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ABSTRACT

A brief history of the Delaware PLATO project and descriptions of the new developments in facilities, applications, user services, research, evaluation, and courseware produced since the Fourth Summative Report (1979) are provided, as well as an overview of PLATO applications at the University of Delaware. Sample lessons, illustrations, and activity summaries are presented for the 29 departments using PLATO, and new sites of development in political science and in the University of Delaware English Language Institute are described, as well as the continuing development of programs in biology and anthropology. The expansion of the PLATO project is indicated in terms of PLATO usage by departments; the number of terminals, both on campus and for outside users; the growth and reorganization of the staff; and the development of "utility" programs, including instruction in using PLATO and a format for constructing a questionnaire. Brief abstracts summarize faculty research in the areas of student achievement, perceptual research, and alternative learning strategies, and a catalog of programs currently under development in the project is appended. (BK)

THE FIFTH SUMMATIVE REPORT OF THE DELAWARE PLATO PROJECT

by

Fred T. Hofstetter

July 1, 1980

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INTRODUCTION

This *Fifth Summative Report of the Delaware PLATO Project* summarizes work done at the University of Delaware with the Control Data PLATO system from the beginning of the Delaware PLATO Project in March of 1975 through June 30, 1980. Each of the five summative reports which have been published to date contains special emphasis on events during the immediately preceding academic year, and therefore this report concentrates on developments during the 1979-80 academic year. More information on events of previous academic years can be found in prior issues of the summative report, which are available from the office of the Delaware PLATO Project.

During 1979-80 a new terminal room was opened in Drake Hall, and new projects were started in political science and in the University of Delaware English Language Institute. The number of terminals on campus increased to 120, and the outside user base grew to 60 terminals. A manager and four junior programmer/analysts were added to the staff in support of program development, and a peripheral design engineer was hired to build and to connect new auxiliary devices to the PLATO terminal. The Project was reorganized through the creation of a new level of staff called the "director's staff," and the Provost established a new University committee called the "Faculty Committee on PLATO" to review new projects.

New grants were received from the National Science Foundation to support program development in political science, biology, and anthropology, and the NSF Summer Institute in Computer-based Education was funded again for 1980. NSF grants for developing materials in psychology and chemical engineering continued from the previous year. The New Castle County School District received a $513,000 grant under the Emergency School Aid Act whereby a PLATO program was installed consisting of a staff of nine PLATO teachers and program developers and twenty-five terminals distributed among five junior high schools.

The Fifth Summative Report is divided into four main divisions: Project History and Development, University Applications, Outside User Applications, and Evaluation. Following these is an appendix which contains a catalog of courseware under development at Delaware.

CHAPTER I. HISTORY AND DEVELOPMENT OF THE DELAWARE PLATO PROJECT

Background

The Delaware PLATO Project originated in the fall of 1974 during deliberations of the University's Computer Applications to Education Committee. 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 the reasons why PLATO was chosen for the demonstration. They required that the demonstration system contain:

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

2. An existing library of demonstration programs encompassing many academic areas.

3. A programming language which 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 learning behaviors.

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

6. A very good overall system reliability.

The first terminal was installed at the University on March 14, 1975. 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 exisiting courseware and/or the development of new PLATO programs. By the end of May, nine departments had proposed to develop materials and 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.

Utilization

From the beginning of the Project there has been a steady rise in the utilization of PLATO at the University of Delaware. Figure 2 shows the growth in terms of hours of terminal usage per quarter. The sharpest rise in utilization occurred during the first two quarters of 1976, when serious development of new programs began. The average utilization tripled during the 1976-77 academic year, when large-scale use by students began. It was at that time that the average utilization rose to over eighty hours per terminal per week. Additional interest shown in PLATO during the 1977-78 academic year produced a level of utilization which was almost twice that of 1976-77. During 1978-79, the level of utilization was fifty percent higher than that of 1977-78. During 1979-80, usage was seventy-five percent higher than that of 1978-79.

Figure 2.

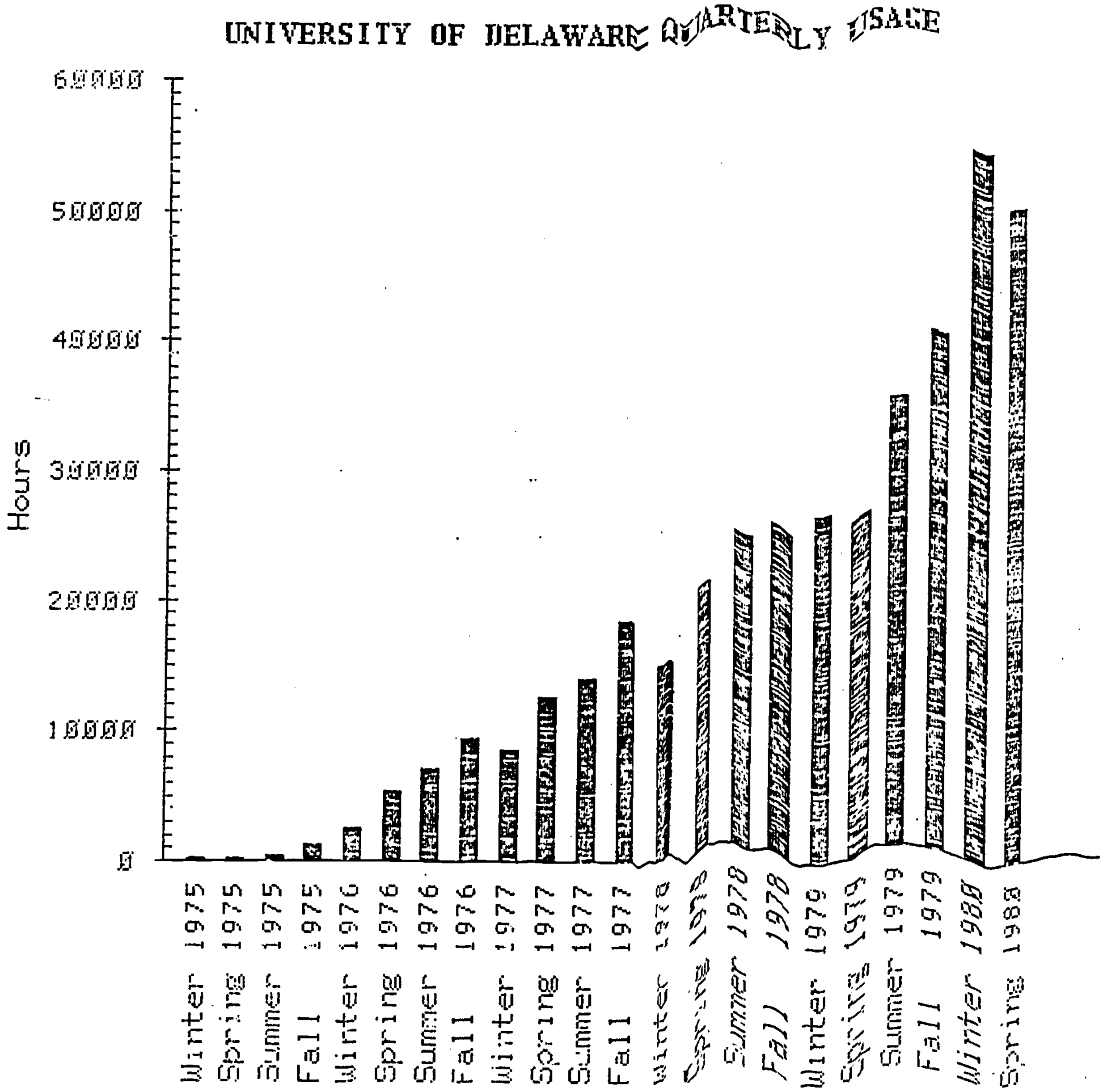


Table 1 shows how ninety courses used PLATO during the 1979-80 academic year. Column one gives the course symbol and number from the University's course catalog. Column two contains the descriptive title for the course. Column three gives the number of credits. Column four shows how many students used PLATO in the course. Column five gives the average number of hours each student used PLATO. The last four columns indicate whether the course used PLATO in the Summer Session, the first semester, the Winter Session, or the second semester. 6,263 students in ninety courses used PLATO during 1979-80. They accumulated a total number of 40,290 hours spent at PLATO terminals.

Table 1

Courses Using PLATO During 1979-80

Course Symbol and Number	Descriptive Title	Number of Credit Hours	Number of Students	Average Terminal Hours per Student	Time of Utilization			
					Summer	Fall	Winter	Spring
ACC 207	Accounting I	3	456	5.1		X	X	X
ACC 208	Accounting II	3	374	7.3			X	X
ACC 415	Advanced Accounting	3	382	10.0		X		X
ACC 515	Financial Accounting	3	61	19.0		X		X
ANT 101	Introduction to Social and Cultural Anthropology	3	341	2.3		X	X	X
ANT 102	Biological Anthropology	3	167	2	X	X		
APS 133	Anatomy & Physiology of Domestic Animals	4	80	12.1		X		
APS 134	Anatomy & Physiology of Domestic Animals	4	67	7				X
APS 310	Animal Genetics Lab	1	23	4.4		X		
ART 200	Typography	3	54	5.1		X		
ART 303	Visual Design and Communication	3	27	18.5		X		
ART 400	Advertising Design I	4	26	6.2		X		
BIO 115	Human Heredity & Development Lab	1	219	2.6		X		X
BIO 303	Honors: Genetic Evolutionary Biology	4	14	5.2				X
C 101	General Chemistry	4	353	2.8		X		X
C 102	General Chemistry	4	54	2.3				X

Table 1

Courses Using PLATO During 1979-80

Course Symbol and Number	Descriptive Title	Number of Credit Hours	Number of Students	Average Terminal Hours per Student	Time of Utilization			
					Summer	Fall	Winter	Spring
C 103	General Chemistry	4	572	2.3		X		X
C 104	General Chemistry	4	76	2.2			X	X
C 105	General Chemistry	5	3	1.2		X		
C 111	General Chemistry	3	105	4.0		X	X	
C 112	General Chemistry	3	34	1.5				X
C 213	Elementary Organic Chemistry	4	1*	9.9		X		
C 321	Organic Chemistry	3	1*	165.6		X		
CHE 231	Chemical Engineering	3	80	2.7		X		X
CHE 325	Chemical Engineering Thermodynamics	3	11	.5		X		
CHE 342	Heat and Mass Transfer	3	58	3.6				X
EC 101	Introduction to Economics I	3	8	3.0		X		X
EC 102	Introduction to Economics II	3	2*	18.8				X
EDC 372	Elementary School Arithmetic	3	90	1.6		X		X
EDC 577	Math Foundations of Elementary Instruction	3	38	3.8	X			
EDC 624	Analysis of Reading Retardation	3	32	1.1	X			
EDF 461	Measurement Theory and Technique	3	10	.6		X		

Table 1

Courses Using PLATO During 1979-80

Course Symbol and Number	Descriptive Title	Number of Credit Hours	Number of Students	Average Terminal Hours per Student	Time of Utilization			
					Summer	Fall	Winter	Spring
EDP 567	PLATO Program Design	3	9	29.4				
EDF 629	Psychology of Teaching	3	1	.75				X
EDF 660	Educational Measurement	3	19	.5		X		X
EDF 861	Masters Thesis Education	1-6	8	11.5		X		
EDO 667	Introduction to Computers in Education	3	9	20.0		X		
EDP 521	Manual Communication I	3	54	1.6		X		X
EDP 667	Program Market Evaluation Strategy	3	9	41.5				X
FR 102	Elementary French II	3	59	3.2		X	X	X
FR 111	Intermediate French	3	34	3.2		X	X	X
LAT 101	Elementary Latin I	3	27*	7.4		X	X	
LAT 102	Elementary Latin II	3	13	10.2				X
LAT 111	Intermediate Latin	3	17	2.9				X
LAT 112	Intermediate Latin	3	6	2.3				X
M 115	Pre-Calculus	3	198	12.0		X		X

Table 1

Courses Using PLATO During 1979-80

Course Symbol and Number		Descriptive Title	Number of Credit Hours	Number of Students	Average Terminal Hours per Student	Time of Utilization			
						Summer	Fall	Winter	Spring
M	241	Honors Calculus	4	79	4.6				
MU	105	Fundamentals of Music	3	13	3.0	X	X		X
MU	185	Music Reading and Ear Training	2	57	25.7		X	X	
MU	186	Music Reading and Ear Training	2	59	12.7				X
MU	188	Basic Musical Experiences	3	97	2.1		X	X	X
MU	195	Music Harmony	3	37	1.3		X		X
MU	285	Advanced Music Reading	2	33	51.9		X		
MU	286	Advanced Music Reading	2	36	57.8				X
N	201	Basic Instrumental & Experimental Functions: Nursing	5	203	2.2		X		X
N	301	Nursing: Adult Physical Health & Illness I	10	168	6.6		X		X
N	304	Nursing: Adult Mental Health & Illness	6	69	1.6		X		X
N	860	Cardiopulmonary Nursing: Acute Care	4	16	.9		X		X
PE	120	Volleyball	1	65	1.1		X		X
PE	144	Skills/Techniques/ Tennis/Volleyball	1	84	1.6				X

Table 1

Courses Using PLATO During 1979-80

Course Symbol and Number	Descriptive Title	Number of Credit Hours	Number of Students	Average Terminal Hours per Student	Time of Utilization			
					Summer	Fall	Winter	Spring
PE 324	Measurement and Evaluation	3	66	2.6		X	X	X
PE 364	Coaching Volleyball	1	10	.8				X
PE 426	Biomechanics	3	79	6.7		X	X	X
PE 602	Measurements & Evaluation in Physical Education	3	6	1.7		X		
PE 603	Research Methods	3	14	3.6		X		
PE 810	Biomechanics	3	9	7.3				X
PHL 324	Philosophy of love	3	23	13.0				
PLS 101	Botany I	4	92	1.0		X		
PSY 201	General Psychology	3	62	3.5	X			X
PSY 201	Honors: General Psychology	3	5	5.0	X			
PSY 310	Sensation and Perception	3	50	1.3				X
PSY 312	Learning and Motivation	3	58	5.0		X		
TDC 211	Clothing 1a: Basic Processes	3	39	1.5		X		
TDC 216	Clothing 1b: Advanced Processes	3	43	1.7		X		X

Table 1

Courses Using PLATO During 1979-80
Non-University Courses

PLATO Group	Descriptive Title	Number of Students	Average Terminal Hours per Student	Time of Utilization			
				Summer	Fall	Winter	Spring
careers	Career Search	10	136.0		X		X
chal 301	Credit by exam for nursing 301	7	2.2				X
chal 406	Credit by exam for nursing 406	6	2.2				X
chalexam	Preparation for the two credit by exam nursing courses	10	4.9				X
hill	Wilmington Col. Children's School	15	1.9		X		X
russian	Russian language help	1*	19.2		X	X	X
seminars	Begining Tutor	87	11.1	X	X	X	X
sexed	Health notes	1*	505.3		X	X	X
sicbe	Summer Institute in Computer Based Instruction	83	25.1	X			
ssp	Summer Sports Program	1*	57.8	X			
udce	University of Delaware Continuing Education	3*	585.6	X			
udgaming	Group for gaming period	39	2.2		X	X	X
ubeng	Upward Bound Program: English	45	1.4	X			
upmath	Upward Bound Program: Math	11	7.5	X			
wcenter	Writing Center	74	2.3		X	X	X
workshop	Urban Coalition authoring and maintenance group	16					X

Organization

There are two main components in the organization of the Delaware PLATO Project: the faculty project leaders and the centralized support staff. In each academic department using PLATO, there is a faculty member identified as "PLATO project leader" to coordinate the priorities and PLATO activities within the department. To each department, the PLATO Project provides a programmer -- either a part-time student or a full-time professional. The faculty/programmer team receives support through the centralized training and management of the PLATO Project, which is independent of the academic departments.

