas, especially the confusion of nominative plurals with nominative singulars. Where parts of speech are concerned, it is noteworthy that students often mistake pronouns for adjectives, but rarely the reverse. Figures from a lesson in which students about to translate a Latin sentence may ask four things (grammatical form, dictionary entry, dictionary meaning, or function in context) about any words they like, revealed a distressing preference (nearly 50%) for just asking for the English meaning. This suggests a need for better instruction in how to approach a Latin sentence. All of the figures, since they reflect just five months of use, must be seen as preliminary. Another year of data collection will be needed, and further refinement of the process is desirable.

Culley, Gerald R. 1980. Individualized Latin at Delaware: A Progress Report. Proceedings, the Second National Conference on Individualized Instruction in Foreign Languages, Ohio State University, Columbus, Ohio, October 24-25, pp. 75-79.

An experimental individualized course in first-year Latin, offered in the 1980-81 school year at the University of Delaware for up to six credits, uses computerized Latin lessons, in conjunction with a conventional textbook and workbook, as self-study materials. Students meet with the instructor only for counseling and testing. Tests are printed by the computer, which selects items from a stored bank of questions in order to create a unique test at each of twelve levels for each student. Students may set up appointments with the instructor using the computer's message-storing capability. They may learn their class standing by consulting an on-line gradebook.

This approach meets four perceived needs of an individualized program. First, the need for monitoring of student skill development and prompt correction of mistakes is met by the error-analysis routines built into the computerized Latin lessons. Second, tests of sufficient variety and comparability can be produced without unreasonable expense of time on the part of the instructor or secretarial staff. Third, access to the instructor, for tutoring or counseling, is relatively easy. Fourth, students have some sense of participation (through the on-line gradebook) in an endeavor shared with their peers, even though the class does not meet as a whole.

Use of the computer has made it possible for one instructor to administer the course with no more expenditure of time than that required for a conventional section, and without the auxiliary facilities or personnel required by similar programs elsewhere.

▶ Culley, Gerald R. 1980. When PLATO Knows Latin: Benefits of Letting the Computer Inflect the Forms. Proceedings, ADCIS Conference, Washington, D.C., March 31-April 3, pp. 237-240.

The Delaware PLATO Latin Curriculum, now near completion after three years of development, combines the use of drivers with the use of routines to inflect the variable parts of speech. These routines enable the computer to offer an error markup based on the structural elements of the individual words -- "intelligent" markup very similar to that which a human teacher would give. The routines also make possible lessons tailored by the student to fit individual skill levels and content requirements. Variety, efficiency, flexibility, and precision are all enhanced.

▶ Hofstetter, Fred T. 1980. Computer-Based Aural Training: The GUIDO System. Journal of Computer-Based Instruction, Vol. 7, No. 3, pp. 84-92.

A comprehensive overview of the GUIDO system, this article explains how GUIDO is used by students, how the GUIDO curriculum is delivered in a table-driven, competency-based format, how GUIDO is being used to conduct educational research in student learning, how the use of systems like GUIDO are changing the roles of teachers and students, and how new technological advances are extending the scope of computer-based music education. Sample screen displays and operational descriptions are given for the five main GUIDO programs, namely, intervals, melodies, chord qualities, harmonies, and rhythms. The instructional variables which can be set by instructors are listed and explained, and the way in which the competency-based tables are edited is presented. Research results obtained from studies of student data saved from the harmonies and intervals programs are summarized in order to show how the tables can be used to conduct educational research in student learning patterns and in order to measure the effects computers can have on student learning styles. The article concludes with a discussion of future hardware which will support the teaching of sight-singing as well as ear-training, and which will allow simulation of the sounds of orchestral instruments.

▶ Kent, James W., and Bayalis, Patricia A. 1980. Doubles Play Strategies in Racquetball on PLATO. Proceedings, International Symposium on the Effective Teaching of Racquet Sports, University of Illinois, Champaign, Illinois, June 11-14.

The purpose of this presentation is to introduce PLATO as a teaching tool in assisting students in the acquisition of cognitive skills for successful doubles play in racquetball. Doubles play for the beginner level racquetball players can be a very hazardous activity. The beginning player has not yet learned to control his stroke echnique, has not mastered spacial awareness of the stroke space or the location of the other players within the confines of the court. Racquetball instructors on college campuses feel obligated to teach doubles play in their classes, because failure to do so presents a deprivation of knowledge about one aspect of the game. However, it is usually with great trepidation that an instructor allows four poorly skilled, free swinging players onto a court to give them an opportunity to practice the strategy of doubles play. Safety for the players is an important consideration and subsequently much time is given to stroke development and refinement in singles rather than doubles play. To facilitate the learning of doubles play strategies, the use of computer-assisted instruction and the development of appropriate materials would greatly enhance the opportunity for learning while not creating the risk of injury. PLATO (Programmed Logic for Automatic Teaching Operations) is a computer-assisted instructional system that allows for unique individual interaction with the special features of a plasma panel screen. The lesson presented will give a brief introduction to court markings, rules of service order, and strategies of play to be employed by the service side and the receiving side. Conference attendees will be given an opportunity to use the PLATO terminals and to experience the lesson for strategy and other cognitive skills for doubles play in Racquetball.

Morrison, James L. 1980. Project DISCO: A PLATO Learning System in Consumer Economics. Proceedings, ADCIS Conference, Washington, D.C., March 31-April 3, pp. 220-223.

At the University of Delaware, A Distributive Information System in Consumer Economics (Project DISCO) is presently being developed. The overall objective of the project is to have students develop, retain, and apply "informed habits" associated with rational behavior in the market-place. Basic to the consumer learning model being adopted as part of the project is the development of fifteen PLATO lessons presenting basic consumer economic theory in layman's terms. The fifteen lessons are to become part of the Consumer in the Marketplace Series (CMS) and are structured to enable individuals to develop competencies related to efficient consumption. The CMS series reflects a "life adjustment education approach" to learning how to maximize satisfaction from spending one's income. By focusing upon the process of rational decision-making, individuals are guided through learning experiences which rely upon the use of appropriate sources of product information, which apply a variety of basic consumer economic concepts, and which enable the evaluation of consumer decisions in terms of benefits and consequences to individuals, society, and the environment.

Mulford, George W. 1980. Who Needs Computers? Proceedings, the Second National Conference on Individualized Instruction in Foreign Languages, Ohio State University, Columbus, Ohio, October 24-25, pp. 193-199.

The use of computers in education is expensive, and in light of the fact that courseware becomes obsolete, large investments of money in computer terminals and of time in developing computerized materials may seem foolish. The computer can, however, be used effectively to cut costs when used as a bookkeeping tool in programs of individualized instruction. As a teaching medium, the computer may offer benefits in terms of student motivation that outweigh its costs. It can greatly enhance the value of the language laboratory. And if proper care is taken in lesson design, costs can be held within reason and the risk of developing elaborate programs that are subsequently abandoned can be minimized.

Methods of computerized test-making and analysis of test results are presented. The functioning of a computerized language lab is described, and the practicality of various equipment choices discussed. Strategies are outlined for the production of non-text-dependent courseware taking full advantage of the computerized medium.

Nichols, Raymond D. 1980. A PLATOnic Dialog. Print, Vol. 34, No. 6, pp. 64-69.

Traditional modes of instruction can make it difficult for students in visual design classes to separate design concepts from techniques. Lack of technical skills on the part of the students is a hindrance to their gaining visual expertise.

To help alleviate this situation, a series of lessons has been designed for the PLATO computer system at the University of Delaware to help remove the need for technical skills from the thinking processes, permitting students to concentrate on conceptual development. These lessons help prevent students from adjusting their aesthetic criteria to more closely match their own capabilities. Also, the instructor is able to present more effective criticism of student abilities.

Two types of lessons from the advertising design curriculum are shown. The first enables the students to adjust the spacing between letters presented in any one of five typefaces. Students using this lesson have shown marked improvement in their own handling of type and a stronger concern for the development of attitudes involving the aesthetics of optical letterspacing. The other lesson aids students in the design of institutional logos. It was conceived to provide an easily manageable format for the rendering of the students' ideas for symbols. By reducing technical effort to a minimum, it is instrumental in encouraging students to refine their visual thinking to a degree that would be difficult to achieve through the manual manipulation of pencil and paper or ink and compass.

Arenson, Michael. 1979. Computer-Based Ear-Training Instruction for Non-Music Majors. Proceedings, ADCIS Conference, San Diego, California, February 27-March 1, pp. 949-958.

During the Spring Semester of the 1978 academic year, fifty-two students enrolled in a beginning music theory course for non-music majors participated in a study designed to examine the success of a competency-based approach for teaching aural interval identification to non-music majors. During the same time period a parallel study was being undertaken to measure the success of a competency-based format for teaching interval identification to music majors (Hofstetter, 1978). Both studies utilized the Interval Dictation Units of the GUIDO program at the University of Delaware. A comparison of data obtained from the two studies was helpful in identifying problems unique to non-majors in their acquisition of aural-perceptual skills.

In both studies the students proceeded through GUIDO interval units covering ascending intervals. Then they received a pretest which tested their skill at identifying ascending, descending, and harmonic intervals. Half of the students were assigned to an experimental group and proceeded through the interval units covering descending intervals, and harmonic intervals following a competency-based format. The other half of the students became the control group and proceeded through the same interval units following a sequential non-competency based format.

Results of the study involving the music majors revealed that the competency-based approach was superior to the sequential approach for teaching interval dictation skills. However, results of the study involving the non-majors indicated that the two methods of instruction were not significantly different in helping the non-majors develop the interval aural-perceptual skills. Other data kept by the PLATO system revealed that among the twenty-seven students in the experimental group, only one student finished all the interval units required for the course. On the other hand, fifteen out of twenty-five students in the control group finished all the units required.

Recommendations for changing the ear-training lessons in the GUIDO program for non-majors are as follows:

(1) The drills should remain in the sequential format. The students should be given mastery tests which will determine the difficulty level of materials to be covered.

(2) Help units should be included on the PLATO system to provide students with techniques for listening.

(3) More elementary units within each of the ear-training lessons should be included to give students practice developing simple ear skills as preparation for the drill materials presently on the system.

▶Hofstetter, Fred T. 1979. Evaluation of a Competency-Based Approach to Teaching Aural Interval Identification. Journal of Research in Music Education, Vol. 27, No. 4, pp. 201-213.

During the 1977-78 academic year, two groups of twelve freshman ear-training students were given the exact same course of instruction in ear-training, with all drill-and-practice given by the computer. The only difference was that, for Group A, a set of competencies was defined and entered into the computer, and the students were not allowed to progress from one unit to another until they had obtained the level of competency required for a given unit. The average pre-test score for Group A was seventy-seven percent, and the average pre-test score for Group B was seventy-five percent. Application of a t-test showed that there were no significant differences among the two groups.

At the end of the course, a post-test was administered to both groups. Group A, which was the competency-based group, had achieved an average score of ninety-three percent, whereas Group B, which was the non-competency group, had a significantly lower average score of eighty-three percent. There was no significant difference between the two groups in the amount of time spent practicing intervals. However, the advancement criteria caused the competency-based group to spend less time on the easier units and more time on the more difficult units. Morever, students participating in the competency-based format felt that the computer was helping them to learn more than the students who were in the non-competency-based group.

▶ Nichols, Raymond D. 1979. The PLATO Display In The Teaching Of Optical Letter-spacing. Proceedings, ADCIS Conference, San Diego, California, February 27-March 1, pp. 1022-1026.

Education in the visual arts possesses one very great problem in the student's normal course of study: the ratio of the effort required to 'get an idea' or 'make a judgement' and the amount of effort required to put that idea/judgement into practice. It is here that contemporary technology, namely computers and more specifically PLATO, can serve as an educational tool which may potentially become one of the most important changes to visual arts education.

In the graphic and advertising design area of the Department of Art, University of Delaware, we are heavily involved in the teaching of advertising design as visual communication, a subject very dependent on the visual appearance of the printed word. When one designs an advertisement there are two main goals relating to its effectiveness:

1. the recognition by the viewer of the desired objectives of the advertisement

2. the actual reading by the viewer of a major portion of the advertisement

As advertisements are viewed as 'out of context' material in magazines and newspapers (given the reason these publications are normally purchased) it is important that the reading matter be designed as easily readable and aesthetically pleasing as possible. It is with this readability in mind that correct 'optical letterspacing' becomes a major concern for the designer. Words in headings, subheadings, etc. must be spaced so as to be read easily, trying to avoid the visual division of the individual word into groups of letters smaller than the word itself. Words which break down into small words can create confusion for the viewer, hindering a positive response.