The project leader serves as an intermediary between the PLATO staff and the rest of the faculty in the department. The project leader coordinates all PLATO activities for the department, including evaluation. All final decisions regarding the content of PLATO lessons are made by the project leader. Most project 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 PLATO at the University. Table 2 contains a list of the PLATO project leaders.

During the spring of 1980, the Provost appointed the University's first Faculty Committee on PLATO. This committee reviews new PLATO projects both at the proposal stage and after the first year of their development, and it can be asked by the Director of the PLATO Project to review older projects as well. The members of this committee have been appointed to two-year terms as follows:

Michael Arenson, Music
David Barlow, Physical Education
Gerald Culley, Languages, Chairperson
Raymond Nichols, Art

The charge to this new committee is as follows:

"The faculty committee on PLATO shall review new projects proposed by faculty members for feasibility, soundness of conception and design, and appropriateness to PLATO, and shall report its findings and recommendations to the Director of the PLATO Project. 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 PLATO Project. 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 PLATO and make recommendations for support."

As requests for the use of PLATO have increased, the University has developed a highly trained staff to support the Project. At the beginning of the Project the staff consisted of three graduate assistants. When the faculty's request for expansion to a level of eight 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 PLATO applications programmer/analysts.

Table 2

PLATO Project Leaders at the University of Delaware

Projects	Project Leaders
Accounting	Angelo Di Antonio
Agriculture	Paul Sammelwitz
Anthropology	Juan Villamarin
Art	Raymond Nichols
Biology	David Sheppard
Chemical Engineering	Robert Pigford/Stanley Sandler
Chemistry	John Burmeister
Civil Engineering	Eugene Chesson
Computer Science	Hatem Khalil
Continuing Education	Jon Heggan
Counseling	Richard Sharf
Economics	Charles Link
Education -- Instruction	Robert Uffelman
Education -- Research	Victor Martuza/Richard Venezky
Honors Program	Donald Harward
Health Education	Paul Ferguson
Human Resources	Frances Mayhew
Institutional Research	Carol Pemberton
Languages	Gerald Culley
Mathematics	Ronald Wenger
Military Science	Thomas Reinhardt
Music -- Aural Skills	Fred T. Hofstetter
Music -- Written Theory	Michael Arenson
Nursing	Mary Anne Early
Physical Education	David Barlow/James Kent
Political Science	Richard Sylves
Psychology -- Instruction	John McLaughlin/James Hoffman
Psychology -- Research	James Hoffman
Security	Stephen Swain
Sociology	Vivian Klaff
Student Center	Marilyn Conway
UD English Language Institute	Patricia Dyer
Upward Bound	William Morris
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 PLATO 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 machine. 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 new PLATO machine.

During 1977-78 it also became evident that the two senior staff members of the Delaware PLATO Project, 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 Seiler was in charge of lesson design, evaluation, and scheduling, and Jim 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 Jim 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: 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 17-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 Seiler to Associate Director for Administration and of James 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 Judy Sandler were promoted to the senior staff to assume the managerial responsibilities formerly done by Bonnie Seiler and James Wilson.

Table 3 (page 16) shows a complete list of the staff of the Delaware PLATO Project. The numbers given in column three are used to identify each staff member in the Project task assignment chart (cf. Figure 3, page 18) which is discussed as follows.

The number of tasks needed to support program development, experimentation, student use, and evaluation for the many departments using PLATO requires that each staff member of the PLATO Project carry out multiple assignments. Figure 3 contains the task assignment chart of the Delaware PLATO Project. It shows how many staff members have assignements at two different levels, namely, program development and supporting services. In program development staff members are assigned to write programs for one or more departments. In supporting services, staff members assume responsibilities which include operations, site management, library cataloging, and other user services.

Table 3

Staff of the Delaware PLATO Project

Position	Name	Number
Director	Fred T. Hofstetter	1
Assistant to the Director	Marianna K. Preston	2
Office Coordinator	Carol-Anne Ritter	3
Secretary	Charlotte Coletta	4
Clerk-Typist	Diana Gemmill	5
Associate Director of Operations	James H. Wilson	6
Associate Director for Administration	Bonnie Seiler	7
Manager	Keith Slaughter	8
Manager	John Silver	9
Senior Applications Programmer/Analyst	Judy Sandler	10
Systems Analyst	David Anderer	11
Systems Analyst	Charles Wickham	12
Peripheral Design Engineer	Robert Stradling	13
Senior Electronics Specialist	Linda Everett	14
User Services Coordinator	Deborah Braendle	15
Applications Programmer/Analyst	Jessica Weissman	16
Applications Programmer/Analyst	Dan Williams	17
PLATO Services Consultant	Carl Gill	18
PLATO Services Consultant	James Trueblood	19
Junior Analyst	Patricia Bayalis	20
Junior Analyst	Kathleen Bergey	21
Junior Analyst	Christine Brooks	22
Junior Analyst	Charles Collings	23
Junior Analyst	Gary Feurer	24
Junior Analyst	Michael Frank	25
Junior Analyst	Roland Garton	26
Junior Analyst	William Lynch	27
Junior Analyst	Joseph Maia	28
Junior Analyst	Aart Olsen	29
Junior Analyst	Carol Rigden	30
Junior Analyst	Rae Stabosz	31
Trainee Staff*	Clare Berrang	32
Trainee Staff	John Beyer	33
Trainee Staff	Maurnice Binn	34
Trainee Staff	Louisa Bizoe	35
Trainee Staff	William Childs	36
Trainee Staff	Brooks Cooley	37
Trainee Staff	Sharon Correll	38
Trainee Staff	Stephen Cox	39
Trainee Staff	Tuan Duc Duong	40
Trainee Staff	Karen Fox	41
Trainee Staff	Kenneth Gillespie	42
Trainee Staff	David Graper	43
Trainee Staff	Shawn Hart	44

Trainee Staff	David Healy	45
Trainee Staff	Michael Houghton	46
Trainee Staff	Kathy Jones	47
Trainee Staff	Carol Leefeldt	48
Trainee Staff	John Looney	49
Trainee Staff	Jean Maia	50
Trainee Staff	Stuart Markham	51
Trainee Staff	Mildred Martin	52
Trainee Staff	Deborah Mellor	53
Trainee Staff	Dawn Mosby	54
Trainee Staff	Brenda Pasapane	55
Trainee Staff	Phyllis Patton	56
Trainee Staff	Richard Payne	57
Trainee Staff	Michael Porter	58
Trainee Staff	Mary Jac Reed	59
Trainee Staff	Bernard Russiello	60
Trainee Staff	Barry Schwarz	61
Trainee Staff	Andrew Semprebon	62
Trainee Staff	Karen Sims	63
Trainee Staff	Philip Smith	64
Trainee Staff	Jeffrey Snyder	65
Trainee Staff	Amy Sundermier	66
Trainee Staff	Jay Tuthill	67
Trainee Staff	Leonid Vishnevetsky	68
Trainee Staff	Susan Waeber	69
Trainee Staff	Walston Warner	70
Trainee Staff	Ben Williams	71

Trainee Staff	Joseph Ayres	72
Trainee Staff	Kim Buckman	73
Trainee Staff	Jeff Davis	74
Trainee Staff	Ivo Domingues	75
Trainee Staff	Jay Green	76
Trainee Staff	Robert Krejci	77
Trainee Staff	Cheinen Marks	78
Trainee Staff	Chris Vinson	79

*Trainee Staff are miscellaneous wage earners. Thirteen of these are work-study students. Trainee Staff listed below the dotted line are funded all or in part by departments other than PLATO.

TASK ASSIGNMENT CHART

Figure 3.

PROGRAM DEVELOPMENT D7

Component Number Four D6
- Art C19, 39, 71
- Languages C17, 55, 59
- Music (Aural) C27, 26
- Music (Written) C27, 24, 52

Component Number Three M8
- Agricultural Economics 48
- Anthropology C26, 63
- Biology C29, 33, 37
- Continuing Education C23
- Counseling C23
- Economics C8
- Honors Program C22
- Institutional Research C29
- Math 57
- Military Science 46
- Nursing 73
- Sociology C16, 65

Component Number Two M9
- Accounting C23, 35, 36, 48
- Agriculture 35, 69
- Agricultural Engineering 35
- Chemistry C26, 60
- Computer Science C28
- Health Education C20, 75
- Physical Education C20, 38, 44
- Psychology Research C25
- Statistics C29
- Student Center C20

Component Number One M10
- Chemical Engineering C17, 61, 62, 67, 72, 74
- Civil Engineering C16, 65
- Educational Instruction C22, 54, 56
- Educational Research C24, 28
- Human Resources C21, 47, 53
- Political Science C30, 51
- Psychology Instruction C31, 16, 32, 50, 76, 78, 79
- Security C23, 77
- U. D. English Language Institute C22
- Upward Bound C31, 50
- Writing Center C31, 50

Supporting Services

User Services D6, D7
- Classroom Assistants M9, 23, 26, 31, 34, 41, 42, 49, 58, 68, 70
- Consultants M8, 9, 16, 18, 19, 26, 31
- Instructional Utilities M8, 25
- User Services 15
- Seminars/Workshops M8, 6, 7, 10, 15, 16, 18, 26, 31
- Evaluation M9, 23, 46
- Pre-College Programs M10, 22
- Staff Orientation M10, 65
- Office Support 40, 43, 68

Cluster Supervisors D6, D7, M9
- Art 19
- Chemical Engineering 17
- Computing Center 12
- Continuing Education 23
- Counseling 23
- Drake 26
- Honors Program 22
- Music 27
- Nursing 8
- Physical Education 20
- PLATO Project Office 28
- Smith Classroom 31, 48
- Student Center 20
- Willard Classroom (009) 23, 46
- Willard Demo Room (203) 23
- Willard Educational Research Room (313) 24
- Wolf Hall 25
- Writing Center 31

PLATO Library D7
- Audio Disks 16
- Microfiche 27
- Printed Materials 5
- Slides M8, 5

Operations D6
- Communications 11, 12
- Data Storage/Transfer 12
- Hardware Construction 13, 45, 66
- Hardware Programming 11, 12, 13, 64
- Hardware Research 13
- Maintenance 14, 45, 66
- Microprocessors 9, 26
- Operator Training 11, 12
- PLATO Courseware 11, 12, 15
- PLATO Software 11, 12
- Printing 11, 19, 39
- Resource Management 6
- Utilities 25, 28

D - Associate Director in Charge
M - Manager in Charge
C - Coordinator of Project

Numbers refer to column 3 of Table 3.

Operational duties include the running of the Delaware PLATO system; the management of files such as instructional programs, utility routines, and work spaces in the 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 all lesson materials available on the Delaware PLATO system; maintenance of PLATO data communications and hardware; diagnosis of needed improvements in PLATO software; and research and development of new and existing equipment which would enhance PLATO services, such as music synthesizers, microprocessor interfaces, and floppy disk units.

Each PLATO site is watched over by a PLATO 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 Education Building, Smith Hall, Drake Hall, 46 E. Delaware Avenue (the PLATO staff building), Music, Art, the Honors Program, Physical Education, Nursing, the Computing Center, Psychology, Continuing Education, the Center for Counseling, Chemical Engineering, the Writing Center, and the Student Center.

The PLATO Library consists of four main parts: first, printed materials, which include all available publications dealing with PLATO and significant publications by users of other systems; second, audio disks, which store up to twenty-two minutes of pre-recorded audio materials for use with PLATO's random access audio device; third, microfiche slides, which contain up to 256 slide images which can be rear-projected onto the screen of the PLATO terminals; and fourth, 35mm color slides of PLATO displays, facilities, and related materials which are used in demonstrations and other presentations.

Other support services include training seminars for campus users, especially prospective new authors; workshops for off-campus users; on-line consulting; help for off-campus users; special programs for pre-college students; instructional utility programs that can be used by many departments; and evaluation tools.

Instructor and Author Training

Since the beginning of the Project, a series of weekly seminars has been offered four times a year in order to give members of the University and its surrounding community an opportunity to learn about various aspects of the PLATO system. There is a short orientation seminar for those who want a brief overview, a sequence of two courses in TUTOR programming, a course in lesson design, a lesson review seminar, and a research and development seminar. These seminars are offered free of charge for no credit to members of the University of Delaware. The introductory seminars have three weekly meetings, and the other seminars have ten weekly meetings.

Because of the success which these seminars have demonstrated in producing competent PLATO authors, and in response to the need for a national training program for PLATO authors, the Delaware PLATO Project has reorganized the training curriculum into a special program of intensive workshops for those seeking PLATO training from outside the University. Participants can elect a one-week or two-week period of training. One-week registration allows participants to choose three modules from the training curriculum. Two-week registration allows participants to study five modules. A brochure giving more information regarding this training program is available from the office of the Delaware PLATO Project. Table 4 shows a list of modules in the training curriculm.

Table 4

Training Curriculum for Users and Authors

1. Introduction to the PLATO System. General purposes and uses of the PLATO System are presented. Instructional materials are demonstrated to illustrate PLATO's special features, such as the touch-sensitive screen, the music box, the random-access audio device, and the speech synthesizer. This module will help participants establish guidelines for the use of PLATO in their respective fields.

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

3. Beginning TUTOR Programming. For those with little or no background in computer usage, this module offers the fundamentals of TUTOR, which is PLATO's programming language; included is guided practice at a PLATO terminal.

4. Advanced TUTOR Programming. For those with some previous knowledge of TUTOR, this module covers advanced topics in PLATO programming, tailored to participants' individual programming needs.

5. PLATO Lesson Design. This module presents guidelines for designing computer-based educational materials on PLATO. Emphasis is placed on the advantages and disadvantages of developing different types of lessons, plus work on basic display techniques, answer handling, and individualizing instruction.

6. PLATO Lesson Review and Critique. This module, designed to help authors improve the instructional materials they are developing, involves informal review and critique of one another's lessons by participants, and the sharing of design techniques.

7. TUTOR Programming Review and Critique. This workshop includes informal review and critique of TUTOR programming techniques used by participants. Lessons are reviewed for readability, documentation, and efficiency. This module provides participants with an excellent opportunity to improve their authoring skills.

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

9. PLATO Computer-Managed Instruction (CMI). Designed to teach participants to use the PLATO Learning Management (PLM) system, this workshop demonstrates PLATO's system for computer-managed instruction. It utilizes 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 packages.

Since the beginning of the Project a growing number of teachers from Delaware's public schools have become interested in using PLATO 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 PLATO and on Project DELTA, a mini computer-based system with terminals in many of Delaware's high schools. In addition, all participants attended a seminar to discuss issues raised in the recent 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, instructional design of computer-based 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.

Participation in the Summer Institutes has reaped several benefits for area teachers. Many have gone on to 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. Two of those originally employed part-time have become full-time professionals in the Delaware PLATO Project.

Lesson Review

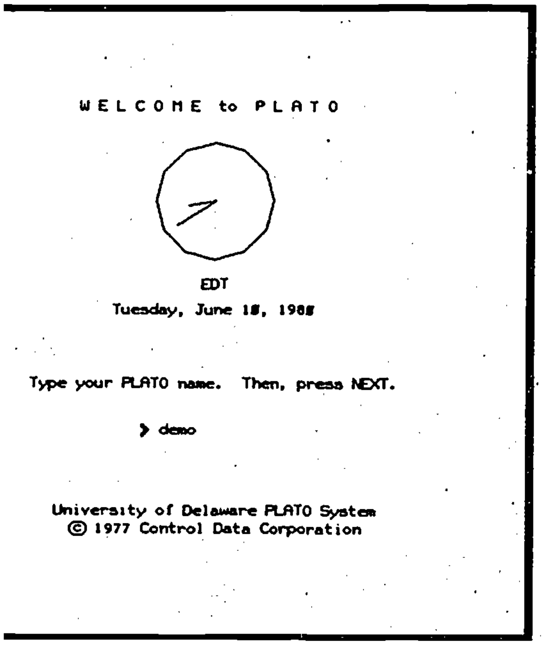
New users usually begin their orientation to PLATO by reviewing some of the more than 4000 hours of lesson materials that already exist on the PLATO system. The ever-increasing PLATO lesson library is organized into twenty-seven subject matter catalogs and is accessible from any PLATO terminal. In addition, comprehensive written guides to lesson materials are available in the PLATO library, located at 46 East Delaware Avenue.

Potential users may review PLATO lessons in their field in order to consider them for use by their students and/or to provide ideas for new lessons. Ideas for PLATO applications in one's own subject can also come from looking at lessons in other subjects.

Another early step in becoming acquainted with the features of the PLATO system involves trying various terminal accessories such as the random access audio device, which presents pre-recorded messages; the four-voice music synthesizer; the Votrax digitized speech device; and the random access slide projector.

In order to facilitate the review of lessons by faculty, staff, students, and visitors, a special "demonstration" sign-on has been created which gives all users immediate and easy access to the lessons on PLATO. Instructions for using this sign-on are illustrated in Figures 4 and 5. First when PLATO asks for your name, type "demo," as shown in Figure 4, then press the NEXT key. Second, when PLATO asks for your group, type "demo," as shown in Figure 5, then hold down the SHIFT key while pressing the STOP key. PLATO will display an index which will let you access most of the instructional materials on PLATO. This index is shown in Figure 6. Reviewers can try a lesson by typing the appropriate letter from the index.

Four PLATO lessons have been written specifically to orient new users to the Delaware PLATO System. They include: "How to Use PLATO," which teaches the new user how to operate the terminal; "Seminars Offered About PLATO," which describes the seminar series offered four times a year by the PLATO staff; "Information About the Delaware PLATO Project," which displays tables and graphs on monthly terminal use, projected costs, and departmental involvement; and "Delaware PLATO System Hardware Configuration," which describes the computer system, communications equipment, and terminals. These four lessons are accessible from the demonstration index.



4. Signing on for Lesson Review:
:e.

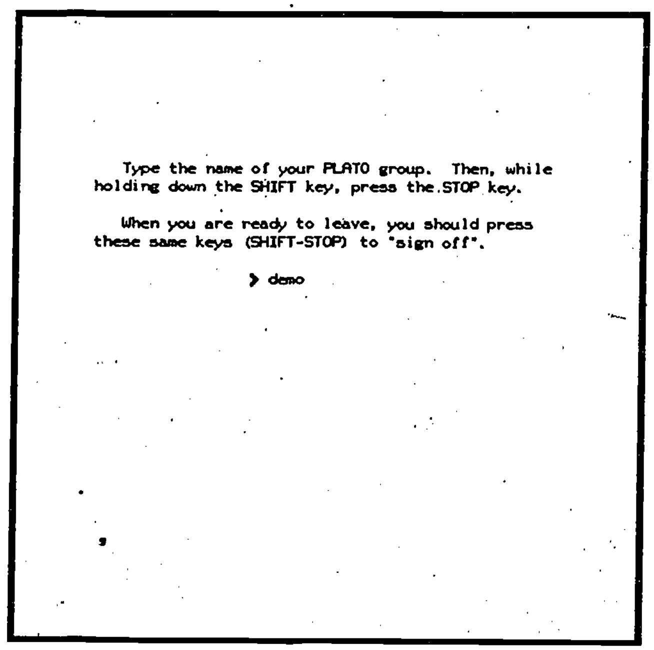
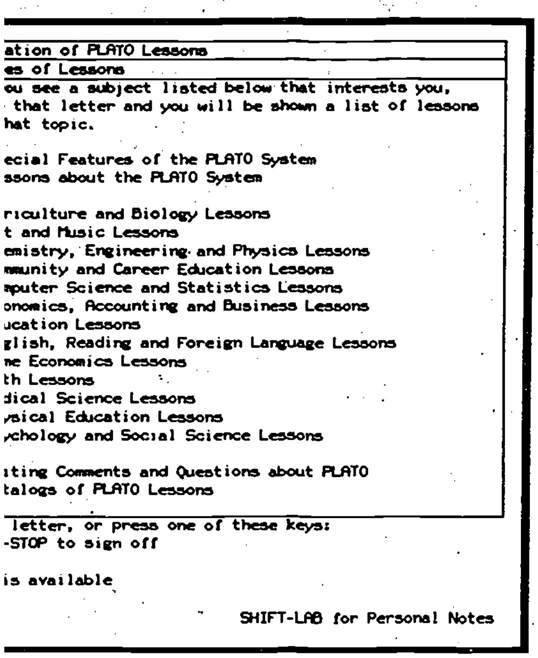


Figure 5. Signing on for Lesson Review:
The Group.



5 (a). Index of Programs for
Review.

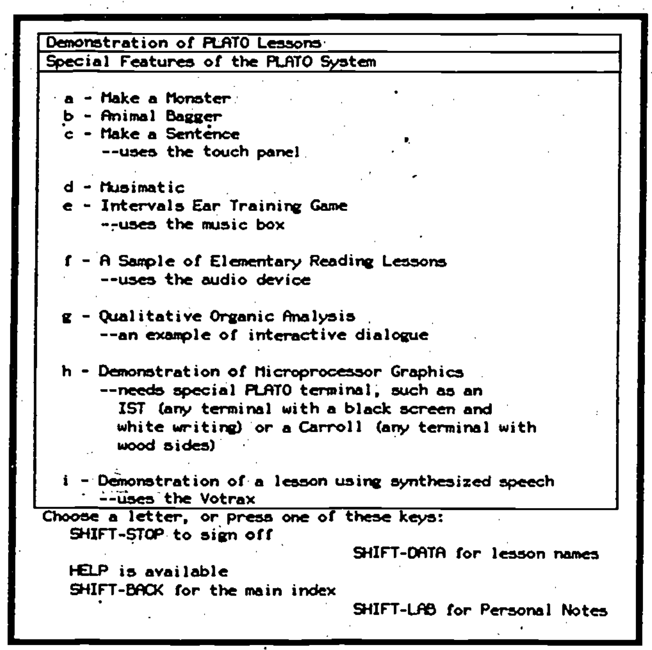


Figure 6 (b). Index of Programs for
Lesson Review.

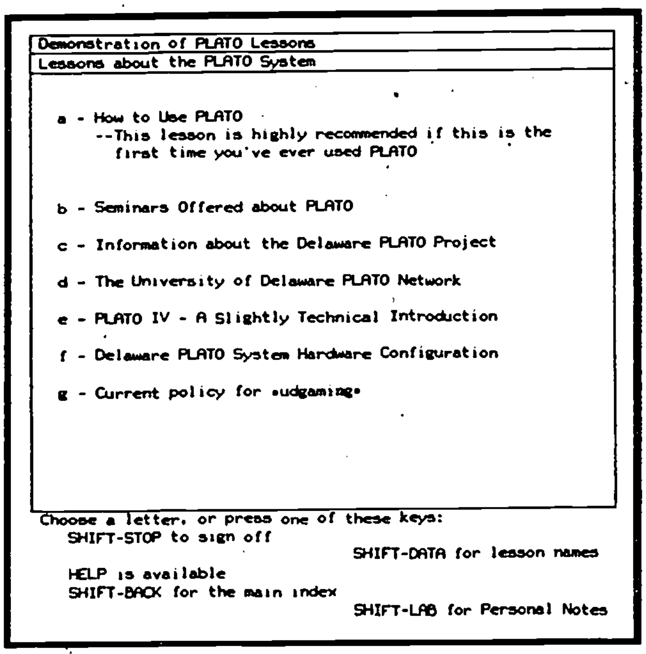


Figure 6 (c). Index of Programs for Lesson Review.

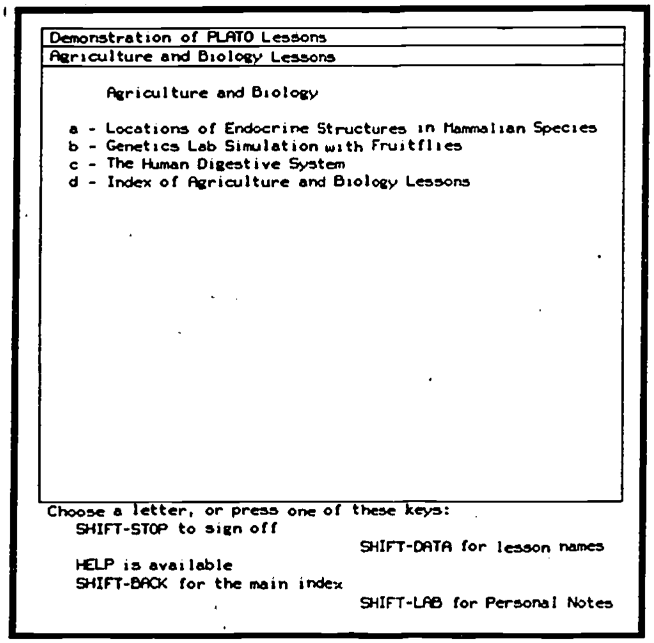


Figure 6 (d). Index of Programs for Lesson Review.

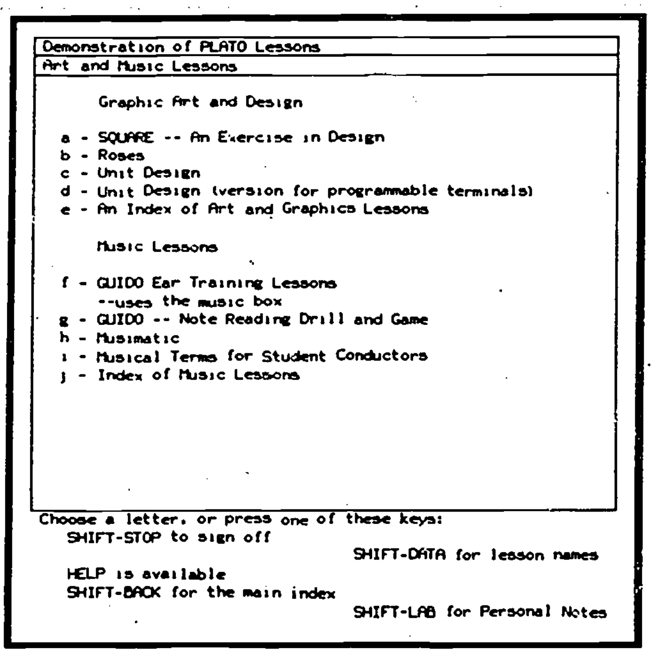


Figure 6 (e). Index of Programs for Lesson Review.

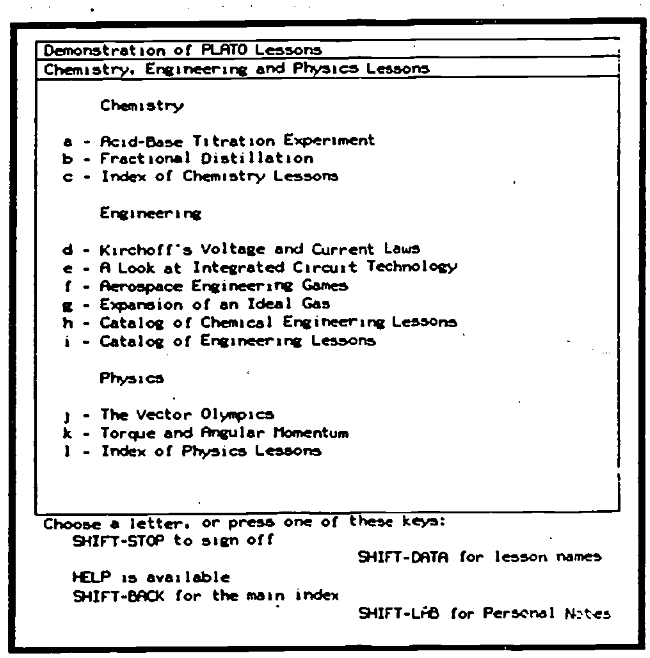


Figure 6 (f). Index of Programs for Lesson Review.

Demonstration of PLATO Lessons
Community and Career Education Lessons

Career Lessons

a - The Self Directed Search
b - Occupation Arrow
c - Index of Career Counseling Lessons

Community Education Lessons

d - Newark Community Resource Agencies

Choose a letter, or press one of these keys:
SHIFT-STOP to sign off
SHIFT-DATA for lesson names
HELP is available
SHIFT-BACK for the main index
SHIFT-LAB for Personal Notes

Figure 6 (g). Index of Programs for Lesson Review.

Demonstration of PLATO Lessons
Computer Science and Statistics Lessons

Computer Science

a - FORTRAN -- Introduction to DO Loops
b - BASIC -- An Introduction to BASIC
c - APL -- An Introduction to APL
d - Index of Computer Science Lessons
e - A compact BASIC compiler system

Statistics

f - Basic Statistical Package
g - Binomial Distribution
h - Catalog of Statistics Lessons

Choose a letter, or press one of these keys:
SHIFT-STOP to sign off
SHIFT-DATA for lesson names
HELP is available
SHIFT-BACK for the main index
SHIFT-LAB for Personal Notes

Figure 6 (h). Index of Programs for Lesson Review.

Demonstration of PLATO Lessons
Economics, Accounting and Business Lessons

Economics, Accounting and Business

a - The Personnel Game
b - Accounting: The Income Statement
c - Beginning Typing
d - Index of Business Lessons

Choose a letter, or press one of these keys:
SHIFT-STOP to sign off
SHIFT-DATA for lesson names
HELP is available
SHIFT-BACK for the main index
SHIFT-LAB for Personal Notes

Figure 6 (i). Index of Programs for Lesson Review.