An example: **LATER**

Due to the physical form of the letters and the fact that each letter is placed the same distance from each other in this example we, as viewers, begin to perceive the word 'LATER' as two words, 'L', and 'ATER', creating confusion in the mind of the reader.

The problem that occurs in the classroom, where the instruction is aimed at heightening the students' awareness of the spacing and teaching them to make the correct judgments, is the amount of time which is necessary to physically execute the work with enough accuracy and weight that a judgement, resulting in a positive educational experience, can be made as to the correctness of the spacing. Simply outlining (which is the quickest method of executing the letters) does not illustrate the weight of the various letters against one another, and the outlining and filling in of the letters can take from 30 to 90 minutes, even in a fairly rough stage. The more accurate the designer wants the spacing, the more exact the execution must be in the preliminary stages.

PLATO, though, provides a format where specific typefaces can be displayed allowing the student to easily execute words of his/her own or of the instructor's choosing.

An example:

DIETERS

This is the form in which PLATO displays the desired word, in this case DIETERS in the typeface Garamond.

DIETERS

This is the finished form of the word after the correct spacing has been completed by the student. The actual execution of the spacing of this particular word by the author required two minutes, thirty-five seconds and a minimal amount of physical effort.

The format of the lesson provides five alphabets for practice (each representing one of the five major families of typefaces). The spacing of the individual letters can be controlled to 1/60th of an inch by moving them either singly or in groups. The instructor can input up to five required words per typeface (these would provide a form for testing and data keeping) and five comparison words. Both the required and comparison words can be spaced by the instructor and stored, with the student able to visually compare his result with that of the instructor's.

▶Nichols, Raymond D. 1979. PLATO in the Teaching of Foundation Visual Design. Proceedings, ADCIS Conference, San Diego, California, February 27-March 1, pp. 986-990.

Foundation courses in visual design rely on two basic skills on the part of the student in order for the course to provide a positive educational value. These skills are the following:

1. technical or hand skills necessary to implement and present an idea to some viewer

2. conceptual skills necessary to the actual mental task of solving a specific problem

To provide this educational experience to our students, it becomes necessary to separate these two skills in order to demonstrate the strengths and weaknesses of each and to show the relation of both to the process of design.

Unit design was developed to provide a solution to four distinct problems that occur with beginning students in the foundations courses in visual design:

1. the restriction which is placed on the visual presentation of the student's ideas resulting from the level of the student's basic technical (hand) skills;

2. the final solution having been dictated not by the student's aesthetic tastes but by the fact that it is easier to change one's tastes than it is to change the actual design;

3. the difficulty involved in the instructor's evaluation which is due to the different mixtures of technical and conceptual skills of the students, making it hard to separate the two areas for discussion or criticism; and

4. the difficulty for the instructor in presenting an effective criticism to the student (given that the experiences and tastes which the instructor uses for his evaluation are not the same experiences and tastes that the student uses in receiving and evaluating the criticism) makes a clear understanding between the instructor and the student quite difficult.

The "Unit Design" program provides for the designing of a two-dimensional image (called a 'unit') which can be placed into a 4 by 4 array by rotating, mirroring and/or reversing the positive/negative relationships of each section.
The 'unit' consists of the dot-like elements of the plasma panel, each of which can be on or off, combining to create the desired image. As these dots are in a fixed position, the method for inputing a given image is the same for all students. Having completed the input of the 'unit,' the student then progresses into design mode where this 'unit' is used to create a modular design comprised of a 4 by 4 array of 'units.' In this mode the student can alter the 'unit' by rotating 0, 90, 180, or 270, mirroring from any of those positions, and/or reversing the positive/negative relationship. The modular design is manipulated until the student arrives at what is felt to be the best, or a series of the best, of the available solutions with regard to the student's aesthetic tastes. These designs can then be judged for aesthetic value in relation to other available designs.

Lesson "Unit Design" utilizes a dithering process for the input of the 'unit.' Dithering is a process which takes a video image and analyzes the tonal density of small areas. These densities can then be duplicated on the PLATO screen by turning on various combinations of plasma panel dots.

The lesson provides the following solutions to the previously stated problems:

1. the lesson reduces the technical skill necessary for the execution of the design, to a simple matter of using the dithering process to input the image into the computer, and the editing of this image has been reduced to the adding or subtracting of fixed dots from which the image is made;

2. the actual execution of the final design is handled through a series of judgements on the part of the student and can be carried out by simply touching the computer screen, making any changes necessary to the final form of the design very simple to implement; and

3. students who create images using the "Unit Design" program have utilized the same technical skills so that any evaluation on the part of the instructor will not have to take into consideration the manner (or at least it will be the same for all students) in which the final design was done and can concentrate on the actual aesthetics and design of the piece.

Culley, Gerald R. 1979. Two-Pronged Error Analysis from Computer-Based Instruction in Latin. University of Delaware Symposium on Language and Linguistics.

This paper describes first-stage results from a package of computer lessons on Latin morphology. It deals with two kinds of error analysis: an immediate response to partially correct verb, noun and adjective forms which will guide the student toward the correct answer, and the collection of precise data on errors by type which will lead to improved teaching by both traditional and electronic means.

These features were made possible by the development of logical models of the Latin verb, noun and adjective in computer code, making it possible for the computer to inflect these parts of speech. Since the machine has this capability for synthesis, it of course has the corresponding analytical capability; it can break down a student's typed response into its structural components of stem, tense/mood sign and personal ending for verbs or base and case ending for nouns and adjectives. Thus the machine can localize errors and offer appropriate comments to the student based on which component is faulty. Further checks within that faculty element can be made for specific errors; e.g., substitution of one tense sign for another.

The same feature permits information on student errors to be saved according to its nature: errors in the stem, errors in personal ending, etc. The first year of use with students has begun to reveal points of difficulty in learning these inflected forms. The relative percentages of errors indicate, for example, that the tense/mood sign of the future gives much more trouble in 3rd and 4th conjugative verbs than in others, and that passive personal endings must be introduced with very careful exposition. A second stage of data collection based on these data will permit still more precise conclusions to be reached.

Culley, Gerald R. 1978. Beyond Flashcards: Using the Computer's Power. American Philological Association, Vancouver, British Columbia, Canada.

This is an account of one means of bringing the computer's computational power and branching capability to bear on language teaching, thus escaping the wasteful, rigid "flashcard" approach. It is a program duplicating the logic of the regular Latin verb and so capable of locating the error in a student's response as within the stem, tense/ mood sign, or personal ending. Judging by segments also permits several special checks for common errors, such as inappropriate tense signs. This approach also makes it possible to establish whether the student's incorrect verb belongs anywhere at all in the tense system of the verb demanded of him. A confused student is led through ten to twelve grammatical questions to isolate the source of his error and correct it, with animation effects revealing the correct form segment by segment as he proceeds with its grammatical identification. Completion of an exercise yields a diagnostic readout, e.g., "trouble in the 3rd plural imperfect passive, both moods." The student may then use a companion lesson to practice these areas, specifying the exact grammatical parameters from which the computer may present challenges in a gaming format.

The code is written so as to permit students to work on any part of the year's curriculum with very little more demand upon computer memory than is made by one student in a single exercise, and versions of the lessons tailored (i.e., in vocabulary and order of introduction of the forms) for any textbook can be quickly and easily produced. The computer saves error patterns on which changes in classroom work or in the computer lessons may be based.

▶ Wilson, James H., and Paden, Elain P. 1978. The Effects of Drill Structure on Learning in Phonetics Lessons. Proceedings, ADCIS Conference, Dallas, Texas, March 1-4, pp.448-456.

This study is undertaken to investigate the advantages and disadvantages of different forms of drills as used in CAI lessons in phonetics transcription. Measurements of student learning, student attitude and time required for completion are considered for drills constructed 1) with and 2) without specific rehearsal of items initially missed.

Time spent by students in exploratory and quiz sections of the lessons is also recorded. Recommendations are made for other similar applications.

▶ Nichols, Raymond D., and Wilson, James H. 1977. The Computer Display as a Medium in the Teaching of Aesthetics in Visual Design. Proceedings, ADCIS Winter Conference, Wilmington, Delaware, February 22-24, pp. 248-255.

Computer graphics have been investigated and improved markedly in recent years, but their application to art education has been largely neglected. In order to facilitate instruction in an introductory course in basic design, programs were developed on the PLATO system to allow computer graphics to serve as a medium for a student activity that had previously been done using traditional media.

This use of the computer for the execution of technical procedures was aimed at three eductional goals: (1) Students, able to revise previous work with minimal effort, are less likely to alter their aesthetic judgment as a result of effort expended than has been the case using traditional media. (2) Students and faculty, no longer influenced by variations in the students' technical abilities, are forced to concentrate on aspects of visual design. (3) Students using the program should be encouraged by it to involve thought processes throughout the experience, rather than to divorce creative thought, execution, and evaluation.

The courseware has been used by sixty University of Delaware freshmen, and preliminary results show that initial goals were achieved. Further, students were able to execute more intricate designs in a shorter time. Finally, students profited from a greater opportunity for ongoing feedback, both through interaction with their instructor and through viewing of classmates' designs. These factors have combined to emphasize perception of the experience as education rather than simply production.

Weaver, Charles A., and Seiler, Bonnie Anderson. 1977. Computer Assistance in the Social Processes of Learning. Proceedings, ADCIS Winter Conference, Wilmington, Delaware, February 21-24, pp. 26-38.

Computer-assisted instruction has traditionally been associated with individualized instruction. While there is a great need for such instruction there are also dangers associated with it.

Many observers have noted that it is important for students to verbalize what they have learned and to interact directly with teachers and fellow students about materials being studied. Great damage can result when individualized instruction is carried out in a situation in which social interaction is lacking.

Computers can be used effectively to aid the student communication process as well as to individualize instruction. In this paper we discuss various ways in which computers can facilitate student-student interaction and also can direct students to deal with one another's written ideas.

Examples include lessons in which students learn from each other's strategies and moves, work cooperatively to solve a common problem, pose problems for other students to solve, display their work for others to use, and exchange questions and comments about subject matter with teachers. Specific examples are taken from materials developed by the authors as part of the PLATO Elementary Mathematics Project.

Research Tools

▶Culley, Gerald R. 1984. A Computer-Aided Study of Confusion in Latin Morphology. Linguistics and Literacy, ed. by William Frawley (NY: Plenum Press, 1982), pp. 239-254.

The rate of attrition in language study has remained high because there is still too little understanding of the process of learning another language. CAI programs can be designed in such a way as to pinpoint the areas most students find difficult and identify learning strategies that are most likely to succeed.

This paper describes a series of six elementary Latin instructional programs that illustrate the technique. The programs contain routines which inflect the variable parts of speech in Latin, thus allowing morphemic analysis of student-typed answers. Data from student use show the relative number of errors in stem, tense/mood sign, and personal ending of verbs as new forms are introduced throughout the year. Problem areas, such as the introduction of a new stem and the addition of passive personal endings, are revealed.

Confusion matrices were used to study student responses in programs where forms are to be identified. Each time a student identified a form incorrectly (e.g., took a nominative plural noun to be a genitive singular), the computer recorded both what the form really was and what it was taken to be. This information, plotted on a matrix, shows the forms that are most frequently confused with one another. Preliminary data for noun-adjective phrases, finite verb forms, and parts of speech are displayed in the paper; and the promise of this approach for further work is discussed.

▶McBride, Suzanne R. 1983. Tutor LOGO: Developing a Procedural Model of Children's Programming in a Research-Based Learning Environment. Proceedings, ADCIS Conference, Denver, Colorado, May 9-13, pp. 222-229.

Instructional computer graphics take shape for children early in their learning experience with programming environments like the LOGO language. Allowing children to reap the full educational benefits LOGO offers will depend on our understanding of how children learn programming concepts, and on our putting this knowledge to use in designing instruction. This paper reviews past attempts to study children's programming experiences; describes Tutor LOGO, a research based implementation of LOGO that permits greater strides toward understanding the learning process; and presents a procedural model of novice programming.

▶Meisel, C. Julius. 1983. Social Comparison Behavior Among Mainstreamed Handicapped Children. Annual Convention of the Council for Exceptional Children, Detroit, Michigan, April 8.

Data were presented from a project on social comparison among handicapped and nonhandicapped children in integrated (mainstreamed) classrooms. The procedure used in this study allowed children in a combined second/third grade class to audit the performance of classmates in a daily behavior management point system. In order to find out how many points they acquired each day, subjects were permitted to enter a two-digit identification code into a PLATO terminal placed in the classroom. After seeking his/her own point total, each subject was permitted to access point totals of any other classmate.

Results suggested that, while the ten handicapped children in the class were audited as frequently on the average as other students, they were much less likely to compare themselves on a regular basis with one or two other students. Those handicapped students that did regularly compare their performance to that of another (3 of 10) chose nonhandicapped students for comparison. Implications of these findings for the goals of mainstreaming and for the psycho-social development of handicapped children were discussed.