Demonstration of PLATO Lessons
Education Lessons

Teacher Education

a - Simulation of the First Year of Teaching
b - Individual Reading Inventory Drill

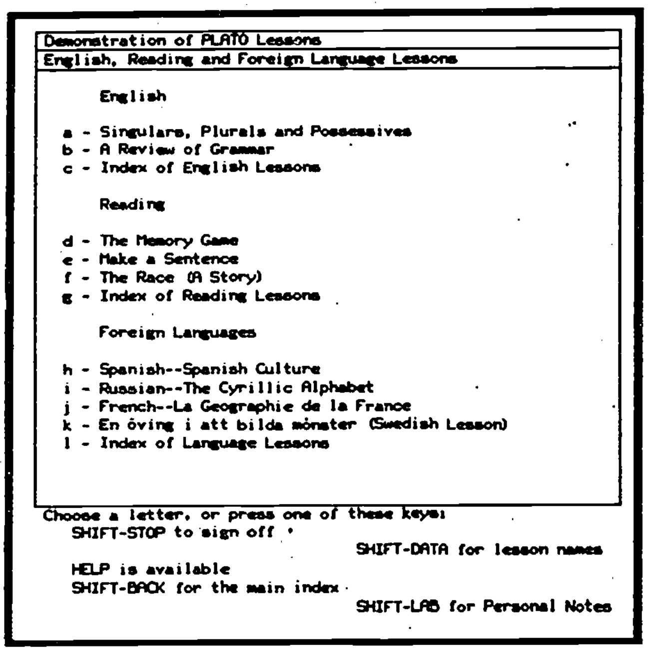
Special Education

c - Finger Spelling

d - Catalog of Education Lessons

Choose a letter, or press one of these keys:
SHIFT-STOP to sign off
SHIFT-DATA for lesson names
HELP is available
SHIFT-BACK for the main index
SHIFT-LAB for Personal Notes

Figure 6 (j). Index of Programs for Lesson Review.



Demonstration of PLATO Lessons
English, Reading and Foreign Language Lessons

English

a - Singulars, Plurals and Possessives
b - A Review of Grammar
c - Index of English Lessons

Reading

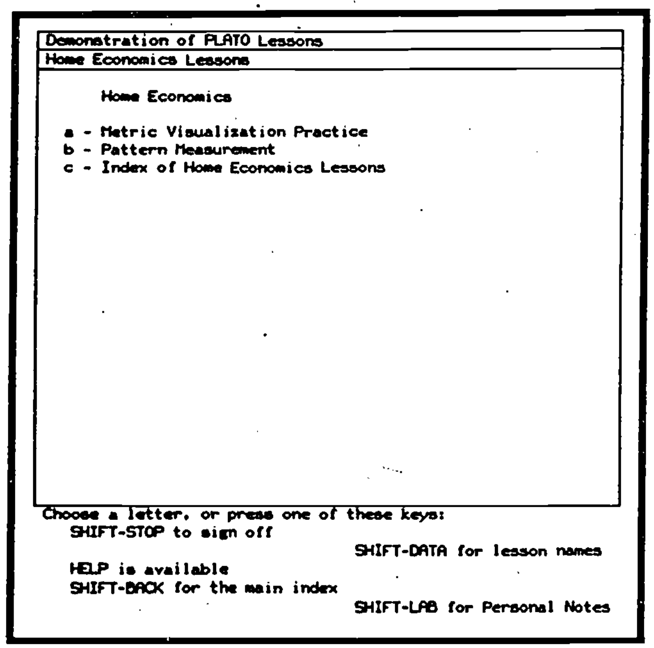
d - The Memory Game
e - Make a Sentence
f - The Race (A Story)
g - Index of Reading Lessons

Foreign Languages

h - Spanish--Spanish Culture
i - Russian--The Cyrillic Alphabet
j - French--La Geographie de la France
k - En övning i att bilda mönster (Swedish Lesson)
l - Index of Language Lessons

Choose a letter, or press one of these keys:
SHIFT-STOP to sign off
SHIFT-DATA for lesson names
HELP is available
SHIFT-BACK for the main index
SHIFT-LAB for Personal Notes

Figure 6 (k). Index of Programs for Lesson Review.



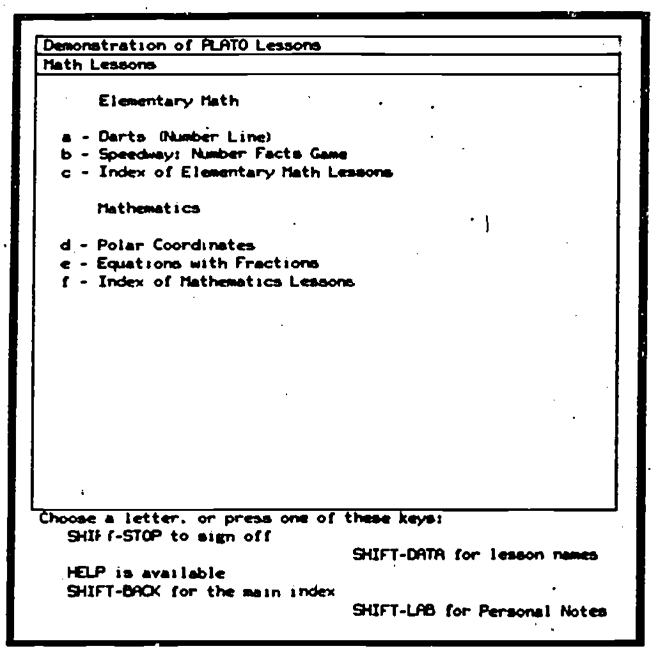
Demonstration of PLATO Lessons
Home Economics Lessons

Home Economics

a - Metric Visualization Practice
b - Pattern Measurement
c - Index of Home Economics Lessons

Choose a letter, or press one of these keys:
SHIFT-STOP to sign off
SHIFT-DATA for lesson names
HELP is available
SHIFT-BACK for the main index
SHIFT-LAB for Personal Notes

Figure 6 (l). Index of Programs for Lesson Review.



Demonstration of PLATO Lessons
Math Lessons

Elementary Math

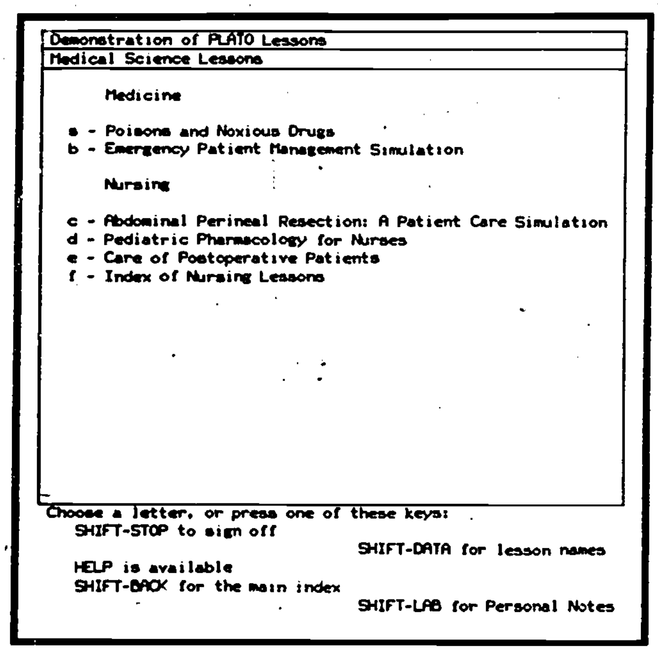
a - Darts (Number Line)
b - Speedway: Number Facts Game
c - Index of Elementary Math Lessons

Mathematics

d - Polar Coordinates
e - Equations with Fractions
f - Index of Mathematics Lessons

Choose a letter, or press one of these keys:
SHIFT-STOP to sign off
SHIFT-DATA for lesson names
HELP is available
SHIFT-BACK for the main index
SHIFT-LAB for Personal Notes

Figure 6 (m). Index of Programs for Lesson Review.



Demonstration of PLATO Lessons
Medical Science Lessons

Medicine

a - Poisons and Noxious Drugs
b - Emergency Patient Management Simulation

Nursing

c - Abdominal Perineal Resection: A Patient Care Simulation
d - Pediatric Pharmacology for Nurses
e - Care of Postoperative Patients
f - Index of Nursing Lessons

Choose a letter, or press one of these keys:
SHIFT-STOP to sign off
SHIFT-DATA for lesson names
HELP is available
SHIFT-BACK for the main index
SHIFT-LAB for Personal Notes

Figure 6 (n). Index of Programs for Lesson Review.

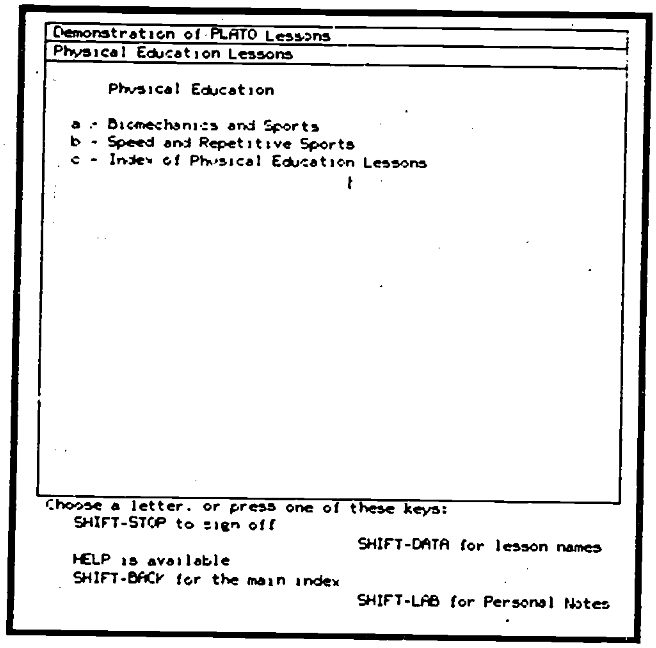


Figure 6 (o). Index of Programs for Lesson Review.

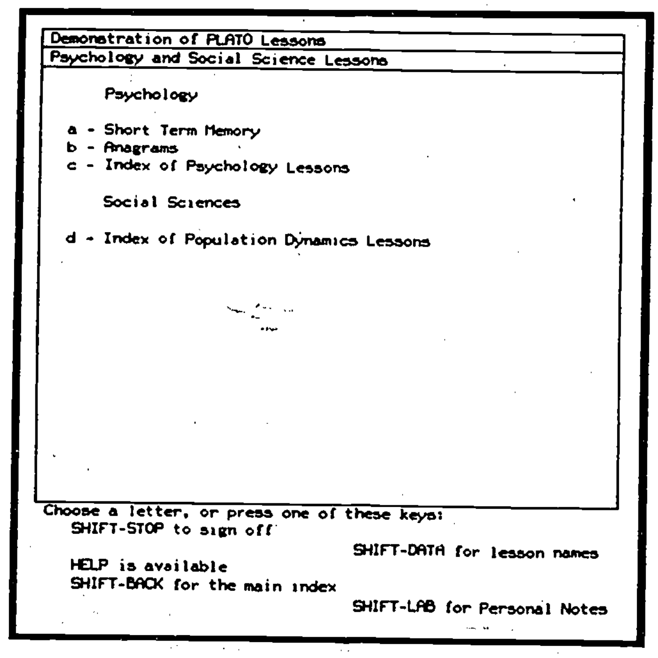


Figure 6 (p). Index of Programs for Lesson Review.

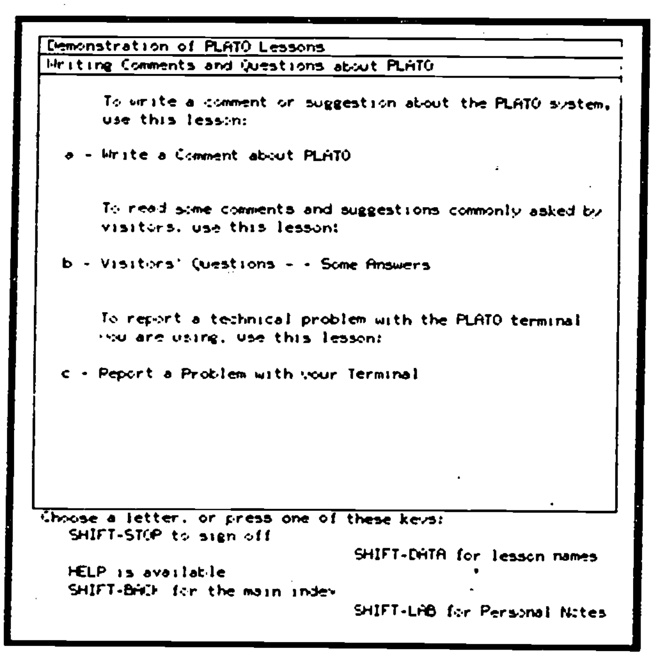


Figure 6 (q). Index of Programs for Lesson Review.

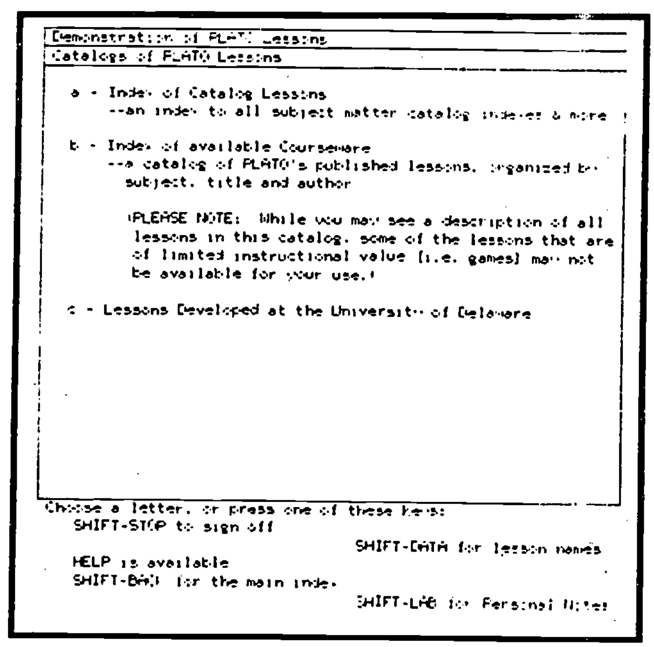


Figure 6 (r). Index of Programs for Lesson Review.

Participation in ADCIS

The Delaware PLATO Project is an active participant in the Association for the Development of Computer-based Instructional Systems (ADCIS). ADCIS is the principal national forum for the scholarly exchange of ideas regarding computer-based education, and the Project regularly delivers progress reports at the Association's annual meetings. Papers have also been presented at ADCIS special interest group meetings for health sciences, implementation, PLATO, elementary-secondary schools, and music. The music interest group was founded by our University's Music Department by means of the PLATO Project. The Home Economics interest group was begun by faculty in the College of Human Resources who use PLATO.

A big event in the history of the Delaware PLATO Project was hosting the 1977 ADCIS National Convention at the Hotel DuPont, February 20-24, 1977. Jointly funded by the Delaware School Auxiliary Association, the Wemyss Foundation, ADCIS, and the University of Delaware, the convention attracted the largest attendance in its 10-year history. The participation of 32 vendors made the exhibit area a most comprehensive showing of computer-based educational technology. A special feature was the pre-session held for teachers on Monday, February 21, in cooperation with the State Department of Public Instruction. Entitled "Introduction to Educational Computing" the pre-session was attended by more than 300 Delaware teachers. During the main portion of the convention, several presentations were made by members of the PLATO staff and of the faculty. These are published in the 1977 ADCIS Proceedings, and they are available upon request in the PLATO office.