▶ Roe, Peter G. 1983. Ethnoaesthetics and Design Grammars: Shipibo Perceptions of Cognate Styles. 81st Annual Meeting of the American Anthropological Association, Washington, D.C., December 6.

A formal generative grammar of the geometric decorative art style of the Shipibo Indians of the Peruvian jungle was developed based on a corpus of designs elecited from the native artists. Then a PLATO program was written so that Delaware undergraduates could create their own Shipibo designs (both orthodox and divergent in style) on the computer monitor. Hard copies were obtained of their efforts and taken to the jungle for informant's reactions, their comments being used to refine the grammar. Shipibo reactions and student creations revealed a significant difference in male/female aesthetic perceptions whereby non-artist men reacted favorably to zoomorphic representational designs while women artists did not. This is attributed to male involvement as shamans with hallucinogenic drugs like ayahuasca which produce visions in which mythic animal symbols play an important role while women do not use the drugs.

▶ Farnham-Diggory, S., and Nelson, Billie. 1982. Cognitive Analyses of Basic School Tasks. Advances in Applied Developmental Psychology, Vol. 1.

Early in this century educational psychologists concerned themselves with school tasks and speculated about thought processes involved in reading, writing, arithmetic, and many other school-based activities. Unfortunately, curriculum research was abandoned with the advent of the testing movement in the 1910's. In recent years, educational psychology has begun to concern itself again with processes involved in basic school tasks. New methods developed by information processing psychologists are now providing the means for fine-grained analyses of these tasks.

This chapter presents some of the ways in which new methods have been applied to the old tasks of reading and spelling. Precise measurement is necessary because switches in attention, decisions, and other mental processes occur at high speed, even in children.

Results of the spelling studies show that spellers' ages and the presentation modality (visual or aural) influence the way a word is parsed into segments, as well as the speed of retrieving these segments and writing the letters. As the age of spellers increases so does their writing speed, segment access time, and number of segments. Also, the size of their pre-segment pause becomes a better predictor of segment size. Visual presentation of words provides segmentation cues and encourages automaticity of spelling procedures. These results reinforce the current instructional preference for giving students practice in copying words before having them spell from dictation.

Findings from the reading studies include: a) capacity for allocating attention during listening is greater, on average, than during reading and develops slower; b) 6-year olds are as facile as 8-year olds in simple high-speed phoneme/grapheme decoding matches; c) slow readers are more sensitive to contextual clues than fast readers; d) line-by-line reading times can reflect constructive processes and predict recall. Some suggestions for instruction include: a) identify tasks germaine to the reading process; b) build on children's capabilities (e.g., begin by reading out loud); c) use the computer to track children's reading behavior.

Computers provide feedback, practice, and individual instruction, and they are also able to monitor high-speed mental activities in ways that a teacher cannot. Computers have introduced powerful new representational systems for both theory and experimental design. Curriculum psychology now has a machine that can construct an on-line theory of how an individual student is learning, instruct the student accordingly, and collect data at the same time.

▶Kent, James W., Barlow, David A., and Craig, Robert. 1980. Relationship Between Ball Velocity and Selected Biomechanical Factors for Male and Female Players in the Backhand Kill in Racquetball. Proceedings, International Symposium on the Effective Teaching of Racquet Sports, University of Illinois, Champaign, Illinois, June 11-14.

Little scientific research has been completed in racquetball. Teaching methodology and technique descriptions have been developed through kinesthesis and observation. The purpose of this study was to identify mechanical aspects that enhance performance of backhand kill shot of high level male (4 'A') and female (3 'A') players. High speed cinematographic techniques (100 fps) were used to investigate performance of the backhand kill in determining relationships between ball velocities and selected biomechanical factors. Successful trials (3) were filmed for each performer. Computerized analysis (using the PLATO system) of film data enabled determination of linear displacements, velocities and centers of gravity. Descriptive statistics were used to present relationships among male and female players. Results indicated male and female performers consistently develop ball velocities ranging between 100.2 and 112.8 mph ($\bar{X}$ = 108.3 mph) and 86.4 and 93.9 mph ($\bar{X}$ =89.2mph) respectively. Ball velocities for male backhand were two percent slower than forehand ball velocities. Although mirror imagery of backhand/forehand strokes occurred from greatest height of racquet head in backswing to ball contact, results from a previous study showed that no other similarities of mechanical technique were found to support the thesis of mirror imagery of total forehand and backhand stroke technique. Comparison of the mean values for ball height at point of racquet contact were very similar (males 14.8 in., females 14.6 in.). Stride length for females ($\bar{X}$ = 2.886 ft) was longer than for males ($\bar{X}$ = 2.53 ft). Resultant stride length/height ratio indicated that females (.55) were striding 21.7% greater than male (.43). Males (11.2 in.) and female (10.3 in.) players were similar in hitting the ball forward of the center of gravity line. Male (1.9 in.) and female (2.1 in.) performers were consistent in hitting the ball in front of a vertical line from their shoulder and somewhat behind the forward edge of the leading foot (-.32 in. males and -.17 in. females). Implications will be presented.

▶Kline, Loren. 1980. Analysis of the Soccer Throw-In. NSCAA Annual Meeting, Philadelphia, Pennsylvania, January 18.

The throw-in has traditionally been the method of starting play after touch line outs. Many teams are now sporting a player with an exceptionally long throw. This means that the throw-in has changed from a simple restart to a real offensive weapon, especially in the offensive third of the field. Some unorthodox methods such as a forward hand spring on the ball are being legally used to increase the length of the throw. I feel the traditional standing or running approach to the throw is still preferable because of the advantage of being able to see the target area through the entire motion, and to make last second adjustments on direction, height and speed. A hand spring thrower would need to throw to a predetermined spot. The traditional type of throw also permits release from a maximum height which mechanically enables the thrown ball to assume a flatter flight path.

Dr. David Barlow, Director of the Biomechanics Laboratory at the University of Delaware, filmed the throw-in technique of Dave Ferrell using a high speed camera. Several performance trials were filmed from the side, the front, and the back at 100 frames per second. After using the PLATO system as a digitizer, the results of the study were analyzed and conclusions were drawn.

Organizational Research

▶ Garton, Roland; Reed, Mary Jac; Reed, George; and Stevens, Evelyn. 1984. Developing a CBI Course: The Process. Proceedings, ADCIS Conference, Columbus, Ohio, May 14-17, pp. 142-148.

In 1981 and 1982, OCBI, under a contract with the Control Data Corporation, helped produce CBI materials for an entire first semester chemistry course. OCBI's model for CBI development was adapted and expanded to serve as a basis for the development of the chemistry course. The revised model included additional stages for overall course planning, conversion of lessons to a stand-alone system, and more carefully defined roles due to the size of the project and the number of groups involved. The purposes of this paper are to compare and contrast OCBI's process for single lesson development with the process of creating an integrated CBE course and to make recommendations regarding large-scale development models based on the experience. Careful records were kept with regard to staff and time requirements at all stages of the project. The results can help provide a foundation for planning similar projects.

▶ Garton, Roland; Reed, Mary Jac; Reed, George; and Stevens, Evelyn. 1984. Programming a CBI Course: A Case Study. Proceedings, ADCIS Conference, Columbus, Ohio, May 14-17, pp. 149-155.

In the summer of 1981, Control Data Corporation decided to develop a series of CBI materials covering the first two years of a standard university engineering curriculum. Lessons were designed and programmed for the chemistry portion of the curriculum at OCBI in conjunction with Control Data and an editorial review board. At OCBI records were kept on length of development time, skills of the programmers, and approaches taken in programming the lessons. This paper discusses team structures and programming practices that helped the process of courseware development. Further, the paper examines correlations among various CAI skills of the programmers and discusses why programming skill was not the greatest determinant of speed of development of the lessons.

The lessons were initially developed on the PLATO network to be converted for delivery by floppy disk on the Micro PLATO system. Conversion was accomplished in roughly four percent of the original programming time. In a separate section this paper discusses aids to the conversion process.

▶ Mulligan, James G. 1984. A Cost Function for Computer-Assisted, Programmed Instruction. To appear in the Journal of Economic Education.

To date, economics instructors have limited their use of computers to simulations, games, demonstrations, study management, and self-testing exercises. Although the interest in the instructional potential of computers has increased in recent years, the lack of theoretically derived educational production models has limited empiricists interested in evaluating new computer-assisted teaching techniques. This paper provides a formal theoretical model for a specific educational process: a computer-assisted, programmed course.

The instruction considered is self-paced with immediate diagnostic feedback provided by a computer software program. In this model the interaction between the instructor and students will be on an individual basis. A teacher or assistant is available in the computer classroom to help students unable to proceed to the next problem without the teacher's assistance. The administrator must choose an optimal mix of instructors and computer terminals to teach these programmed courses. The model allows the administrator to determine the expected cost-minimizing allocation of computer terminals and instructors and to compare the merits of competing technology.

Even though the development of computer-assisted programmed instruction is still in its infancy, this form of instruction will become an increasingly attractive option as the relative price of computers decreases. Programmed instruction with a computer-based interactive system and on-site instructor assistance may provide students with the individualized instruction and immediate feedback missing in large lecture classes while lowering the cost of instruction. This paper provides a formal model that can be used to evaluate the cost and benefits of these computer-assisted teaching methods. The structure of the model comes from queuing theory.

Hofstetter, Fred T. 1982. The Cost of PLATO in a University Environment. Proceedings, the First National Congress on Computers in Education, University of Stellenbosch, South Africa, April 13-16.

The University of Delaware has been operating its own PLATO system since 1978. Both the capital costs of acquiring the system and the ongoing costs of running it are exposed and analyzed. It is shown how the design philosophy of the PLATO system can allow a university to substantially reduce the hourly cost of using PLATO below commercial rates. The actual cost of using PLATO at Delaware is compared to past projections of what the cost would be. Continuing efforts to reduce the cost of using PLATO are described. It is shown how the cost of PLATO hardware is continually decreasing, and the influence of Micro PLATO on cost projections is discussed. The issue of cost effectiveness is addressed in the context of dollars spent and value received.

Garton, Roland and Silver, John. 1981. Approaches to Converting PLATO Courseware to Computer-Based Instruction. Proceedings, ADCIS Conference, Atlanta, Georgia, March 2-5, pp. 162-166.

It was the purpose of this study to determine how easily a sophisticated PLATO lesson could be converted to run on a Micro PLATO system. If PLATO lessons could be converted to run as well on local microprocessors with floppy disk drives as they do on a mainframe system, the system load would be decreased and it would be shown that conversion of other large PLATO lessons to Micro PLATO is feasible. The conversion was made on two GUIDO lessons, Intervals and Harmony, which are among the largest in use of memory and central processing on the PLATO system. The practicality of the conversion process has been shown. It took approximately 500 hours to convert these two lessons. That was about half of the original programming time. It is estimated that 30 to 35 percent of the code had to be changed. In the conversion process approaches to converting lessons were developed, and many differences between the mainframe and micro systems were dealt with, including differences in the programming languages they use. The Micro PLATO versions of these lessons are functional equivalents of the originals, which has many implications for the future of PLATO in computer-based education.

Hofstetter, Fred T. 1981. Computer-Based Instruction: Roots, Origins, Applications, Benefits, Features, Systems, Trends and Issues. Prepared for the International Sales Meeting of the Digital Equipment Corporation, Amelia Island, Florida, November 10-12.

This paper provides an overview of the field of computer-based instruction. After discussing its roots and origins, it is shown how instructional computers are being used in educational, government, professional, and industrial markets. The many student benefits of computer-based instruction are enumerated and explained, as are its characteristic features. An overview of instructional computers on the market today is provided for both large and small systems. The paper concludes with a discussion of the major trends and issues in the field of computer-based instruction.

Hofstetter, Fred T. 1981. Investing in Computer Technology: Criteria and Procedures for System Selection. Proceedings, the National Conference on Technology and Education, Sponsored by the Institute for Educational Leadership of the George Washington University, the Shoreham Hotel, Washington, D.C., January 6, pp. 45-53.

Matching needs with available technology poses a constant challenge for educational decision-makers. Seven years ago the University of Delaware began what has become a major institutional effort aimed at determining to what extent the needs of higher education can be met by computer-based educational techniques. Essential to the success of this effort was the identification of what available computer-based educational system offered the most capability. As the result of a careful assessment of the characteristics which that system should have and a nationwide search involving both visits to existing computer-based educational projects and consultation with experts in the field, the PLATO system was selected.

Since 1974 the University of Delaware has made a considerable investment in its PLATO capabilities, having installed its own central system in 1978, and having since upgraded it on an annual basis to meet the needs of its growing user community. Over one hundred faculty members are developing computer-based learning materials in thirty subject areas and testing them with students using the two hundred terminals connected to the Delaware PLATO system. The progress made toward determining the extent to which PLATO can meet the needs of higher education at Delaware is described in the Fifth Summative Report of the Delaware PLATO Project, which concludes with an eleven-part classification of the benefits of computing in higher education (Hofstetter, 1980).

It was well known in 1974 that rapid changes were occurring in the computer field, and it would appear on the surface that the University took a substantial risk in investing in a large central system like PLATO. Indeed, recognized authorities publicly stated in the mid-1970's that PLATO was a dinosaur that would never make it into the 1980's. Just the opposite has happened; PLATO has emerged in the 1980's in a new microcomputer format which combines the power, communications, and record-keeping features of a central system with the microcomputer's ability to run off-line, to acquire real-time scientific data, and to interface with new microprocessor-based peripheral devices like videodiscs. Through comparative study of the capabilities of available educational computers and through careful analysis of trends in microelectronics and of vendor commitments to making use of microelectronic advances, the decision to install PLATO at Delaware was not as risky as it may have seemed. It is the purpose of this paper to present the system selection criteria used at Delaware and to describe the procedures followed in making a selection based on those criteria.

Hofstetter, Fred T. 1981. Synopsis of the University of Delaware's Office of Computer-Based Instruction. Proceedings, ADCIS Conference, Atlanta, Georgia, March 2-5, pp. 5-11.

An overview of the University of Delaware's Office of Computer-Based Instruction is provided. Background information includes a discussion of its origins, the growth of its PLATO network, grants received, research projects underway, and its philosophy about educational computing in the 1980's. An organizational chart is presented and explained showing operations, outside user services, research, and program development components. A list of the overall objectives of the OCBI concludes the article, with references to the overall educational goals of the University where appropriate.

Seiler, Bonnie A. 1981. Applying a Systematic Approach to CBE Development in an Academic Environment. Proceedings, ADCIS Conference, Atlanta, Georgia, March 2-5, pp. 305-310.

The Office of Computer-Based Instruction at the University of Delaware assists faculty members in developing courseware for the PLATO system. Faculty members, working with professional programmer/coordinators and student programmers, follow a procedure that consists of four stages -- proposal, design, programming, and dissemination -- each of which involves review/feedback loops. This paper describes Delaware's model for courseware development as well as the roles of each team member, OCBI's training seminars in programming and design, a systems approach to courseware development that emphasizes outside advisors at each stage, and the periodic design and programming reviews of a lesson as it is developed.

Weissman, Jessica and Molad, Clarisse. 1981. Guidelines for Contracting an Outside CBE Development Vendor, Proceedings, ADCIS Conference, Atlanta, Georgia, March 2-5, pp. 318-321.

This paper offers guidelines for computer-based education (CBE) users for contracting outside vendors to do courseware development. The procedures described are designed to help both client and vendor produce quality courseware that meets the client's instructional needs in a cost-effective way. Important features of the development process include the appointment of individuals to represent to client and vendor groups during development, systematic development of materials including review by the client at each stage, and a defined period for field testing and revision. Documentation throughout the process not only forms a record of the project, but serves as a written delineation of the responsibilities of both parties involved in the development effort.

Descriptive Publications

▶ Frank, Louisa and Smith, Lynn H. 1984. The Conversion of PLATO Courseware to the Apple Microcomputer. Proceedings, ADCIS Conference, Columbus Ohio, May 14-17, pp. 92-96.

Many steps of the development process must be reconsidered in any conversion of courseware to a different system. Although content and instructional design need not be changed, redesign of screen displays and reprogramming pose problems similar to those encountered in original development. Two conversion projects are being carried out at OCBI. Problems that arose during conversion as well as tools and solutions that were developed to overcome the problems are described.

▶ Hofstetter, Fred T. 1984. Perspectives on a Decade of Computer-Based Instruction. Dean Lecture, ADCIS Conference, Columbus, Ohio, May 14-17. To appear in the Journal of Computer-Based Instruction.

An analysis of trends in computer-based instruction during the past decade, this paper begins by characterizing the criteria used to select a CBI system in 1974. Rapid growth in computer-based learning has been accompanied by fundmental changes in attitudes toward the cost and the effectiveness of the computer as a medium for instruction. The results of several hundred controlled studies of CBI effectiveness are summarized. A modern approach to CBI system selection criteria is explored. Melen's Figure of Merit is exposed and scrutinized. An analysis of the three most important CBI selection criteria is provided; these are graphics, communication with the screen, and the quantity and the quality of available courseware. It is shown how a $9 joystick can do the work of an $800 touch panel. In addressing the problem of courseware transportability, the CBI marketplace is analyzed. Machines that came and went during the past decade are listed and discussed. Examples of the lack of standardization are provided. It is suggested that Melen's Figure of Merit may be a common denominator that runs across all machines, but that good courseware tends to use features not included in Melen's law. A list of the features of good CBI is given. The article concludes with projections for the decades ahead. Common pitfalls of designing CBI materials for the mass market are exposed and discussed. The importance of working with high-end machines is stressed. Examples of low-end programs that were high-end inspired are provided.

▶ Stabosz, Rae D. and Weissman, Jessica. 1984. A Model for the PLATO Services Organization in a Large, Multi-System CBE Environment. Proceedings, ADCIS Conference, Columbus Ohio, May 14-17, pp. 156-162.

The Plato Services Organization (PSO) of OCBI has developed a model for consulting which concentrates on author training and user services as its primary functions. This model has been used successfully while the PLATO network was the only development system for CBE at Delaware and continues to serve as the PLATO network takes its place in an expanding CBE environment which utilizes other mini- and microcomputer systems for courseware development. Included is a list of PSO competencies which delineate the scope of expertise and information dissemination expected within the PLATO Services Organization under this model.

▶ Cotugna, Nancy; Corrosi, Ann Marie; and Berrang, Clare. 1983. Computerized Nutrition Counseling in a Coordinated Undergraduate Program. Journal of the American Dietetic Association, February, Vol. 82, No. 1, pp. 182-183.

In the fall of 1980, no direct nutrition information services were available to the student population as a whole at the University of Delaware. The services of a part-time nutritionist, which had previously been available through the student health service, were eliminated because of budget cuts. In an effort to provide access to nutrition information for a maximum number of students, a computer project was developed jointly by the University's Office of Computer-Based Instruction (OCBI) and the coordinated undergraduate program in dietetics (CUPD).

▶ Hofstetter, Fred T. 1983. The Design, Development, and Implementation of the University of Delaware Sound Synthesizer. Proceedings, ADCIS Conference, Denver, Colorado, May 9-13, pp. 197-202.

It is the purpose of this article to present the University of Delaware Sound Synthesizer (UDSS). By way of introduction, the historical background which led to its development is given. The four design goals which determined the features of the synthesizer are discussed. First, the synthesizer is fully programmable in the domains of frequency and time. Second, it includes its own microprocessor, freeing its host computer to perform other tasks while music is playing. Third, programmable memories are included to permit real-time performance. Fourth, while it is expensive, care has been taken to keep its cost in an affordable range. The article concludes with a description of an orchestration program written to support the synthesizer both on the central PLATO system and on Micro PLATO. The UDSS is connectable to and controllable by any microcomputer or terminal which can connect with a Z-80 processor.

▶ Arenson, Michael, ed. 1982. National Consortium for Computer-Based Instruction 1982 Courseware Directory.

This directory is a listing of music courseware developed by leaders in the field of computer-based instruction in music. Each listing includes detailed information about the software and hardware involved as well as an abstract giving more detail about instructional strategies used and the purpose of the programs.

▶ Brooks, Morris W., and Wenger, Ronald H., eds. 1982. Microcomputers in Education: A Handbook to Support Teacher Development Courses and Workshops in the State of Delaware.

This handbook is a compilation of useful information about instructional uses of microcomputers. It was collected by teachers who participated in a year-long Leadership Training Program supported by the National Science Foundation. Topics discussed include computer literacy, using computers to enhance instruction, computer programming in the schools, administrative uses of microcomputers, microcomputer hardware, and resources for further information. Several extensive appendices contain reviews of courseware and textbooks on educational computing. Also included are suggested syllabi for programming courses at several levels, comprehensive sets of objectives for computer literacy, and glossaries of computer jargon.

Overall Educational Value of Computer-Based Instruction for the University of Delaware

As the number of departments using computer-based instruction has increased from the original three in 1974 to the present forty-three, the faculty and students have identified many benefits of CBE to the University of Delaware. It is through the realizaton of these benefits that CBE has received widespread support and acceptance at the University. This report concludes with the classifcation of these benefits according to eleven main purposes which are enumerated and explained as follows:

1. To individualize instruction. Faculty members and students often complain that the level of instruction is never right for all members in a class. Some are fast learners; others are slow learners. Some drop out because a course is too boring; others drop out because they can't keep up. The individualized, self-paced approach of CBE has proven to be a remedy for this problem of individual differences.

2. To expand the University's educational market. The market needs a delivery system which can economically deliver instruction over a wide geographical area. Through computer-based techniques, the University can reach more students. For example, if three people in Georgetown wanted to learn Persian, PLATO could teach them whereas a regular course would be cancelled because of small enrollment. This aspect becomes even more important as the learner population is becoming more adult in its make-up.

3. To reduce the time needed for instruction. Computer-based, self-paced techniques make it possible for students to finish courses in less than the normal fourteen-week semester. Students could complete their degrees ahead of schedule, thereby reducing the cost of instruction to the parent and the taxpayer.

4. To emphasize the intrinsic joy of learning and deemphasize competition with peers as a motivating force. In the computer-based environment the anxieties associated with the traditional classroom are minimized. The student is free to respond as he wishes without fear of ridicule from either his peers or his teacher. In such an environment learning is a lot of fun, and motivation is high.

5. To enable students to develop a richer intuitive grasp of complex phenomena through graphic visual representation. Especially applicable to PLATO is the saying that "A picture is worth a thousand words." The ability of PLATO to create interactively a display suited to the student's specific learning needs cannot be overestimated.

6. To provide students with access to a wide range of data for checking out hypotheses. A good example of this benefit is the population dynamics program. Stored in the computer are up-to-date data on the populations of countries throughout the world. The student is able to set variables which affect the futures of those populations, such as time and extent of famines and can then see the effects of those variables upon future generations of the populations.

7. To enable students to learn more of the complexities of phenomena through modeling and simulation. In addition to giving students drill-and-practice and tutorials on various sujects, computers can also allow the student to create models and to simulate complex phenomena. For example, the student can make electronic circuits, design clothes, compose music, draw pictures, mix chemicals, breed fruit flies, and then study the results of the models and simulations. Such flexibility is not a regular part of education in university courses; it should be.

8. To encourage students to tailor their learning experiences to meet their own objectives. How often do students complain that they did not get what they wanted out of a course? They may have met the instructor's objectives, but they did not meet their own objectives. Computers can help them do both. For example, in the University's advanced music theory courses, very little time is spent on set theory. However, some students want to explore it in depth. It is a complex analytical system which cannot be learned by the average student by reading a book. Interactive instruction in this area is made available to the students who want it by means of PLATO's set theory program. There are ten hours of of instruction available for students who want to learn set theory, including periodic tests which assure the students that they are mastering the material. In this way, students are encourged to extend their learning beyond the requirements of the course.

9. To give immediate feedback. One of the greatest advantages of computer-based techniques is immediate feedback. Through individual interaction with the computer, the students partake in a dialogue in which they receive instantaneous responses to their input. There is no other medium which provides this interaction, a benefit which has led to the documentation of significant improvement of instruction in such diverse areas as anesthesiology, French, music, mechanics, dentistry, sociology, calculus, geography, ecology, health, physics, and accounting.

10. To provide students with an anonymous way of asking questions about sensitive matters. Recent research has shown that the use of anonymous sign-ons whereby students can use PLATO without revealing their identities has encouraged students to ask questions and get responses on sensitive issues which they would normally be afraid to discuss. PLATO's group notesfile capabilities enable students not only to ask questions and to get responses on their own personal questions, but also to see the questions and responses anonymously written by other students. Especially in the area of sex education this has proven to be an excellent means of allowing students to anonymously explore sensitive personal issues.

11. To provide maximum flexibility. Microelectronic technology has progressed to the point at which practically any electronic device can be connected to a computer terminal. The terminal already has a slide projector, a touch-sensitive screen, a random-access audio device, a speech synthesizer, and a music generator. The terminal also contains a microprocessor, the latest development in computer hardware, which secures product flexibility for the foreseeable future.