At the 1978 ADCIS Convention which was held in Dallas, Texas from March 1 through March 4, 1978, all three members of the PLATO senior staff were elected officers. Bonnie Seiler was named Newsletter Editor for the PLATO Users Group, Jim Wilson was elected System Representative in the PLATO Users Group, and Fred Hofstetter was re-elected to a third consecutive term as President of the National Consortium for Computer-based Music Instruction and holds an ex officio seat on the ADCIS Steering Committee. At the 1979 ADCIS Convention which was held in San Deigo, California, from February 26 through March 1, 1979, Bonnie Seiler was reappointed newsletter editor for the PLATO Users Group, James Wilson was reelected System Representative in the PLATO Users Group, and Fred Hofstetter was elected Conference Secretary and was also elected to serve on the Editorial board of the Journal of Computer-Based Instruction.

During the 1980 Convention, held in Arlington, Virginia, the PLATO materials developed at the University were demonstrated at the Project's new demonstration booth, designed by Ray Nichols. John Silver hosted a PLATO User's Group session devoted to the computer hardware used by PLATO, including a demonstration of PLATO terminals running programs stored on floppy discs, completely independent of the central computer.

Several members of the PLATO staff and of the faculty have made formal presentations at ADCIS conventions. These are listed in Table 5. Copies of the presentations are published in ADCIS Proceedings, available in the Delaware PLATO Library.

Table 5

Presentations by Delaware Faculty and Staff
at National ADCIS Conventions

Name	Title of Presentation	Year
Michael A. Arenson	"The Development of a Competency-Based Education Program in Music Theory"	1979
David A. Barlow, A. Stuart Markham, Jr., and James G. Richards	"PLATO Facilitation of Precision Analysis in Biomechanics"	1979
Edward Boas, Jr.	"An Analysis of Instructional Delivery Systems in Vocational Education Comparing Computer-Managed Instruction, Teacher-Delivered Module"	1979
Morris Brooks	"University of Delaware Honors Program"	1980
John Brown	"Mathematics Applications of Computer Technology"	1977
Gerald R. Culley	"When PLATO Knows Latin: Benefits of Letting the Computer Inflect the Form"	1980
Angelo E. Di Antonio, and Keith Slaughter	"Advanced Accounting"	1980
John Eisenberg	"Overview of the PLATO Modern Hebrew Project"	1977
Monica Fortner	"Important Criteria to Consider for Evaluating Instructional Simulation in Computer Based Education"	1980
Nevin Frantz	"A Computer Managed Instructional System for Vocational Technical Education"	1977
Fred T. Hofstetter	"GUIDO: An Interactive Computer-Based System for Drill and Practice in Ear-Training"	1976
Fred T. Hofstetter	"Computer-Based Recognition of Perceptual Patterns in Harmonic Dictation Exercises"	1978

Fred T. Hofstetter	"Controlled Evaluation of a Competency-Based Approach to Teaching Aural Internal Identification"	1979
Fred T. Hofstetter	"Program Design"	1980
Fred T. Hofstetter	"Cooperative PLATO Program Between the University of Delaware and the New Castle County School District Aimed at Eliminating Minority Group Isolation in New Castle County Schools"	1980
Fred T. Hofstetter	"Computer Based Recognition of Perceptual Patterns in Chord Quality Dictation Exercises"	1980
Hank Hufnagel	"MENTOR -- A PLATO-like Systems of CAI"	1977
Rosemary Killam	"Data Retention and Analysis: Experience and Recommendations"	1977
Mark Laubach and James Hoffman	"Examination of a PLATO Based Psychology Research Laboratory for Visual Perception"	1980
James Morrison	"Computer Applications in Business Education"	1977
James Morrison	"Innovative Classroom Applications of Computer Technology"	1979
James Morrison, Frances Mayhew and Jo Kallal	"Strategies for Using Computer-Based Education with Home Economics Content"	1980
Raymond Nichols and James H. Wilson	"The Computer Display as a Medium in the Teaching of Aesthetics in Visual Design"	1977
Raymond Nichols	"The PLATO Display in the Teaching of Optical Letterspacing"	1979
Bonnie A. Seiler	"Computer Assistance in the Social Processes of Learning"	1977
Bonnie A. Seiler	"Planning a Lesson"	1980
Richard Sharf	"A Computer-Based Career Guidance System"	1977

John Silver	"Microfiche, Random Access Slide Projectors and Alternatives for Displaying Visual Images"	1980
Robert Uffelman	"Computer-Assisted Testing at the Education Resource Building"	1978
Rita Wagstaff	"Media Selections: Alternative Delivery Systems"	1978
Jessica Weissman	"Learner Controlled Audio for Remedial Reading"	1980
Jessica Weissman	"Diagnosing and Teaching to Black English Vernacular Features"	1980
Ronald H. Wenger and Keith Slaughter	"Pre-Calculus Mathematics with PLATO Support"	1980
Charles Wickham and Raymond Nichols	"PLATO in the Teaching of Foundation Visual Design"	1979
James H. Wilson	"The Effects of Drill Structure on Learning in Phonetics Lessons"	1978

Peripheral Development

During 1979-1980 the University of Delaware PLATO Project added to its staff the position of peripheral design engineer. This position was created in order to allow the Project to solve some hardware problems related to research being done on the system and to facilitate the design of new equipment not currently available for the PLATO system. 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, and art.

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 in making accurate stick figures which 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 has been a music synthesizer which could provide control over timbre, envelope, and special effects, in addition to control of time and frequency. In its final design stage is a new music synthesizer which contains fully programmable wave shapes and envelopes, plus control of glissando, tremolo, and vibrato. Based on a Z-80 microprocessor, the new synthesizer will be able to be used not only with PLATO but with any terminal which can interface to the Z-80.

During the 1980-81 academic year plans call for the development of interfaces to a Cybex torque analyzer for use in Physical Education's muscular experiments, to random-access Kodak slide projecters for multi-projector slide shows in the Art department, and to a pitch detector for teaching sight-singing in the Music department.

CHAPTER II. UNIVERSITY APPLICATIONS

This chapter contains a summary of activities in the departments using PLATO 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 Project. Study of these descriptions gives not only an overview of the wide range of activities which are being supported in the PLATO system, but it also provides a source of ideas from which new applications can arise.

Accounting

In the Fourth Summative Report of the Delaware PLATO Project it was noted how in a controlled experiment students using PLATO scored significantly higher in Accounting than did students who learned by traditional means. Based upon the results of this evaluation, the Accounting Department greatly increased its use of PLATO from 350 students in 1978-79 to 1200 students in 1979-80. Accounting faculty members also began to develop their own PLATO lessons.

Figure 7 shows a sample display from a lesson on cost accounting and the break-even point. PLATO provides a graph of the break-even equation and asks the student to choose a point on the graph. PLATO then asks whether that point will result in a profit or a loss. As this process is repeated, PLATO helps the student fill in a chart which shows how much profit or loss is obtained from the various sales amounts.

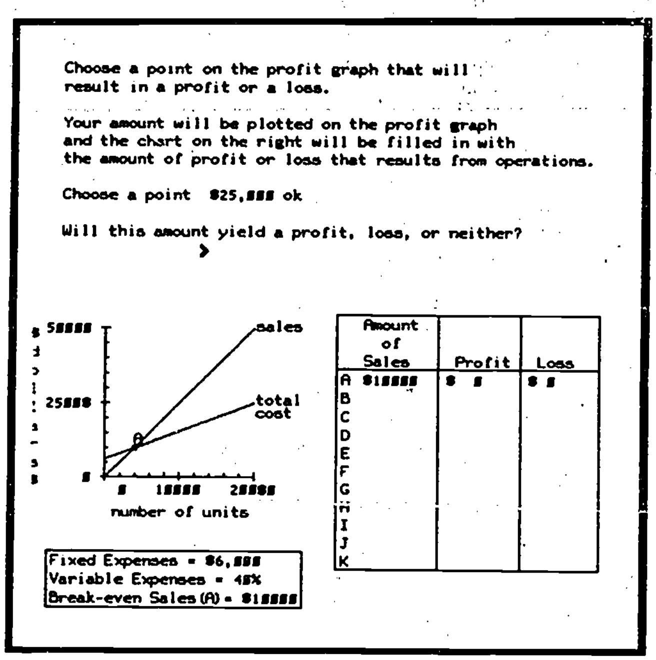


Figure 7. <u>What is Break-Even Point</u>? by Angelo Di Antonio and Louisa Bizoe. Copyright © 1979, 1980 by the University of Delaware PLATO Project.

Figure 8 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.

The Accounting Department has also implemented under PLATO Learning Management a review for the auditing section of the Uniform CPA Examination. Twelve thousand questions taken from previously administered CPA exams comprise the item bank. The questions are organized according to objectives in which the students take practice tests. If the students score lower than 85% on the tests, PLATO prescribes learning activities with which the students can learn the material to prepare themselves for trying the test again. If the students score 85% or higher, they are considered to have mastered the objective, and PLATO moves them ahead to the next objective. Figure 9 shows a sample question asked by PLATO in the CPA review.

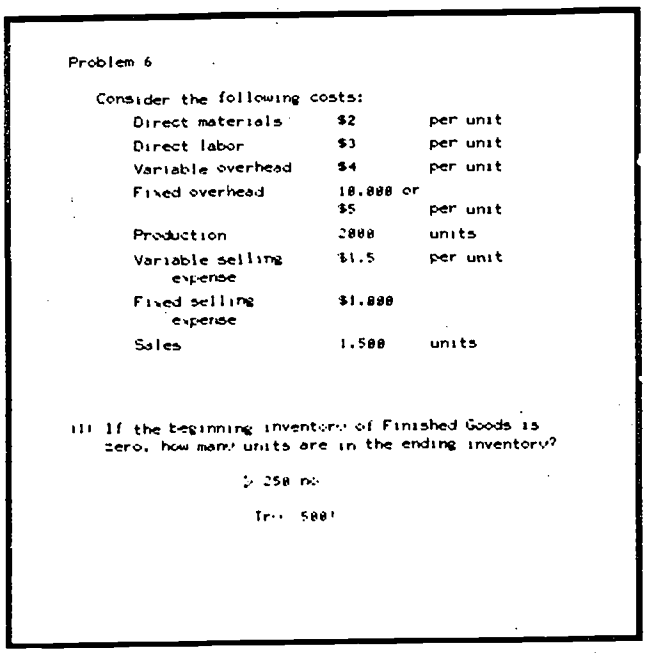


Figure 8. <u>Costing Methods</u>, by William Childs and Jeff Gillespie. Copyright © 1979 by the University of Delaware PLATO Project.

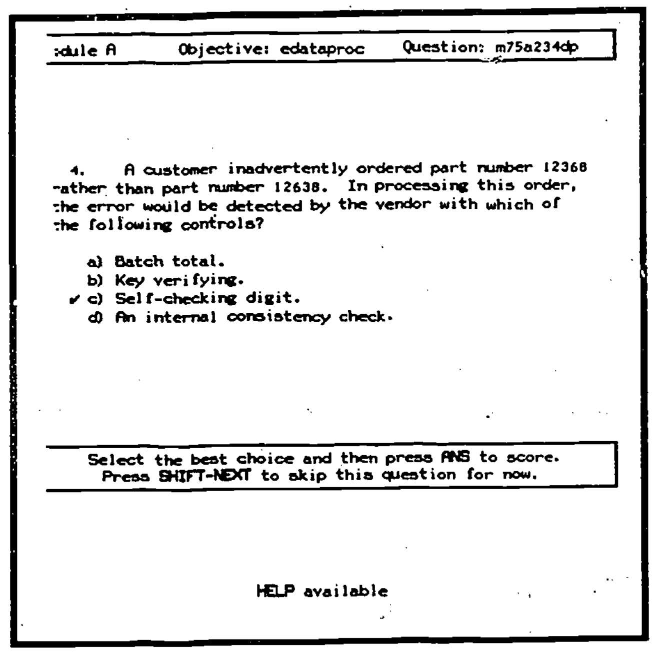


Figure 9. <u>CPA Review</u>, by Angelo Di Antoni Copyright © 1979, 1980 by the University of Delaware PLATO Project.

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 which 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 PLATO 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 PLATO is illustrated in the following example. Figure 10 shows a sample display from the neuron structure and

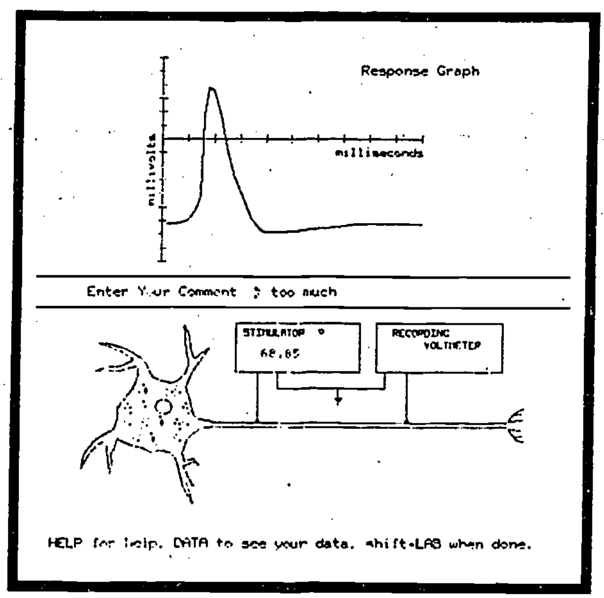


Figure 10. Neuron Structure and Function, by S. H. Boggs. Copyright © 1976 by the Board of Trustees of the University of Illinois.

function program. PLATO simulates neurons with 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. PLATO keeps track of what the student does and provides the student with reports in the form of response graphs.

Since 1977 the College of Agriculture has been developing a series of PLATO lessons dealing with the endocrine system. Four lessons of this series have been completed to date covering 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

After teaching terminology, definitions, and classifications of endocrine structures in the first two lessons, PLATO presents the students with an outline of the human body in the third lesson and asks the students what endocrine structures they would like to see. Figure 11 shows how one student has asked to see the kidneys, and PLATO has responded by drawing the kidneys 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 12 shows how this way of teaching locations of endocrine structures was expanded to include avian species in the fourth lesson.

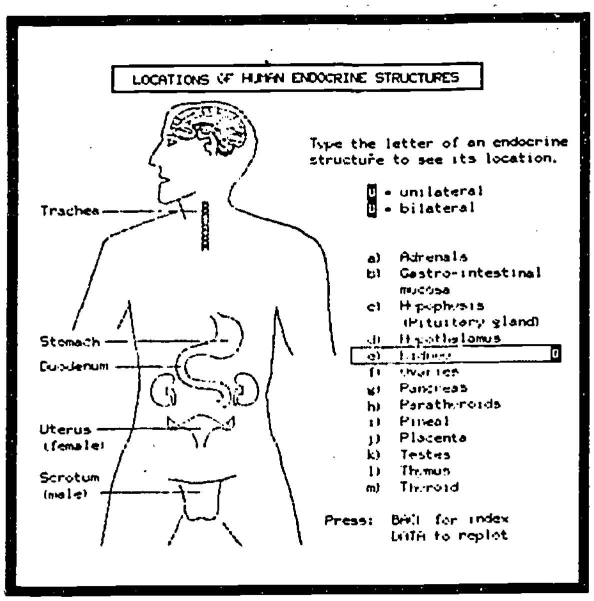


Figure 11. Endocrine System, by Paul Sammelwitz and Dan Tripp. Copyright © 1978 by the University of Delaware PLATO Project.

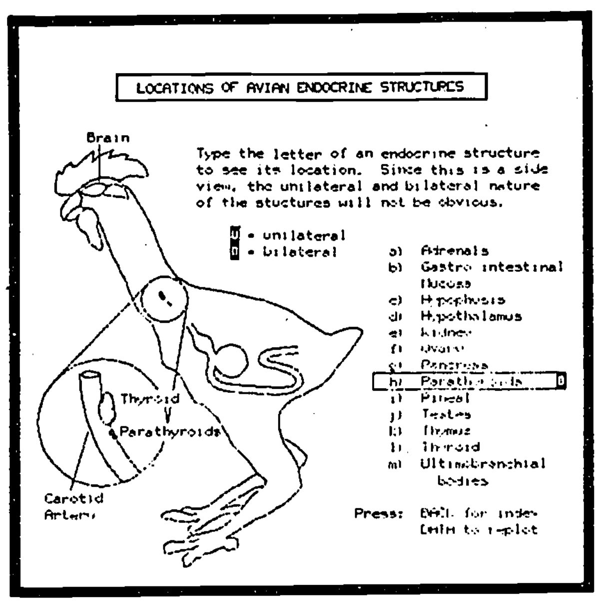


Figure 12. Endocrine System, by Paul Sammelwitz and Dan Tripp. Copyright © 1978, 1979 by the University of Delaware PLATO Project.

The College is also using PLATO Learning Management to make available practice tests to beginning animal and plant 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.

New programs are also being developed in Agricultural Engineering where students are beginning to use a lesson on the fundamentals of drafting. This lesson explains the purpose, history, and principles of modern drafting, and it demonstrates proper line drawing and the procedures used in projectioning and dimensioning.

Anthropology

The Anthropology Department has developed tutorial and drill lessons for 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 which 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 13 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. The student learns 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.

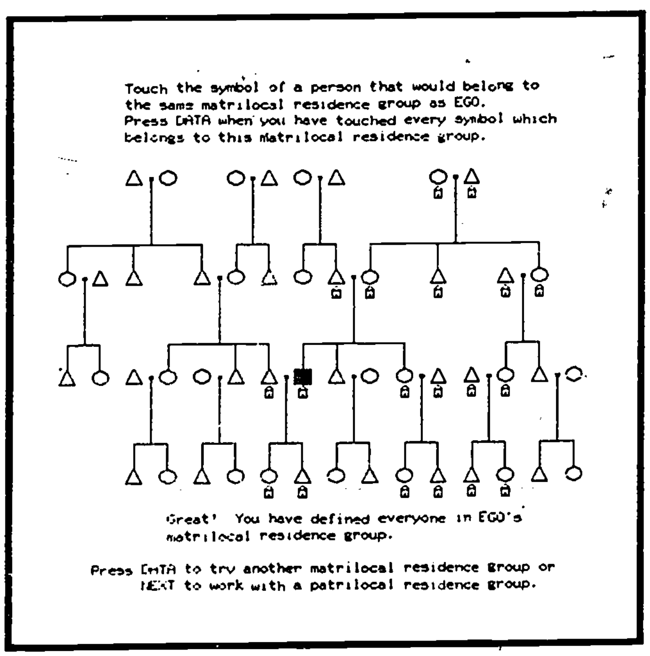
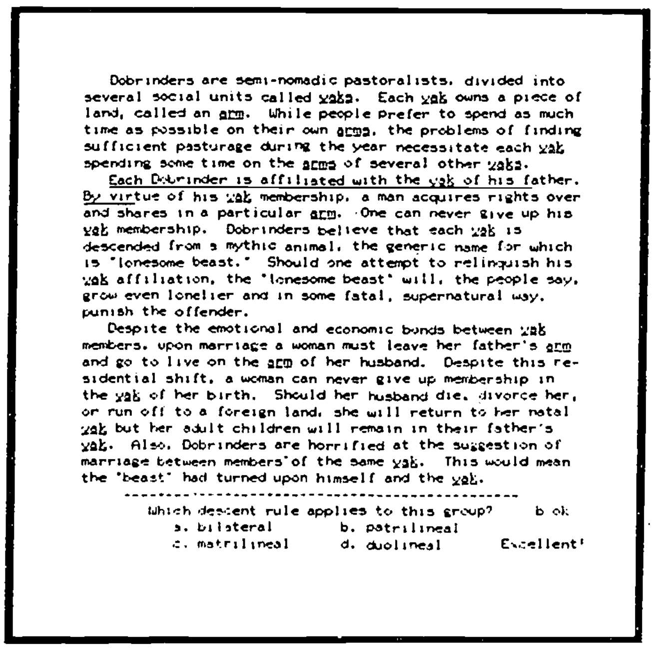


Figure 13. Anthropological Residence Theory, by Norman Schwartz, Monica Fortner and Charlie Collings. Copyright © 1978, 1979 by the University of Delaware PLATO Project.

In a lesson on anthropological descent theory, the student must similarly identify descent relationships for a given individual in a population group. Later in the lesson, the student is presented with an ethnographic description, and asked to identify the descent rule which applies to the population group described. As depicted in Figure 14, a student has correctly identified the patrilineal descent rule which applies 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 which applies.

Dr. Peter Roe, Assistant Professor, Department of Anthropology, was awarded a Local Course Improvement grant by the National Science Foundation for the term June, 1980 through August, 1982. The grant calls for the PLATO system to be used 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 which produces it. Two lessons will be developed and evaluated, one which will introduce the concepts of aesthetic syntactics and give examples of their application, and a second which will require students to utilize these concepts to create designs according to a specified set of rules.


Dobrinders are semi-nomadic pastoralists, divided into several social units called yaks. Each yak owns a piece of land, called an arm. While people prefer to spend as much time as possible on their own arms, the problems of finding sufficient pasturage during the year necessitate each yak spending some time on the arms of several other yaks.

Each Dobrinder is affiliated with the yak of his father. By virtue of his yak membership, a man acquires rights over and shares in a particular arm. One can never give up his yak membership. Dobrinders believe that each yak is descended from a mythic animal, the generic name for which is "lonesome beast." Should one attempt to relinquish his yak affiliation, the "lonesome beast" will, the people say, grow even lonelier and in some fatal, supernatural way, punish the offender.

Despite the emotional and economic bonds between yak members, upon marriage a woman must leave her father's arm and go to live on the arm of her husband. Despite this residential shift, a woman can never give up membership in the yak of her birth. Should her husband die, divorce her, or run off to a foreign land, she will return to her natal yak but her adult children will remain in their father's yak. Also, Dobrinders are horrified at the suggestion of marriage between members of the same yak. This would mean the "beast" had turned upon himself and the yak.

Which descent rule applies to this group? b ok

a. bilateral b. patrilineal

c. matrilineal d. duolineal Excellent!

Figure 14. Anthropological Descent Theory, by Norman Schwartz, Monica Fortner and Charlie Collings. Copyright © 1978, 1979 by the University of Delaware PLATO Project.

Art

The Art Department 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 PLATO, students are interactively able to create and to alter designs on the terminal screen. Work which used to take fifteen hours to complete on paper can be done in three hours on PLATO, thereby giving students the opportunity to work many more problems than they could before. They are also developing a better aesthetic judgment, because PLATO makes it so easy for them to alter their designs. If they don't like part of a design, PLATO lets them 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 PLATO in Art can best be explained by looking at how students use three programs, namely, "unit design," "grey scale practice in tonal recognition," and "optical letter spacing." In the unit design program, the student enters a shape into the computer by either turning on or turning off dots on a 96 x 96 dot matrix. Figure 15 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 16 shows how the student creates the composite image by rotating, mirroring, and inverting the positive/negative relationships of each element.

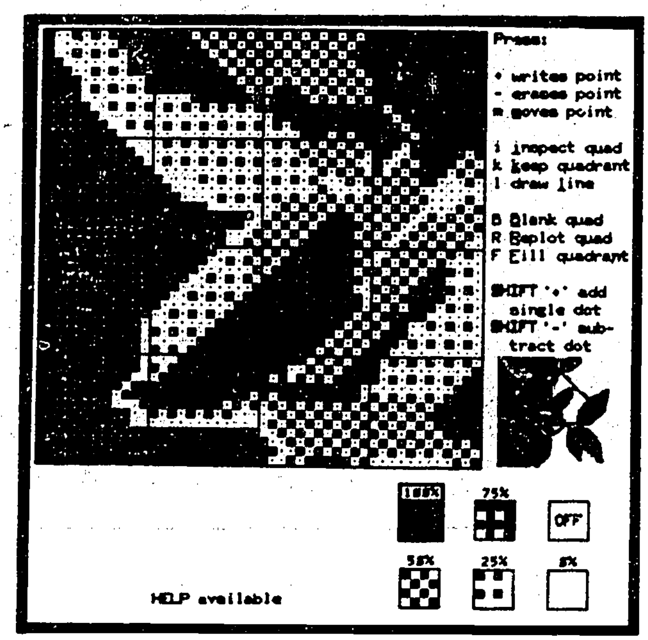


Figure 15. Unit Design, by Ray Nichols; creating the basic image. Copyright © 1977 by the University of Delaware PLATO Project.

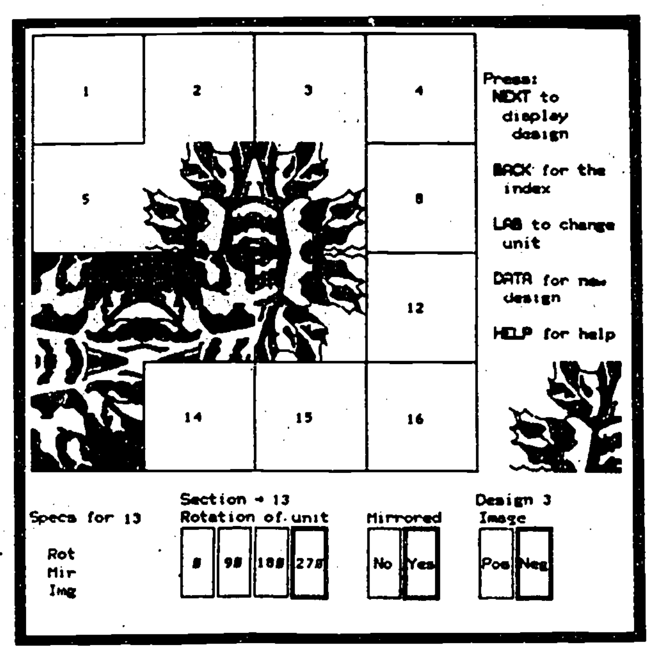


Figure 16. Unit Design, by Ray Nichols; creating the composite. Copyright © 1977 by the University of Delaware PLATO Project.

Through successive tries at designing basic shapes and performing graphic transformations, the student learns how to create clever and intricate designs such as the one shown in Figure 17.

The grey scale program gives Art students practice in recognizing the tonal values of the many shades of grey. PLATO presents the students with a grid of 20 x 30 squares. The student can then see the shade of grey for each square by telling PLATO the percentage of grey which should be in the square. Some students have become so adept at recognizing values of grey on PLATO that they can use the grey scale program to create facial images, such as the one shown in Figure 18.

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 PLATO, 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. Students can work with words containing up to 9 letters from each of five typefaces: Helvetica, Baskerville,

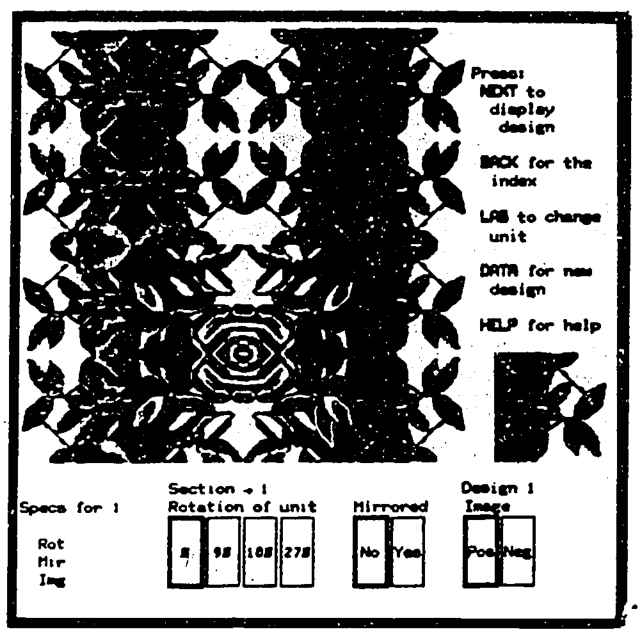


Figure 17. Unit Design, by Ray Nichols; the finished product. Copyright © 1977 by the University of Delaware PLATO Project.

Figure 18. Grey Scale, by Ray Nichols. Copyright © 1977 by the University of Delaware PLATO Project.

Garamond, Century Expanded, and Bodoni. Figure 19 shows a sample display from the letter spacing program. In this display the student is just about to move the "E" further over to the left.

One lesson newly developed during 1978-79 is called "Logodesign" which was written to provide the graphic design student with a format for the development of designs which would be used for trademarks and corporate identity work. Figure 20 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 which 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. By indicating the desired areas to

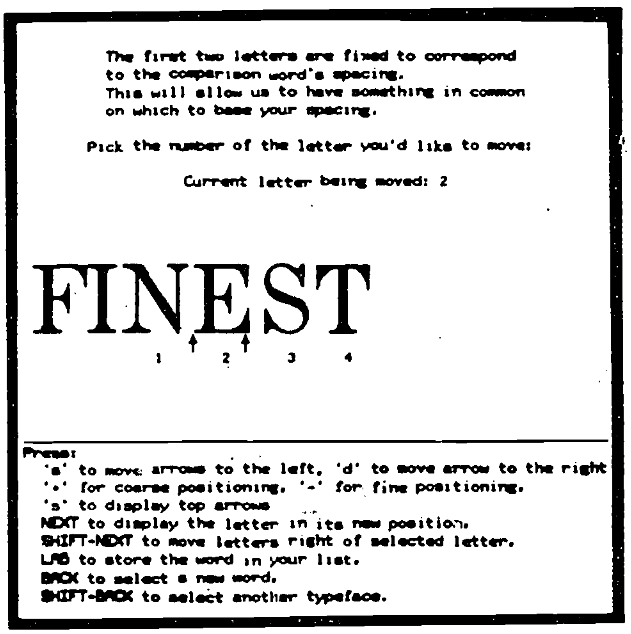


Figure 19. Letter Spacing, by Ray Nichols. Copyright © 1977 by the University of Delaware PLATO Project.