APPENDIX

Catalog of Programs Under Development in the Office of Computer-Based Instruction

CATALOG OF PROGRAMS UNDER DEVELOPMENT IN THE OFFICE OF COMPUTER-BASED INSTRUCTION

PART I: PLATO LESSONS

INSTRUCTIONAL LESSONS

Project	Title	Filename	Developer	Programmer
Accounting	Accounting Sample Test	acc207t	A. DiAntonio	L. Frank W. Childs C. Leefeldt K. Slaughter
	The Balance Sheet Equation	bsheet	A. DiAntonio	G. Betz K. Slaughter
	Costing Methods	costing	J. Gillespie	W. Childs
Accounting: PLM	Advanced Accounting	acc415	A. DiAntonio	C. Leefeldt
	CMA Review	accumacu	A. DiAntonio	A. DiAntonio
	CPA Review	cpareview	A. DiAntonio	A. DiAntonio
	Financial Accounting	acc207cu	A. DiAntonio	C. Leefeldt
	Intermediate Accounting	acc316cu	A. DiAntonio	C. Leefeldt
	Managerial Accounting	acc208cu	A. DiAntonio	C. Leefeldt
Advisement Center	General Academic Information	maini acinfo actutor actutor2 actutor3 actutor4 actutor5	P. Rees and Staff	S. Correll
	Exploring Individualized Curriculum Options	indivcur	P. Rees A. Crowley	S. Correll

Project	Title	Filename	Developer	Programmer
Agriculture	APS101: Sample Test Questions	apsintro	Sammelwitz	Sammelwitz
	Anatomy and Physiology on PLATO	agplato	Sammelwitz	D. Anderer
	Dance Language in Honey Bees	bee2	D. Caron Mason	Sharnoff Greenberg
	Terminology & Definitions	endocrine1	Sammelwitz	D. Tripp S. Waeber M. Porter M. Larkin
	Listing & Classifications of Endocrine Structures	endocrine2	Sammelwitz	D. Tripp S. Waeber M. Porter M. Larkin
	Locations of Endocrine Structures in Mammalian Species	endocrine3	Sammelwitz	D. Tripp S. Waeber M. Porter M. Larkin
	Locations of Endocrine Structures in Avarian Species	endocrine4	Sammelwitz	D. Tripp S. Waeber M. Porter M. Larkin
	Hormones Secreted by the Endocrine Structures	endocrine5	Sammelwitz	D. Tripp S. Waeber M. Porter M. Larkin
	Genetic Relations	relations	G. Haenlein Sharnoff	C. Lewis D. Tripp M. Larkin
	Preparing a Balanced Animal Ration	rations	Saylor Sharnoff	M. Larkin Sharnoff
	Preparing a Balanced Animal Ration Laboratory	fration	Saylor Sharnoff	Sharnoff Andersen
	Senses: Classifying the Senses	senses	Sammelwitz Sharnoff	C. Murray

Project	Title	Filename	Developer	Programmer
Agriculture (continued)	Senses: Identifying the Senses	senseg	Sammelwitz Sharnoff	J. Landis
	Senses: Location and Function of Ear Structures	earquiz	Sammelwitz Sharnoff	M. Larkin
	What's My Kind?, An Insect Order Identification Game	insects	C. Mason Sharnoff	R. Charles
Agriculture: PLM	Digestion	apsmod4	Sammelwitz	Sammelwitz
	Endocrine System	apsmod2	Sammelwitz	Sammelwitz
	Life Organization	apsmod1	Sammelwitz	Sammelwitz
	Metabolism	apsmod7	Sammelwitz	Sammelwitz
	Muscles	apsmod6	Sammelwitz	Sammelwitz
	Reproduction	apsmod3	Sammelwitz	Sammelwitz
	Respiratory System	apsmod	Sammelwitz	Sammelwitz
	Skin and Bones	apsmod5	Sammelwitz	Sammelwitz
Agricultural Economics	Simag: An Agribusiness Simulation	simag	M. Hudson Toensmeyer A. DiAntonio	C. Leefeldt
Agricultural Engineering	Beginning Drafting	engdraft	L. Frank	L. Frank
Anthropology	The Anthropological Study of Art Style	roe1	P. Roe	K. Sims
	Anthropological Descent Theory	descent2	N. Schwartz M. Fortner	C. Collings K. Sims
	Anthropological Residence Theory	reside2	N. Schwartz M. Fortner	C. Collings K. Sims
	Cellular Structure	physanthro	M. Hamilton	M. Fortner
	Grammatical Study of Art Style Part I	roe2a	P. Roe	C. Brooks S. Lamphier K. Sims

Project	Title	Filename	Developer	Programmer
Anthropology (continued)	Grammatical Study of Art Style Part II	roe2b	P. Roe	C. Brooks S. Lamphier K. Sims
Art	Aesthetic Value	value	R. Nichols	Joseph Maia
	Composition Using Grey Scale Tones	gscale	R. Nichols	Joseph Maia B. Williams
	Design Aesthetics and Creation	des	R. Nichols	C. Wickham J. Trueblood C. Vinson
	Newspaper Copy Fitting	copyfit	R. Nichols	S. Cox
	Optical Letterspacing	nols	R. Nichols	C. Wickham J. Trueblood S. Cox
	Painting on a Computer	mpt	R. Nichols B. Williams	B. Williams
	Pigment Identification	pigid	J. Stoner	B. Listman L. Frank C. Patchel
	Random Dot Pattern Generator	random	R. Nichols	K. Abele
	Rotating Squares Generator	square	R. Nichols J. Wilson	J. Wilson
Biology	Genetics of Operons	operona operonb operonc	D. Sheppard	K. Bergey B. Cooley
	Meiosis	meiofine	J. Beyer A. Olsen	J. Beyer
	Molecular Basis of Mutation	mutagen	D. Sheppard	P. Draus

Project	Title	Filename	Developer	Programmer
Biology (continued)	Population Genetics	beans	A. Clark	B. Cooley
	Recombinant DNA: Techniques and Applications	recomb	D. Sheppard	J. Beyer
Chemical Engineering	Mass Balance With Chemical Reactions	mb3	S. Sandler J. Ayres	J. Ayres
	Vapor-Liquid Equilibrium	vliquid	S. Sandler J. Ayers	B. Schwarz
Chemistry	Determining Shapes of Molecules: VSEPR	vsepr vsprquiz vspredit	E. Davis R. Garton	S. Digel R. Garton Vishnevetsky
Computer Science	Push-Down Automata Simulator	pdsim	Weischedel	Joseph Maia
	Turing Machine Simulator	tmsim	Weischedel	Joseph Maia
Counseling	The Centrality of Work	wrkethic	R. Sharf	L. Frank C. Collings K. Jones R. Sutor Zembrzuski Slaughter
	Choices	choices	R. Sharf	L. Frank C. Collings K. Jones R. Sutor Zembrzuski Slaughter
	Counseling for Career Decisions	vocouns vocouns1 vocouns2 vocouns3	R. Sharf	L. Frank
	Counseling for Career Decisions: A Simulation	vocdism	R. Sharf	L. Frank

Project	Title	Filename	Developer	Programmer
Counseling (continued)	Custodian	janitor1 janitor2	L. Bloom	L. Frank S. Lesnik C. Collings
	The D.O.T.	dot	R. Sharf	L. Frank C. Collings K. Jones R. Sutor Zembrzuski Slaughter
	Exploring Careers: The Theory	couselr	R. Sharf	L. Frank C. Collings K. Jones R. Sutor Zembrzuski Slaughter
	Exploring Careers: The Theory Review Questions	counsqz	R. Sharf	L. Frank C. Collings K. Jones R. Sutor Zembrzuski Slaughter
	Holland's Theory of Vocational Development	holland	R. Sharf	L. Frank C. Collings K. Jones R. Sutor Zembrzuski Slaughter
	Parson's Theory of Vocational Development	parsons	R. Sharf	L. Frank C. Collings K. Jones R. Sutor Zembrzuski Slaughter
	Retail Sales Clerk	retail1 retail2 retail3 retail4	G. Sharnoff R. Sharf	L. Frank S. Lesnik R. Sutor K. Jones

Project	Title	Filename	Developer	Programmer
Counseling (continued)	Secretary: Skills and Careers	secretar secretr1 secretr2 secretr3	J. Morrison R. Sharf	L. Frank S. Lesnik R. Sutor K. Jones Zembrzuski
	Vocational Development	vocdevl	R. Sharf	L. Frank C. Collings K. Jones R. Sutor Zembrzuski Slaughter
Economics	Economic Practice Problems	econprob	C. Link J. Miller L. Pienta	Slaughter Zembrzuski S. Lamphier B. Polejes
	Fiscal Policy (adapted from University of Illinois)	padend	D. Paden J. Miller	Zembrzuski
	Income Determination with Government (adapted from University of Illinois)	consum1	D. Paden J. Miller	Zembrzuski
	Income Determination without Government (adapted from University of Illinois)	consum	D. Paden J. Miller C. Link	Zembrzuski P. Smith
	Supply and Demand	supply	D.Paden J. Miller C. Link	Zembrzuski P. Smith
Education	Big Story	readalong	P. Pelosi	J. Weissman
	Factors in Reading Comprehension	readlab	F. Murray	J. Sandler
	Fast Accurate Symbol Transcription for Evaluation of Elementary Reading	squiggles	J. Pikulski	D. Braendle

Project	Title	Filename	Developer	Programmer
Education (continued)	Hang-a-Spy (hangman with spies)	hangspy	J. Weissman B. Seiler	J. Weissman
	Hang-a-Spy Word List Maker	hangsetup	J. Weissman	J. Weissman
	Make a Spy	makespy	J. Weissman	J. Weissman
	Metric Estimate Game	skunkwar	B. Seiler J. Wilson	B. Seiler J. Wilson
	Sight Word Attack Team	swat	R. Bianco P. Pelosi J. Weissman B. Seiler	J. Weissman
	Sight Word Teaching Method Simulations	sightword	P. Pelosi	J. Weissman
	Spy Meeting	spymeet	J. Weissman B. Seiler	J. Weissman
	Spot the Spy	spotspy	J. Weissman P. Pelosi B. Seiler	J. Weissman
	Spy Concentration	newtwo	J. Weissman B. Seiler	J. Weissman
	Spy Concentration Word List Maker	consetup	J. Weissman	J. Weissman C. Leefeldt
	SWAT Promotion Test	swattest	J. Weissman P. Pelosi	J. Weissman
	Word Zoo	wordzoo	S. Hansell	J. Weissman
English	The Animal Game	animal	L. Arena S. Homsey	J. Weissman J. Snyder R. Stabosz
	The Animal Game Editor	animaled	S. Homsey R. Stabosz	R. Stabosz J. Snyder
	Diagnostic Test Instructions	ndtins	L. Arena M. Peoples S. Homsey	J. Snyder J. Landis

Project	Title	Filename	Developer	Programmer
English (continued)	IS and ARE, the Missing Links	odelete	L. Arena M. Peoples	J. Weissman
	"S" on Third: When to Put S on a Verb	threepv	L. Arena P. Townsend	J. Maia
Food Science and Human Nutrition	Nutrition and Diabetes Mellitus: Part I: Nutritional and Clinical Management of Diabetes Mellitus	ndiabet1	L. Aljadir	E. Stevens F. Dunham
	Nutrition and Diabetes Mellitus: Part II: Estimation of Energy Needs for Weight control	ndiabet2	L. Aljadir	J. Snyder E. Stevens
	Nutrition and and Diabetes Mellitus: Part III: Using Exchange Lists for Meal Planning	cdiabet3	L. Aljadir	J. Snyder E. Stevens
	Weight Control: Topic I: Hormonal Action and Metabolism of Carbohydrate, Fat and Protein	nweight	L. Aljadir S. Garton	P. Patton
	Weight Control: Topic II: Metabolic Basis of Hazardous Dietary Regimens	nwt2	L. Aljadir C. Blanchet	P. Patton S. Garton E. Stevens J. Krinsky

Project	Title	Filename	Developer	Programmer
Languages	Artifex Verborum	artnset	G. Culley	G. Culley
	¡ESPAÑOL! Lengua y cultura de hoy	hoy1	T. Lathrop	B. Pasapane
		hoy2	T. Lathrop	B. Pasapane
		hoy3	T. Lathrop	G. Mulford
		hoy4	T. Lathrop	B. Pasapane G. Mulford
		hoy5	T. Lathrop	E. Kapp
		hoy6	T. Lathrop	E. Kapp
		hoy7	T. Lathrop	P. Vinall
		hoy8	T. Lathrop	B. Pasapane G. Mulford
		hoy9	T. Lathrop	V. Gardner
		hoy10	T. Lathrop	G. Mulford
		hoy11	T. Lathrop	G. Mulford
		hoy12	T. Lathrop	B. Pasapane V. Gardner
		hoy13	T. Lathrop	G. Mulford
		hoy15	T. Lathrop	A. Haughay G. Mulford
	French Verbs	verbs verbedit	T. Braun B. Robb	G. Mulford C. Marks K. Jones
	German Adjective Endings	pgerm	A. Howard	A. Howard
	Hidden Word Game and Generator	subpuz	C. Brooks	C. Brooks
	Language Lab Tape Editor	tapemaker	G. Mulford	J. Wilson
	Latin Substitution and Transformation Drill	vsubdrill	D. Williams	D. Williams V. Gardner
	Les quatre cents Mots	vdrill frenpix lrem vdrledit vdrldata charmake audioles	T. Braun G. Mulford V. Gardner	V. Gardner C. Collings G. Mulford M. Baum

Project	Title	Filename	Developer	Programmer
Languages (continued)	Cursus Honorum	ncursus	G. Culley	G. Culley
	Mare Nostrum: A Game with Latin Nouns and Adjectives	mare	G. Culley	G. Culley
	Multi-language Substitution and Transformation Drill	vsubmake subdrill	D. Williams	D. Williams V. Gardner
	Principal Parts of German Verbs	gquiz	R. Skillman	R. Skillman
	Review of English Grammar	udgrammar	G. Culley	G. Culley
	Ringers: A Grammar Recognition Lesson	ringers	G. Mulford	G. Mulford
	Translat: Exercises in Translating Latin Sentences	translat	G. Culley	G. Culley
	Touché: A French Word Order Touch Lesson	touche	G. Mulford	D. Williams
	Underliner: A Word-in-Context Lesson	uliner	G. Mulford	G. Mulford E. Kapp
	Verb Factory	factory1	G. Culley	G. Culley
Library	Doing Research? A Beginning Library Research Strategy	nlibdex	P. Arnott FitzGerald L. Masters	J. Snyder C. Parker
	Card Catalog	ncardcat	P. Arnott FitzGerald L. Masters	J. Snyder C. Parker D. Richards
	Periodical Indexes	nperdex	P. Arnott FitzGerald L. Masters	D. Mosby C. Parker D. Richards
	Newspaper Indexes	nnewspap	P. Arnott FitzGerald L. Masters	Sundermier J. Snyder D. Richards

Project	Title	Filename	Developer	Programmer
Library (continued)	Government Documents	ngovdoc	P. Arnott FitzGerald L. Masters	Dominguez Jr D. Richards
	Locating Library References	nlocate	P. Arnott FitzGerald L. Masters	M. Baum C. Parker
	Test	libtest	P. Arnott FitzGerald L. Masters	D. Richards
Mathematics	Centers of Mass	calcstuf	J. Bergman	M. Rogers
	Consumption: An Exercise in Graphing and Interpreting Linear Functions	causec1a	J. Miller J. Bergman	M. Morrow S. Coburn S. Lesnik
	Cost Functions	causec4	C. Link	S. Coburn
	Derivative, Difference Quotients, and Increments	deriv4	A. Stickney	A. Stickney
	Differentiation Formulas	deriv5	A. Stickney	A. Stickney
	Dynamic Programming	dynprog shortpth shrubcov helmet digitize dpapx	C. Sloyer W. Copes W. Sacco L. Smith	L. Smith C. Vinson S. Kowalski B. Williams M. Baum Slaughter
	Exponential Harvesting	harvest	J. Bergman	M. Rogers
	Glyphs	glyph1 glyph2	C. Sloyer W. Copes W. Sacco L. Smith	L. Smith M. Baum

Project	Title	Filename	Developer	Programmer
Mathematics (continued)	Graph Theory	graf chrom plan trees digraf	C. Sloyer W. Copes W. Sacco L. Smith	L. Smith S. Kowalski
	Integration Using Areas	integ1	A. Stickney	A. Stickney
	Interval Notation Quiz	interval	M. Brooks	M. Brooks
	Mathematics in Medicine	mathmed med2	C. Sloyer W. Copes W. Sacco L. Smith	S. Kowalski L. Smith
	Math Interactive Problem Package (MIPP) a. Driver Lesson b. Introduction to MIPP	 mippdemo mippintr	R. Wenger M. Brooks	R. Payne Slaughter
	Parametric Curve Plotter	pplotter	M. Brooks	M. Brooks
	PLM Curriculum for Intermediate Algebra	pcmath	B. Daley	M. Brooks A. Tripp
	Polar Coordinate Game	polarco	A. Stickney	A. Stickney
	Power Series Plotter	psplotter	M. Brooks	M. Brooks
	Production Functions	causec3	C. Link	S. Coburn
	The Production Possibility Curve	causec2	J. Miller	S. Lesnik
	Profit Maximization	causec5a	C. Link	S. Coburn
	Properties of Integrals	integ2	A. Stickney	A. Stickney
	Queues	queue queue2	C. Sloyer W. Copes W. Sacco L. Smith	L. Smith S. Kowalski

Project	Title	Filename	Developer	Programmer
Mathematics (continued)	Rectangular Coordinates	carteco	A. Stickney	A. Stickney
	Rootfinder and Function Plotter	rootfind	A. Stickney	A. Stickney
	Sequence Plotter	sequence	M. Brooks	M. Brooks
	Sigma Notation Quiz	sigma	M. Brooks	M. Brooks
	Surface Plotter	plot2b	A. Stickney	A. Stickney
	Two Variable Function Plotter	plot2	A. Stickney	A. Stickney
	Vector Field Plotter	vplotter	M. Brooks	M. Brooks
Music	Bass Figurization	bfigrev bfigin	M. Arenson	P. Nelson S. Monarski
	Basic Part Writing	bpwrev bpwin	M. Arenson	P. Nelson
	Beat Divisions and Units	beatrev beatin	M. Arenson	P. Nelson
	Competency-Based Chord Quality Drill	udchord	Hofstetter	W. Lynch
	Competency-Based Harmony Drill	udharmon	Hofstetter	W. Lynch
	Competency-Based Interval Drill	udinter	Hofstetter	W. Lynch
	Competency-Based Interval Drill for Pitch Detection	pinter	Hofstetter	W. Lynch M. Baum J. Conrad
	Competency-Based Melody Drill	udmelody	Hofstetter	W. Lynch
	Competency-Based Melody Drill for Pitch Detection	pmelody	Hofstetter	W. Lynch M. Baum J. Conrad

Project	Title	Filename	Developer	Programmer
Music (continued)	Competency-Based Rhythm Drill	udrhythm	Hofstetter	W. Lynch
	Chord Construction and Identification	funirev funcrev functin	M. Arenson	P. Nelson
	Guide to the GUIDO Written Music Theory System	curihelp	M. Arenson	P. Nelson J. Conrad
	Half Steps and Whole Steps	halfrev halfin	M. Arenson	P. Nelson G. Sloyer
	Interval Hall of Fame	intervals	Hofstetter	W. Lynch
	Key Signatures	ksigrev ksigin	M. Arenson	P. Nelson S. Monarski
	MusiMatic	musimatic	W. Lynch	W. Lynch
	Note Reading	noterev notein	M. Arenson	P. Nelson S. Monarski
	Note Reading Hall of Fame	notegame	P. McCarthy	D. Braendle
	Orchestration for the University of Delaware Sound Synthesizer	box	Hofstetter	W. Lynch
	Partials	partrev partin	M. Arenson	P. Nelson
	Rhythmic Notation	rhrev rhynotin	M. Arenson	P. Nelson
	Scales	scalerev scalein	M. Arenson	P. Nelson S. Monarski
	Set Names (after Forte)	setnames	Hofstetter	J. Trueblood

Project	Title	Filename	Developer	Programmer
Music (continued)	Seven Basic Rhythms	rrnythm	M. Arenson W. Lynch	R. Preiss
	Transposition	tposrev tposin	M. Arenson	P. Nelson
	Written Intervals	wrintrev wrintin	M. Arenson	P. Nelson
Nursing	Abdominal Perineal Resection: A Patient Care Simulation	peri	M. A. Early	M. Fortner
	Death: A Personal Encounter	ndanding	M. Lambrecht	M. Greenberg E. Stevens
	Human Heart Valves (adapted from a University of Illinois veterinary medicine lesson)	heartv2	M. A. Early	C. Criste D. Graper
	An Introduction to the Format of the Challenge Exam	introtst	M. Fortner M. A. Early	M. Fortner
	Nurse 201 Meds Test	test201	A. Craig	M. Fortner
	The Nursing Process (Adapted from the University of Pittsburgh)	soapie	S. Cudney	C. Wickham J. Trueblood
	PLM Test Modules for Psychopharmacological Nursing Lessons	phm3mod1 phm3mod2	S. Alderson E. Boettcher	E. Stevens
	PLM Test Modules for The Nursing Process and Antipsychotic Medication	phm3mod3 phm3mod4	S. Alderson E. Boettcher	E. Stevens
	PLM Test Modules for The Nursing Process and Antianxiety Medication	phm4mod1 phm4mod2	S. Alderson	L. Smith E. Stevens

Project	Title	Filename	Developer	Programmer
Nursing (continued)	PLM Test Modules for The Nursing Process and Antidepressant Medication	phm5mod1 phm5mod2	S. Alderson	L. Smith E. Stevens
	PLM Test Modules for The Nursing Process and Lithium Carbonate	phm5mod3 phm5mod4	S. Alderson	F. Dunham E. Stevens
	An Introduction to Psychopharmacological Nursing	pharm1f	S. Alderson E. Boettcher	E. Stevens F. Dunham
	The Nursing Process and Psychotropic Medication: The Steps of the Nursing Process	ngpharm2	S. Alderson E. Boettcher	M. Fortner M. Greenberg J. Nicholson E. Stevens
	The Nursing Process and Antipsychotic Medication	pharm3j	S. Alderson E. Boettcher	E. Stevens
	The Nursing Process and Antianxiety Medication	npharm4j	S. Alderson	R. Skillman E. Stevens J. Krinsky
	The Nursing Process and Antidepressant Medication	npharm5a	S. Alderson	L. Smith F. Dunham E. Stevens
	The Nursing Process and Lithium Carbonate	npharm5b	S. Alderson	L. Smith F. Dunham E. Stevens J. Nicholson
	Sample Challenge Exam	nursesampl	M. A. Early D. Williams F. Kazmierczak	M. Fortner Slaughter
Physical Education	Basic Racquetball Strategies for Doubles Play: Defense	raquet2	J. Kent	P. Bayalis T. Byrne N. Balogh
	Basic Racquetball Strategies for Doubles Play: Quiz	raqtest	J. Kent	P. Bayalis S. Giniger

Project	Title	Filename	Developer	Programmer
Physical Education (continued)	Biomechanics Application Problems The Laws of Signed Numbers	lawsign	D. Barlow	P. Bayalis N. Balogh
	Biomechanics Application Problems: Balancing Equations	balance	D. Barlow	P. Bayalis N. Balogh
	Biomechanics Application Problems: Formula Transformation	formula	D. Barlow	P. Bayalis T. Byrne N. Balogh
	Biomechanics Application Problems: Proportionality	proport	D. Barlow	P. Bayalis D. Richards N. Balogh T. Byrne
	Biomechanics Application Problems: Unit Conversion	unitcon	D. Barlow P. Bayalis	S. Correll N. Balogh
	Biomechanics Application Problems: Trigonometric Functions	trig	D. Barlow P. Bayalis	S. Correll N. Balogh
	Biomechanics Application Problems: Vector Motion Analysis in Sport I	bioprob1	D. Barlow P. Bayalis	S. Correll N. Balogh T. Byrne
	Biomechanics Application Problems: Vector Motion Analysis in Sport II	bioprob2	D. Barlow P. Bayalis	S. Correll N. Balogh T. Byrne
	Biomechanics Application Problems: Vector Motion Analysis in Sport III	bioprob3	D. Barlow P. Bayalis	S. Correll N. Balogh T. Byrne
	Biomechanics Application Problems: Vector Motion Analysis in Sport IV	bioprob4	D. Barlow P. Bayalis	S. Correll N. Balogh T. Byrne

Project	Title	Filename	Developer	Programmer
Physical Education (continued)	Biomechanics Application Problems: Pre/Post Test	preptst	D. Barlow P. Bayalis	S. Correll T. Byrne
	Cartesian Coordinate System	cartesian	J. Richards	J. Richards
	Film Motion Analysis Bitpad Version	analbit	D. Barlow	Markham Jr.
	Projector Version			
	Fitness III: Your Fitness Program	fitnes3	J. O'Neill	C. Berrang D. Galla T. Byrne
	Muscle Identification: Upper Extremities	muscle	K. Handling P. Bayalis	S. Hart
	Muscle Identification: Lower Extremities	muscle2	K. Handling P. Bayalis	S. Hart
	Muscle Identification: Trunk	muscle3	K. Handling P. Bayalis	S. Hart
	Social Dancing	dancer	J. Pholeric	P. Bayalis
Physics	The Positions of the Planets	planets	S. Lamphier	S. Lamphier
PLATO and OCBI	Delaware PLATO System Hardware Configuration	udhard	J. Wilson B. Fortner	B. Fortner D. Anderer
	Example of TUTOR Judging Flexibility	udmeow	R. Stabosz	R. Stabosz
	How to Read and Write in a Notefile	raeguide	R. Stabosz	R. Stabosz
	How to Use PLATO	udhelp udhlp sudhelp nhlpstor	J. Weissman B. Seiler	J. Weissman S. Hart