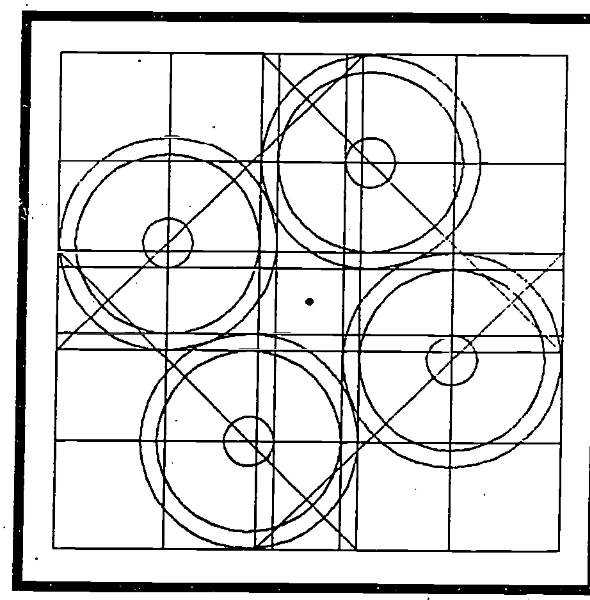


Figure 20. Logodesign, by Ray Nichols; creating the basic design. Copyright © 1979 by the University of Delaware PLATO Project.

be filled PLATO will then execute the finished design. Figure 21 shows the finished design superimposed over the original drawing. The small dots spread over the drawing are the indicators that those specific shapes have been chosen for filling.

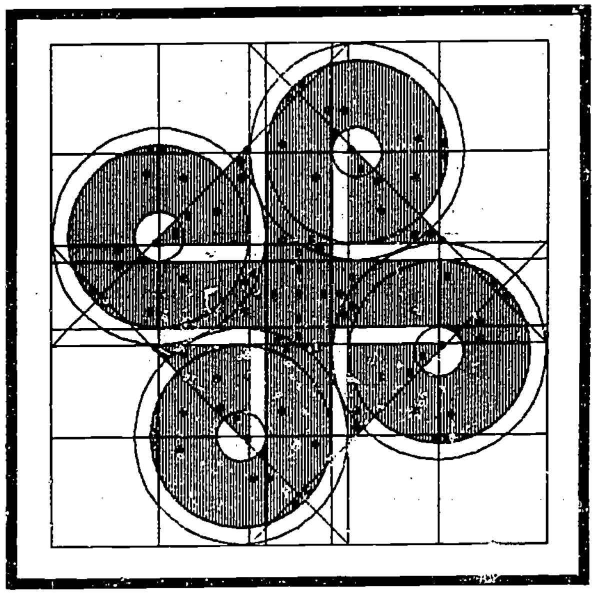


Figure 21. Logodesign, by Ray Nichols; the finished design. Copyright © 1979 by the University of Delaware PLATO Project.

Biology

The School of Life and Health Sciences is using PLATO to supplement laboratory exercises in genetics. Many traditionally taught genetics exercises require that students 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 master time-consuming procedures which do not contribute to their knowledge. 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, they can obtain data from sources normally unavailable to beginning students.

Figure 22 shows a display from a lesson in human genetics. Two generations of a family tree are shown. A chromosomal error in one of the parents has resulted in two severely affected daughters, one stillborn male, and two fetal miscarriages. From this display students can elect to see the chromosome spread of any family member and thereby determine the origin and inheritability of the defect. A clinical description of each afflicted individual is also available and adds realism to the student's role as genetic counselor.

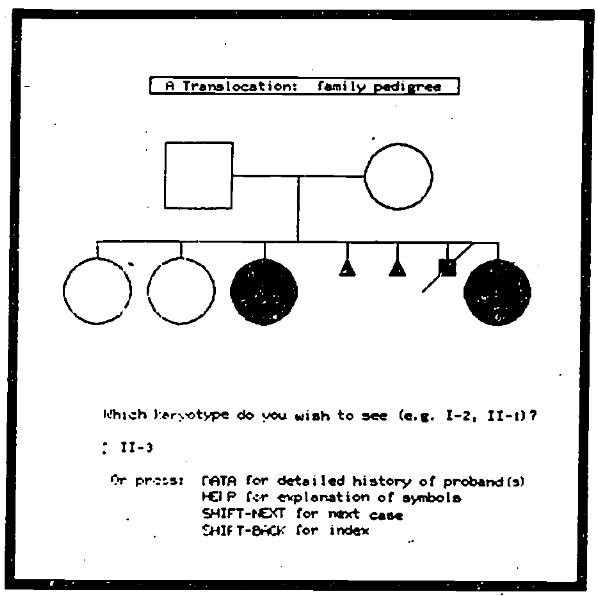


Figure 22. Human Karyotype Analysis, by Aart M. Olsen. Copyright © 1979 by the University of Delaware PLATO Project.

Figure 23 shows the results of a classic experiment in bacterial genetics. Two strains of bacteria have been mated, and the transfer of each gene from one strain to the other has been measured as the timed increase of the transferred population of the recipient cells. This information enables the student to locate the position of each gene on the bacterial chromosome. The sequence of genes from donor strain HfrH is seen to be thr-leu-azi-pro-lac-gal-trp.

Figure 24 shows the result of an experiment in developmental genetics. Wing length of mutant fruit flies depends on ambient temperature during a critical stage of larval development. In this lesson students themselves help design the experimental procedure which will unambiguously show in which larval stage the critical gene is temperature-sensitive.

In order to speed up the development and increase the scope of the Biology PLATO project, Professor David Sheppard sought and received a Local Course Improvement Grant from the National Science Foundation to develop a complete PLATO Genetics curriculum over the next two years. Lessons on recombinant DNA methods (genetic engineering), somatic cell genetics, and population genetics will be included.

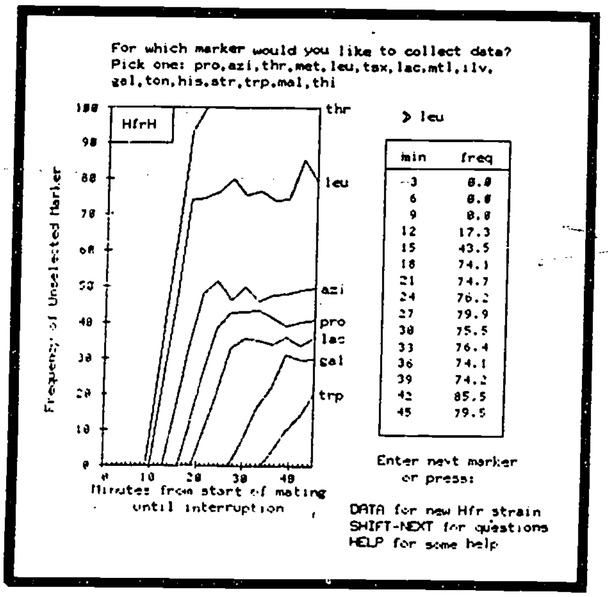


Figure 23. Gene Mapping in E. Coli by Conjugation Analysis, by Aart Olsen. Copyright © 1979 by the University of Delaware PLATO Project.

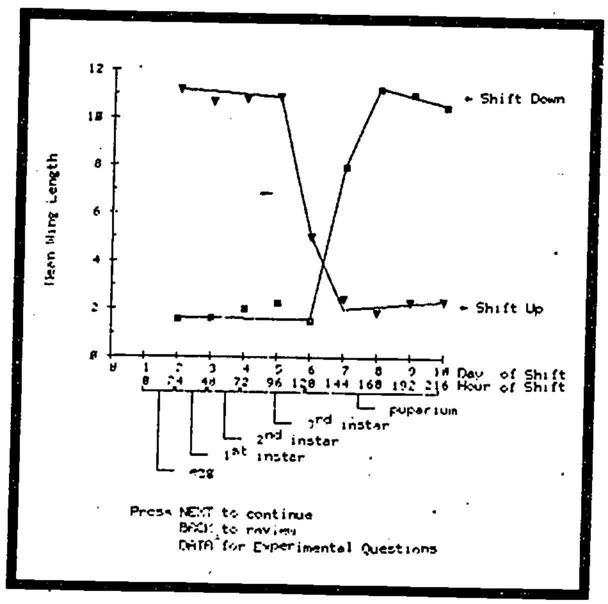


Figure 24. A Temperature Sensitive Morphological Mutant of Drosophilia Melanogaster, by David E. Sheppard and Kathleen J. Bergey. Copyright © 1979 by the University of Delaware PLATO Project.

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 is being supported by a two-year grant awarded by the National Science Foundation to Professor Stanley Sandler.

Though most of the lessons being developed are intended for use in the two-semester upper-level course sequence in Chemical Engineering thermodynamics, work is also underway on several lessons for freshman and sophomore courses. Figure 25 is part of a lesson which 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 26 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.

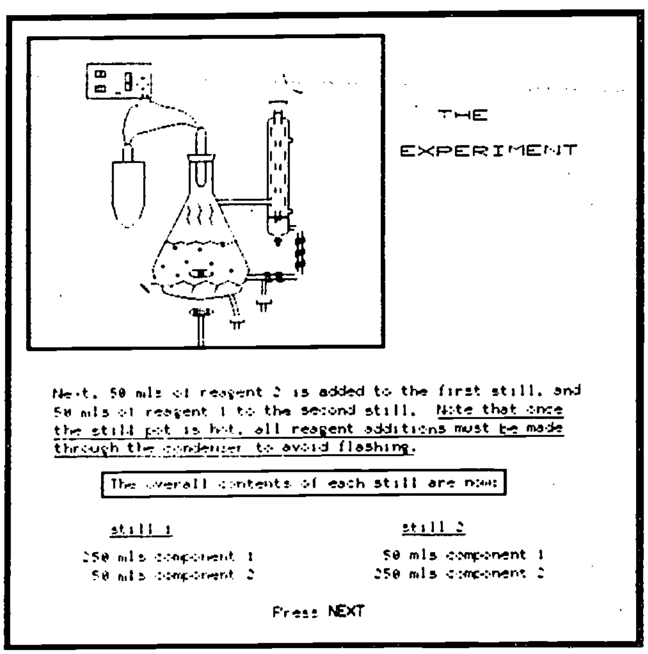


Figure 25. Modelling of Binary Mixtures, by Stanley Sandler and Douglas Harrell. Copyright © 1978 by the University of Delaware PLATO Project.

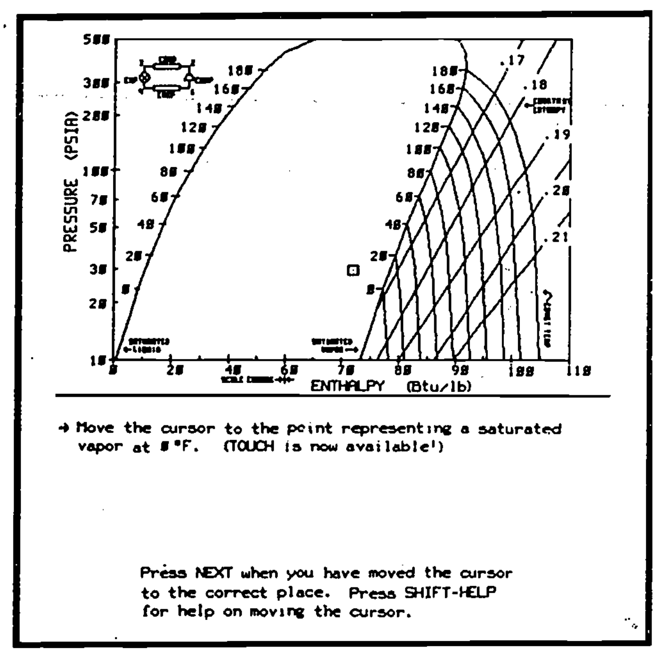


Figure 26. The Rankine Refrigeration Cycle, by Stanley Sandler and Robert Lamb Copyright © 1980 by the University of Delaware PLATO Project.

Chemistry

In response to the growing number of Chemistry students using PLATO lessons, a PLATO classroom of seventeen terminals was installed in a specially modified Chemistry laboratory in the fall of 1979. Use of the new site allows Chemistry students to freely schedule PLATO sessions during the semester. It has also allowed more instructors to make PLATO curricula available to their students.

Taking advantage of the large package of Chemistry lessons written under NSF funding at the University of Illinois, the Chemistry Department 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 27 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.

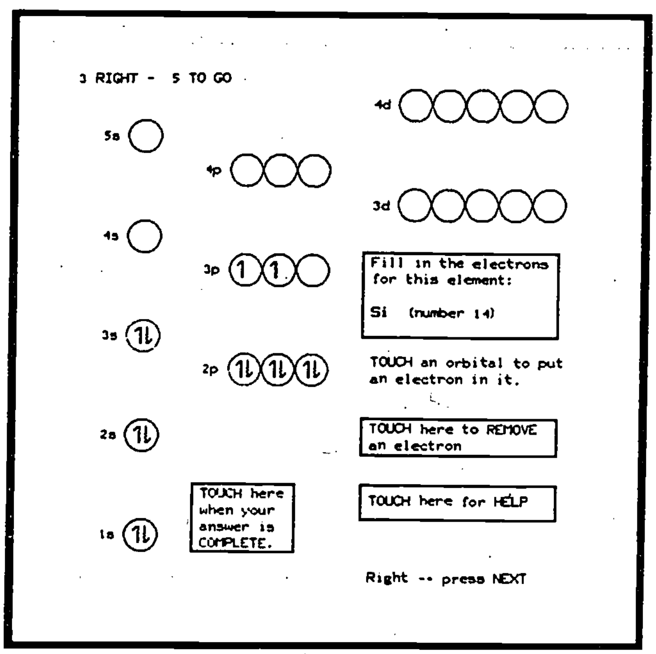


Figure 27. Electronic Structure of Atoms Part I: The Aufbau Principle, by Ruth Chabay. Copyright © 1976 by the Board of Trustees of the University of Illinois.

Figure 28 shows how PLATO 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. PLATO makes sure that the student follows correct laboratory procedures, helping out with suggestions when necessary.

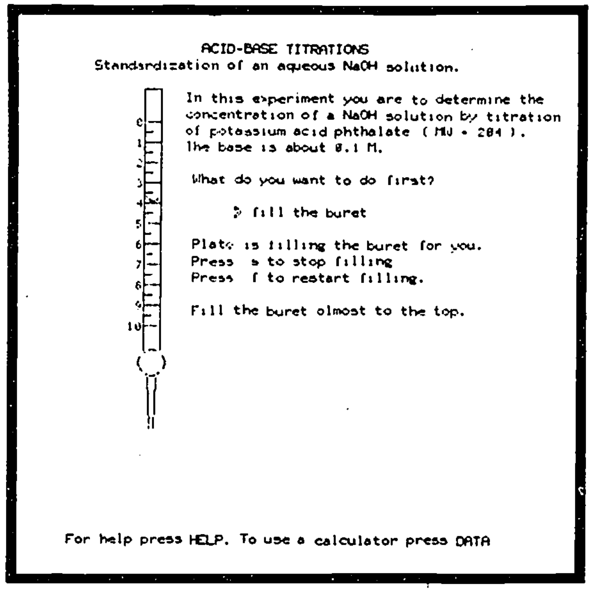


Figure 28. <u>Acid-Base Titrations</u>, by Stanley Smith. Copyright © 1976 by the Board of Trustees of the University of Illinois.

Civil Engineering

The faculty is investigating the value of the PLATO computer as a tool in teaching topics in Civil Engineering. A lesson has been developed for use in Statistics and Structural Analysis courses, covering the topics of axial force, shear and moment. This lesson teaches students the concepts of internal force, definitions and methods of calculating internal axial force, shear and moment, and it provides practice in calculating these forces.