Project	Title	Filename	Developer	Programmer
PLATO and OCBI (continued)	Information on OCBI	udinfo	Hofstetter J. Wilson	J. Wilson D. Graper
	Programming for the Touch Panel	touchhelp	J. Weissman	J. Weissman
	System Messages -- Who Sent It and Why	messages	J. Weissman	J. Weissman
Political Science	Committee Chairman (adapted from University of Illinois)	npols8	R. Sylves S. Garton	K. Kahn S. Garton
	Organization Charts and Public Administration	orgch	R. Sylves S. Garton	J. Hassert
	Political Districting (adapted from University of Illinois)	npols3	R. Sylves S. Garton	S. Gill
	State Agency Head (adapated from University of Illinois)	npols5	R. Sylves S. Garton	W. Smith R. Smith
Psychology	Anagrams	anagrams	Berg-Cross Mc Laughlin	J. Sandler
	Conservation	clare	C. Berrang	C. Berrang
	Direct Scaling	dscale	J. Hoffman	J. Weissman R. Krejci M. Frank W. Daniels
	An Experiment in Memory	remember	Mc Laughlin	J. Sandler
	Eyepath	eyepath	L. C. Skeen	C. Vinson W. Daniels

Project	Title	Filename	Developer	Programmer
Psychology (continued)	Geometrical Optical Illusions	illusion	J. Hoffman J. Weissman	J. Weissman R. Krejci
	Short-Term Visual Memory Experiments	rletters letters	J. Hoffman	J. Green C. Marks R. Krejci
	Memory Experiment	retain	Mc Laughlin	J. Sandler C. Berrang
	Mental Imagery	wrmps	Mc Laughlin R. Stabosz	R. Stabosz C. Berrang
	The Poggendorf Illusion	pogexp	J. Hoffman	J. Weissman
	Reaction Time and the Measurement of Mental Processes	reactime	J. Hoffman	C. Marks R. Krejci
	Visual Perception	eye1	J. Hoffman	J. Weissman R. Krejci
SOAC	Choosing an Effective Leadership Style	soac1	M. Harper	C. Berrang P. Mattera
	The SOAC Leadership Program: A Package of Leadership Lessons	soacint	M. Harper	C. Berrang P. Mattera
Security	Professionalism	secprof	J. Schimmel	R. Schwartz
	Public Safety 10 Code	tencode	S. Swain	R. Krejci
Statistics	Statistics Worksheet Lesson	statone	V. Martuza	A. Olsen M. J. Reed G. Feurer
Textiles, Design and Consumer Economics	Sewing Pattern Alteration Laboratory	alterlab	F. Mayhew D. Elias F. Smith	D. Anderer V. Gardner K. Bergey
		altintro altedit	F. Mayhew V. Gardner F. Mayhew	V. Gardner V. Gardner

Project	Title	Filename	Developer	Programmer
Textiles, Design and Consumer Economics (continued)	Body Measurement	bigbody	D. Elias F. Mayhew	D. Anderer K. Bergey
	Consumer Education Resource Network	consume	H. Stewart	M. Laubach D. Mellor K. Bergey D. Tripp D. Anderer
	Consumer Education Steps to Problem Solving	cesteps	H. Stewart N. McShaw	K. Bergey
	Consumer Financial Management	persfin2	J. Morrison D. Richards	M. Dombrowski L. Keil
	Consumer in the Marketplace: Topic #1 - Consumption	conecon1	J. Morrison D. Mellor	D. Mellor K. Bergey et al.
	Consumer in the Marketplace: Topic #2 - Information	conecon2	J. Morrison D. Mellor	D. Mellor K. Bergey et al.
	Consumer in the Marketplace: Topic #3 - Consumer Purchasing Matrix	conecon3	J. Morrison K. Bergey	K. Bergey D. Mellor et al.
	Consumer in the Marketplace: [illegible] - Consumer Price Index	conecon4	J. Morrison [illegible]	K. Jones K. Bergey et al.
	Consumer in the Marketplace: Topic #5 - Sovereignty in the Marketplace	conecon5	J. Morrison K. Jones	K. Jones K. Bergey et al.
	Consumer in the Marketplace: Topic #6 - Time-Probability	conecon6	J. Morrison K. Jones	K. Jones K. Bergey et al.

Project	Title	Filename	Developer	Programmer
Textiles, Design and Consumer Economics (continued)	Consumer in the Marketplace: Topic #7 - Opportunity Costs in the Family	conecon7	J. Morrison K. Jones	K. Jones K. Bergey et al.
	Consumer in the Marketplace: Topic #8 - Investment in Human Capital	conecon8	J. Morrison C. Ford-Kipp	C. Ford-Kipp K. Bergey et al.
	Consumer in the Marketplace: Topic #9 - Consumer Rights and Resposibilities	conecon9	J. Morrison C. Ford-Kipp	C. Ford-Kipp K. Bergey et al.
	Consumer in the Marketplace: Topic #10 - Concept: Rationality	coneco10	J. Morrison S. Garton	R. Smith S. Gill et al.
	Comsumer in the Marketplace: Topic #11 - Consumer Delivery System	coneco11	J. Morrison J. Snyder	J. Snyder et al.
	Consumer in the Marketplace: Topic #12 - Concept: Optimal Consumption Stream	coneco12	J. Morrison	J. Hassert et al.
	Consumer in the Marketpl ce: Topic #13 - Product Liability Concept	coneco13	J. Morrison S. McBride	R. Smith J. Simpson et al.
	Consumer in the Marketplace: Topic #14 - Transfer of Income Concept	coneco14	J. Morrison	J. Hassert et al.
	Consumer in the Marketplace: Topic #15 - Concept: Public Policy	coneco15	J. Morrison	B. Goldfarb et al.

Project	Title	Filename	Developer	Programmer
Textiles, Design and Consumer Economics (continued)	Consumer in the Marketplace: Topic #16 - Concept: Transfer Payments	coneco16	J. Morrison	J. Hassert et al.
	Determining Pattern Alterations	mod	D. Elias F. Mayhew	D. Anderer D. Elias
	Ease Requirements	ease	D. Elias F. Mayhew F. Smith	D. Anderer D. Elias
	Lessons in Architectural Drawing: Introduction	draft1	L. Gil S. Garton W. Boenig L. Frank	W. Boenig
	Lessons in Architectural Drawing: Lesson I: Sketch Lines	draft2	L. Gil S. Garton W. Boenig L. Frank	W. Boenig
	Lessons in Architectural Drawing: Lesson II: Architectural Lettering	draft3	L. Gil S. Garton W. Boenig L. Frank	W. Boenig
	Lessons in Architectural Drawing: Lesson III: Architectural Symbols	draft4	L. Gil S. Garton W. Boenig L. Frank	W. Boenig
	Lessons in Architectural Drawing: Lesson IV: Dimensioning	draft5	L. Gil S. Garton W. Boenig L. Frank	W. Boenig
	Metric Practice	seemet	D. Elias F. Mayhew F. Smith	D. Anderer D. Elias
	Pattern Measurement	patterns	D. Elias F. Mayhew B. Seiler F. Smith	D. Anderer K. Bergey D. Elias J. Wilson

Project	Title	Filename	Developer	Programmer
Wellspring Health Education Project	Contraception: Choosing a Method That's Best for You	precontr	A. Lomax	C. Berrang J. Merryman
	Contraception: Information	contra	Dominguez Jr A. Lomax	Dominguez Jr
	Sex Education Referral Network	refer	A. Lomax	M. Laubach D. Tripp
	Sex Myth Quiz	myth	Dominguez Jr A. Lomax	Dominguez Jr
	Thinking About Drinking	alcohol	D. Bremer	C. Berrang J. Schmidt T. Harvey
	Wellspring: What It's All About	wellspri	Dominguez Jr A. Lomax	Dominguez Jr
	Resources for Women	womanles	G. Hirsch	G. Hirsch

RESEARCH PROGRAMS

Project	Title	Filename	Developer	Programmer
Educational Studies	Educational Studies: Curriculum Management System	distedit schledit	R. Venezky	K. Kahn G. Feurer
	Gradebook	dgrader dchild	C.J. Meisel	C. Brooks D. Herr
	Graph Reading	graphs	V. Martuza	J. Trueblood
	Lexical Recognition	lexiless	R. Venezky	G. Feurer
	Moving Window	window	R. Venezky	D. Anderer
	Multi-Dimensional Scaling Survey Package	mdsfix mdsrun mdsedit	V. Martuza	Joseph Maia C. Prettyman R. Ozer G. Feurer
	Reading Experiment	reading	D. Birkmire	D. Anderer
	Recall Patterns Among Autistic and Retarded Learners	recall	C. J. Meisel G. A. Smith	C. Brooks D. Mosby
	String Rating	ratedriver	J. Hart R. Venezky	D. Anderer
	Visual Perception	vper	R. Venezky	D. Anderer
Psychology	Binocular Vision Consistent Mapping with Orientation	visbinoc visbidgt visbiort	J. Hoffman	M. Frank B. Nelson
	Consistent and Varied Mapping	vstatcvm viscmtrk viscvm viscvmt visvmtrk	J. Hoffman	M. Frank B. Nelson

Project	Title	Filename	Developer	Programmer
Psychology (continued)	Consistent Mapping (3 versions)	vstatcmo vstatcm1 viscmb5 visualcm visualdg viscmo viscmx viscmx1 viscmxdg viscmxd1 viscmxpt	J. Hoffman	M. Frank B. Nelson
	Consistent Mapping with Orientation and Audio	vstatcma visatx viscmax viscmox visdgx visotx viscm viscm12 vstatcm vstatcvm	J. Hoffman	M. Frank B. Nelson
	Consistent Mapping with Evoked Potential Measurement	viscmeda viscmedv viscmef vstatced	J. Hoffman	M. Frank
	Data Re-formatting Routine	visrdfix	J. Hoffman	M. Frank B. Nelson
	Depth Tunnel	visdpth	J. Hoffman	M. Frank B. Nelson
	Orientation Experiments (6 versions)	visualo visualod visualon visualoq visualos visualot visualo2 visualq2 visualto visualtq visualtx vstatso vstatson vstatsq	J. Hoffman	M. Frank B. Nelson

Project	Title	Filename	Developer	Programmer
Psychology (continued)	Psych Research Index	varchive visindex	J. Hoffman	M. Frank B. Nelson
	Recall Experiment	visualr	J. Hoffman	M. Frank B. Nelson
	Statistics Development	vstatz	J. Hoffman	M. Frank B. Nelson
	Subject Group Info and Editor	visgroup	J. Hoffman	M. Frank B. Nelson
	Varied Mapping	visualvm visualvt vstatsvm	J. Hoffman	M. Frank B. Nelson
	Varied Mapping with Probes	visualdt visualpt visual7n vstats7n	J. Hoffman	M. Frank B. Nelson

UTILITY PROGRAMS

CIRCLe	ASCII Output Print Routines	asciprnt datprint	K. Kahn G. Feurer	K. Kahn G. Feurer
	Catalog Edit and Search Utility	bibledit biblsrch	K. Kahn G. Feurer P. LeFevre B. Sheaffer B. Lewis	K. Kahn
	ERIC search utility	ericread	G. Feurer	G. Feurer C. Prettyman
	Mailing Label Print Program	circmail	T. Smith K. Kahn	T. Smith
Educational Studies	Grading Utility	vgrader	R. Venezky	G. Feurer
Institutional Research	Graph Generating Program	gredit	C. Pemberton A. Williamson	B. Fortner A. Olsen M. J. Reed

Project	Title	Filename	Developer	Programmer
OCBI	Basic Skills Data Converter	bslsconv	C. Wickham	C. Wickham
	Budget Management Package	budguse bmanage tparams teditor budgarea budgsumm basumm budgclus bcsumm tprint sprint clprint budgcopy	A. Sundermier B. Seiler	A. Sundermier S. Correll
	Character Set Checker	charchek	A. Olsen	A. Olsen
	Classroom Scheduler Package	scheduse	B. Seiler Joseph Maia J. Silver	Joseph Maia M. Frank
	Classroom Schedule Monitor	schedmon	J. Wilson Joseph Maia	Joseph Maia M. Frank
	Comprehensive Accounting Analysis Package	caap	J. Wilson C. Wickham	C. Wickham
	Equipment Inventory	inv	R. Stradling	A. Sundermier S. Correll
	Equipment Repair Requests	repair	J. Wilson C. Wickham	M. Laubach P. Smith D. Williams E. Downey
	Equipment Repair Statistics	reprstat	J. Wilson	S. Correll
	Equipment Usage Statistics Package	mstats	M. Laubach J. Wilson	M. Laubach
	Full-Lesson Search Utility	lsearch	J. Trueblood	J. Trueblood

Project	Title	Filename	Developer	Programmer
OCBI (continued)	Grading Utility	ngrader	A. Stickney	A. Stickney
	Group Records Roster Utility	roster rostersys	C. Wickham	C. Wickham
	Group Scan Deletion Utility	delete	M. Laubach M. Porter	M. Laubach M. Porter
	Group Statistics Printer	groupstats	C. Wickham	C. Wickham
	Index System	indexsys	M. Frank	M. Frank
	Information System for Small Documents	infosys	M. Laubach D. Tripp	M. Laubach
	Inventory Search Utilities	invserch idsort	R. Stradling	Sundermier J. Davis S. Correll
	Lesson Access Controller	lac	M. Laubach	M. Laubach
	Lesson Code Comparer	comparer	W. Smith B. Williams A. Semprebon	W. Smith B. Williams A. Semprebon
	Lesson List Manager	leslists	J. Trueblood	J. Trueblood
	MicroPLATO CPU Data Transfer	mtcopy	J. Silver	S. Hart
	MicroPLATO Driver for the Bitpad One	mpad	C. Wickham	S. Hart P. Smith
	Minder: A Schedule Minder Utility	minduse	M. Laubach Joseph Maia	M. Laubach Joseph Maia
	Multi-Plot	mplotter	J. Hoffman	M. Frank
	OCBI Logo	ocbilogo	R. Nichols	R. Nichols
	OCBI Staff Schedule Utility	thesched	B. Seiler D. Graper	D. Graper W. Stainton R. Stabosz
	OCBI Staff Schedules	mysched	B. Seiler R. Stabosz	R. Stabosz

Project	Title	Filename	Developer	Programmer
OCBI (continued)	Time Management Utility	tmu2	M. Laubach	M. Laubach R. Stradling
	Time Report Form Package	trfs	B. Seiler J. Sandler C. Coletta D. Tripp	D. Tripp M. Porter
	UD Lesson Catalog Package	catalog	B. Seiler D. Anderer	D. Anderer
	Willard Weekend Scheduler	weekend	M. Porter	M. Porter

CATALOG OF PROGRAMS UNDER DEVELOPMENT IN THE OFFICE OF COMPUTER-BASED INSTRUCTION

PART II: MICROCOMPUTER LESSONS

INSTRUCTIONAL LESSONS

Project	Title	Computer	Developer	Programmer
Agricultural Engineering	Stormwater Management Alternatives	IBM PC	J. T. Toubier	S. McMillan
Chemical Engineering	The Rankine Refrigeration Cycle	IBM PC	S. Sandler	M. Rogers A. Semprebon L. McGivern J. Walters
	Repressurizer	IBM PC	S. Sandler	M. Rogers A. Semprebon L. McGivern J. Walters
Counseling	Custodian	Micro PLATO	L. Bloom	L. Frank S. Lesnik C. Collings
	Retail Sales Clerk	Micro PLATO	Sharnoff R. Sharf	L. Frank S. Lesnik R. Sutor K. Jones
	Secretary: Skills	Micro PLATO	Sharnoff R. Sharf	L. Frank S. Lesnik R. Sutor K. Jones Zembrzuski
Ceography	Principles of Map Layout	I3M PC	F. Gossette T. Meierding	G. Reed L. Frank B. Williams S. Warren
Geology	The Sedimentology of Floodplains	IBM PC	J. Pizzuto	N. Balogh M. Toschlog M. Frank

Project	Title	Computer	Developer	Programmer
Library	Card Catalog	IBM PC	D. Richards	A. Sundermier C. Jarom R. Hamadock
	Government Documents	IBM PC	D. Richards	A. Sundermier C. Devore
	Newspaper Indexes	IBM PC	D. Richards	A. Sundermier D. Dizio
	Periodical Indexes	IBM FC	D. Richards	A. Sundermier C. Jarom
Mathematics	One-Variable Function Plotter	IBM PC	M. Brooks	M. Brooks R. Payne
	Curve Fitting	IBM PC	M. Brooks	R. Payne
	Dynamic Programming I: The Shortest Path Problem	Apple	C. Sloyer L. Smith Tri-Analytics Inc.	Apple Development Team*
	Dynamic Programming II: The Shrub Covering Problem	Apple	C. Sloyer L. Smith Tri-Ana'ytics Inc.	Apple Development Team
	Dynamic Programming III: The Helmet Sizing Problem	Apple	C. Sloyer L. Smith Tri-Analytics Inc.	Apple Development Team

*Apple Development Team: T. Ferrara
R. Dove
J. Landis
M. Wright
S. Kowalski
T. Gruner
M. Jacobs
T. Neal
B. Field
P. Sine
L. Smith

Project	Title	Computer	Developer	Programmer
Mathematics (continued)	Dynamic Programming IV: Optimal Coding of Digitized Photographs	Apple	C. Sloyer L. Smith Tri-Analytics Inc.	Apple Development Team
	Glyphs I	Apple	C. Sloyer L. Smith Tri-Analytics Inc.	Apple Development Team
	Glyphs II	Apple	C. Sloyer L. Smith Tri-Analytics Inc.	Apple Development Team
	Mathematics in Medicine I: Evaluating Indices	Apple	C. Sloyer L. Smith Tri-Analytics Inc.	Apple Development Team
	Mathematics in Medicine II: Using Indices	Apple	C. Sloyer L. Smith Tri-Analytics Inc.	Apple Development Team
	Queues I	Apple	C. Sloyer L. Smith Tri-Analytics Inc.	Apple Development Team
	Queues II: Simulations	Apple	C. Sloyer L. Smith Tri-Analytics Inc.	Apple Development Team
	Graph Theory I: Chromatic Number	Apple	C. Sloyer L. Smith Tri-Analytics Inc.	Apple Development Team

Project	Title	Computer	Developer	Programmer
Mathematics (continued)	Graph Theory II: Planarity and Trees	Apple	C. Sloyer L. Smith Tri-Analytics Inc.	Apple Development Team
	Graph Theory III: Digraphs	Apple	C. Sloyer L. Smith Tri-Analytics Inc.	Apple Development Team
Physical Education	Mechanics of Muscles Contraction	Micro PLATO	R. Neeves	Markham Jr S. Hart M. Houghton
Statistics	Looking at Data	VAX 11/780	V. Martuza A. Hoerl Schuenemeyer	M. J. Reed M. Porter S. Cox A. Godil J. Mackin E. Bishop
	Events	VAX 11/780	A. Hoerl V. Martuza Schuenemeyer	M. J. Reed M. Porter J. Mackin E. Bishop
	AMPL	VAX 11/780	F. Masterson	Brittingham
	Confidence Intervals for the Mean	VAX 11/780	Schuenemeyer A. Hoerl V. Martuza	M. J. Reed M. Porter C. Brooks
	Distribution Characteristics of Spread, Location and Shape	VAX 11/780	V. Martuza A. Hoerl Schuenemeyer	M. J. Reed M. Porter C. Brooks
	Graphical Displays Based on Rank Order	VAX 11/780	V. Martuza A. Hoerl Schuenemeyer	M. J. Reed M. Porter
	Introduction to Estimation Procedures	VAX 11/780	Schuenemeyer A. Hoerl V. Martuza	M. J. Reed M. Porter

Project	Title	Computer	Developer	Programmer
Statistics (continued)	Number Line Displays	VAX 11/780	V. Martuza A. Hoerl Schuenemeyer	M. J. Reed M. Porter C. Brooks J. Merryman Shollenberger
	Probability	VAX 11/780	A. Hoerl V. Martuza Schuenemeyer	M. J. Reed M. Porter C. Murray
	Time Order Approach	VAX 11/780	E. Hall J. Johnson T. Thompson V. Hans A. McCutcheon	C. Leefeldt
	Transformations	VAX 11/780	V. Martuza A. Hoerl Schuenemeyer	M. J. Reed M. Porter C. Murray

UTILITY PROGRAMS

Utility	Graphics Editor	IBM PC	A. Sundermier	A. Sundermier C. Green E. Albers

Spring, 1980

- Grants received from the National Science Foundation for projects in political science, biology, and anthropology, and for the 1980 Summer Institute in Computer-Based Education for Teachers of Mathematics, Chemistry, Physics, Biology and Social Sciences, and for a Student Science Training Program for gifted high school students
- Provost appoints the first CBI Faculty Committee to assist in the quality control of Delaware's computer-based learning materials.
- Staff reorganized with the formation of the director's staff

Fall, 1980

- New projects in museum studies, SOAC, University Parallel Program, and urban affairs
- New sites for agriculture, human resources, and mathematics
- Department of Education awards Community Basic Skills Improvement grant to the Urban Coalition of Metropolitan Wilmington
- Grant received from Control Data to develop a career guidance package
- Education and psychology grant received from the Interdisciplinary Research Committee; research terminal located at the Downes Elementary School
- Center for Interdisciplinary Research in Computer-Based Learning (CIRCLe) is founded in the College of Education
- Continuing Education begins to offer courses from the PLATO courseware library
- Staff additions of two senior analysts, one middle analyst, five junior analysts, one PLATO services consultant, four research assistants, and one secretary
- Number of terminals increased to 132 on campus and 96 off campus
- PLATO extended memory increased from one million to two million words

Spring, 1981

- New site in the Counseling Annex
- Grants received from the National Science Foundation for Leadership Training of Teachers in Computer-Based Mathematics Education, for the 1981 Summer Institute in Computer-Based Education for Teachers of Mathematics, Chemistry, Physics, Biology, Psychology, and Economics, and for a Student Science Training Program for gifted high school students
- The University becomes a Participating Institution in Control Data's Lower Division Engineering Curriculum
- Mathematics project forms national consortium which becomes special interest group in ADCIS
- CIRCLe forms special interest group for theory and research in ADCIS
- CIRCLe sponsors Faculty Retreat on Research in Computer-Based Learning
- University of Delaware Sound Synthesizer (UDSS) completed and offered for sale by OCBI
- Microcomputer classroom established in the Willard Hall Education Building

Fall, 1981

- New site in the University Library
- Grants received from the National Science Foundation for a CAUSE program in first-year college mathematics, a DISE program for developing mathematics enrichment lessons for gifted high school students, and a dissemination institute for introducing school administrators to educational uses of microcomputers
- Control Data funds OCBI to develop the first semester of chemistry in the Lower Division Engineering Curriculum
- College of Education establishes graduate degree programs in computer-based education
- Staff additions of one senior analyst, three middle analysts, and eight junior analysts
- PLATO system upgraded to a dual processor CYBER 174

Spring, 1982

- Number of PLATO terminals increases to 335, with 195 on campus and 140 off campus
- Grants received from the National Endowment for the Humanities for a Summer Institute in Computer-Based Education for Foreign Language Teachers, and for the production of a videodisc series in music theory, history, and appreciation
- CIRCLe hosts National Conference on the Past, Present, and Future of Research in Computer-Based Learning

Fall, 1982

- Small Business Association Grant to train local businesses in the use of computer technology
- FIPSE grant to put the University's advisement system on PLATO
- Grant from the Digital Equipment Corporation whereby a VAX 11/780 is installed and dedicated to CBI
- Grant from Atari to develop AtariMusic I and II
- National Science Foundation awards DISE grant for the development of biology courseware

Spring, 1983

- New sites established in the music building for the Atari project and at 42 East Delaware Avenue for the VAX statistics and courseware conversion projects
- CIRCLe hosts faculty/staff retreat on CBI research techniques at Clayton Hall
- National Science Foundation provides support for a Summer Institute on Modern Techniques in Applied Mathematics

Fall, 1983

- National Institute of Education grant to develop cognitive paradigms for computer-based reading instruction
- Improvement of Instruction Grant for CBI in Food Service Systems Management
- OCBI organizes the Greater Delaware Chapter of the Association for Educational Data Systems
- Public site established in the Newark Free Library

Spring, 1984

- ASCII communications allow microcomputers to access the Delaware PLATO System
- OCBI recognized as a Certified Apple Developer
- IBM PC Ethernet designed for the College of Engineering
- Latin Skills Package published on Apple II microcomputers