Figure 29 shows a part of the lesson which explains the concept of internal force. Here the student is shown a rod which 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 30 the student has just completed a section which explains the method of calculating axial force, shear and moment, and is now being asked to use this method to calculate these internal forces at point B. If the student answers correctly, he continues on to the next part of the lesson. If not, the student is given helpful hints, depending on the nature of his error, and then he must try again.

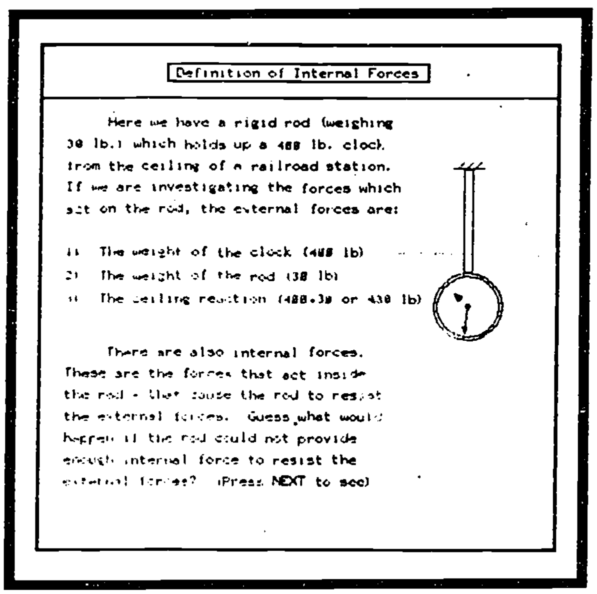


Figure 29. Internal Force, by Eugene Chesson and Jeff Snyder. Copyright © 1979, 1980 by the University of Delaware PLATO Project.

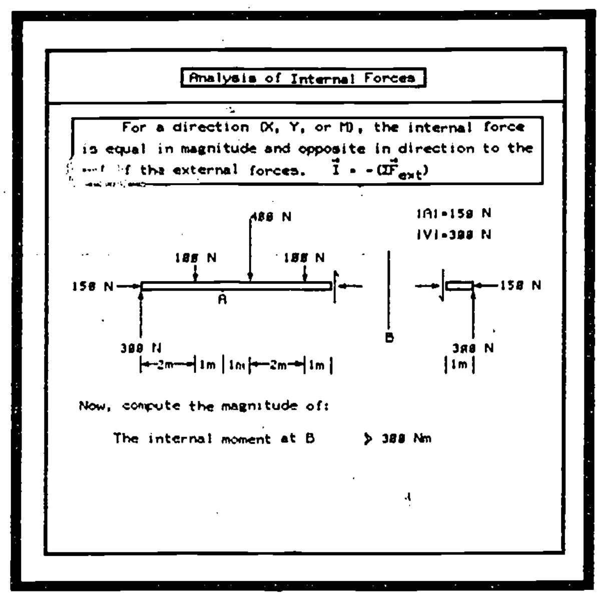


Figure 30. Internal Force, by Eugene Chesson and Jeff Snyder. Copyright © 1979, 1980 by the University of Delaware PLATO Project.

Figure 31 is from a tutorial section where the lesson teaches the student 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 which is being acted on by various loads. PLATO has already shown the student how to do the calculations at two points along the beam, and now the student is being asked to calculate the load at other points. Helpful hints are given if the student encounters difficulty.

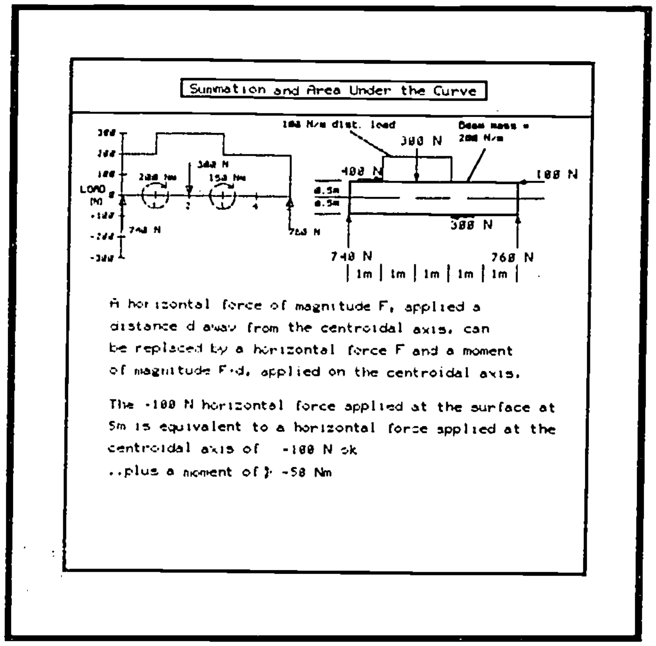


Figure 31. Internal Force, by Eugene Chesson and Jeff Snyder. Copyright © 1979, 1980 by the University of Delaware PLATO Project.

Computer Science

The Computer and Information Sciences Department has submitted to the National Science Foundation a proposal to implement a core curriculum to teach the basic concepts of Computer Science. This introductory-level curriculum will be modularly designed in order to allow the greatest flexibility of use. Modules will be developed in the following areas: computer architecture, data structures, algorithms and heuristics, control structures, and language design. Other modules that will be included are: the history of computing, the effects computers have on society, information theory, computer science theory, and artificial intelligence. If funded, this competency-based package will fill a great need for effective courseware in introductory Computer Science courses aimed at students studying in a wide range of disciplines.

Existing lessons on the PLATO system range from advanced topics such as systems programming, numerical analysis, and information processing to introductory lessons that teach what a computer is, basic computer terminology, and programming languages. Shown below are two lessons that teach FORTRAN programming. In Figure 32, the students are given an "old program," and they are asked to retype it as a "new program" by compressing the if-statements together using Boolean constructs. So far, the student has written the third and fourth lines of the old program as one statement in the third line of the new program, and he is in the process of making the fifth, sixth, and seventh lines of the old program the fourth line of the new program.

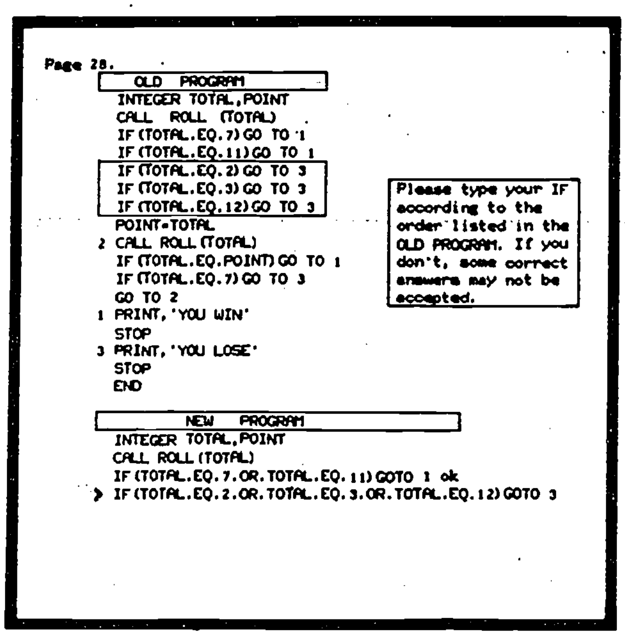


Figure 32. Experience with FORTRAN FORMAT Statements, by Rick Simkin and H. G. Friedman. Copyright © 1977 by the Board of Trustees of the University of Illinois.

Figure 33 shows how the PLATO system can simulate a FORTRAN compiler and help the students understand what the various statements do by allowing them to change their parameters and then observe their execution. In this example, the students are allowed to use four formating statements and two program execution statements. The students can edit the statements, enter data cards, initialize variables, and execute the program to find out the effects of their changes.

During the 1979-80 academic year enhancements were added to lessons that had previously been developed at the University of Delaware. These lessons use simulation techniques in order to allow the students to design a machine and then simulate the execution of the machine. Two mathematical models were previously implemented: Turing Machines and Push-Down Automata. Figure 34 shows how a student enters the states, tape symbols, and state transitions for a Turing machine. After the state transition table has been completed, the student can see the execution of the Turing machine occur in real time on the PLATO screen, and the student can step through the process one statement at a time, or the student can see the entire execution carried out

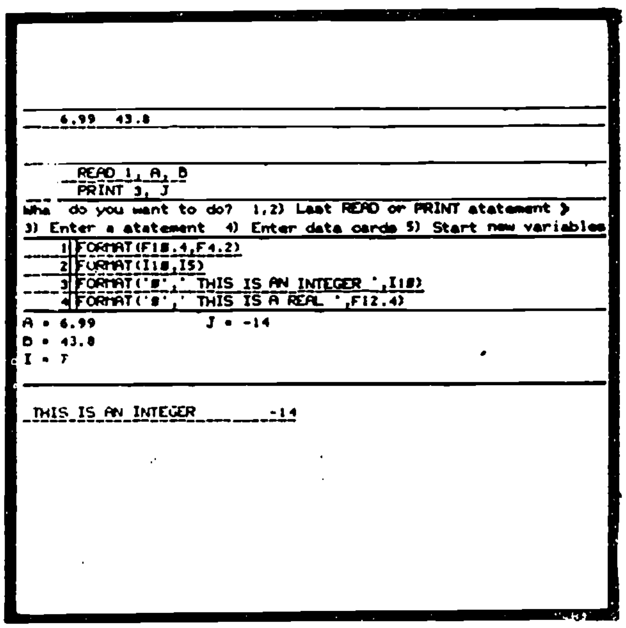


Figure 33. Understanding the FORTRAN IF Statement, by Greg Strass. Copyright © 1975 by the Board of Trustees of the University of Illinois.

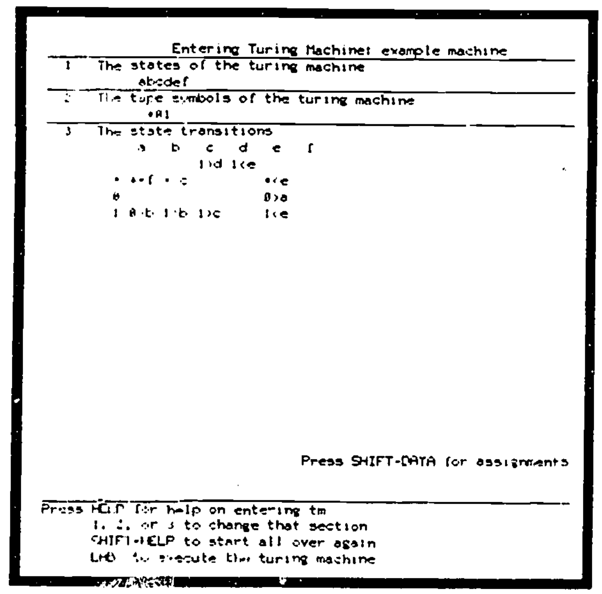


Figure 34. A Turing Machine Simulator, by Ralph Weischedel and Joseph P. Maia. Copyright © 1979 by the University of Delaware PLATO Project.

automatically. Figure 35 shows what the display looks like when the execution of the table in Figure 34 is halted. The enhancements added to these lessons include a revision of student flow through the lesson to increase their ease of use, and a major redesign of the storage mechanism so the student can work on and save any one of up to Thirty assignments. There are "instructor options" lessons associated with these simulators. They allow the instructor to enter assignments, inspect student work, and grade completed assignments by entering "test input strings" and executing the students' machines.

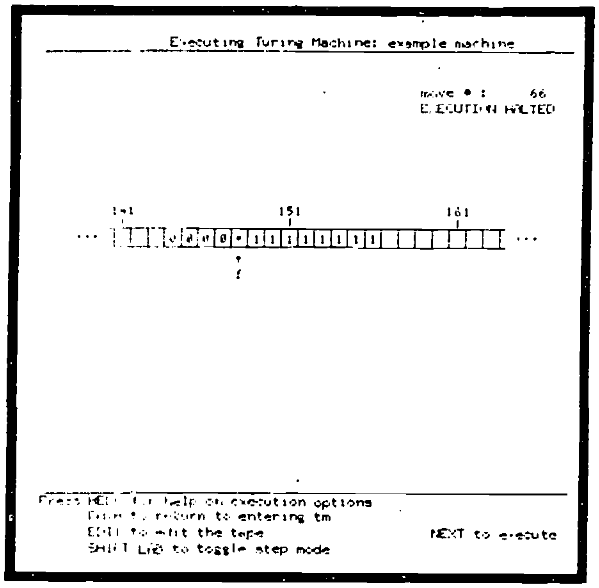


Figure 35. <u>A Turing Machine Simulator</u>, by Ralph Weischedel and Joseph P. Maia. Copyright © 1979 by the University of Delaware PLATO Project.

Continuing Education and Counseling

The Center for Counseling is using PLATO to develop a computer-based career guidance system which allows people to clarify their interests and abilities and helps them explore the characterisitcs of occupations. The Division of Continuing Education is providing funds to use the system in its adult counseling operations. The system has 2 parts. The first part consists of a computerized version of The Self Directed Search, an interest and ability inventory developed by John Holland (1974). The user spends 15 to 20 minutes answering 228 items in the 6 scales, namely, realistic, investigative, artistic, social, enterprising, and conventional. Figure 36 shows a sample display from the investigative scale. In this scale, the user indicates whether the activities printed on the screen are liked or disliked by touching the appropriate boxes. The boxes chosen by the user light up.

When the user completes The Self Directed Search, PLATO computes the scores for each of the six categories. After comparing these scores to a data bank of occupations, PLATO then allows the user to ask questions regarding the occupation. In Figure 37 PLATO has been asked to display the employment outlook for the occupation "guidance counselor." The computer memory contains current information on 317 occupations. PLATO allows users to look at any occupation they wish to examine, in an order determined by PLATO.

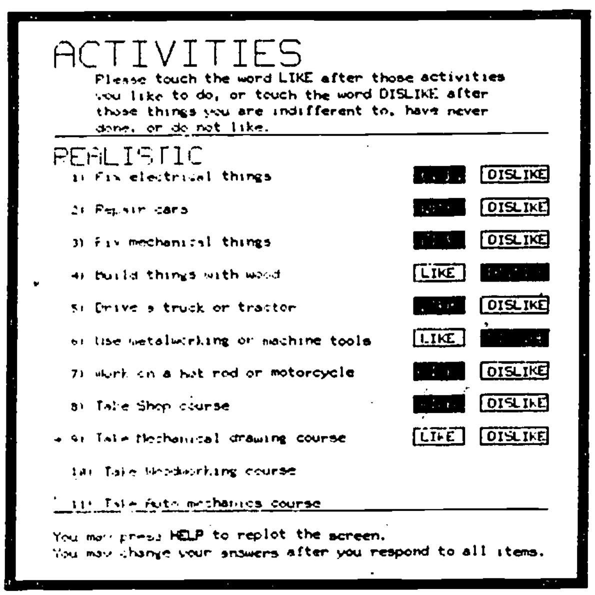


Figure 36. Interest Inventory from The Self Directed Search, by John L. Holland. Copyright © 1977 by Consulting Psychologist Press, Inc.

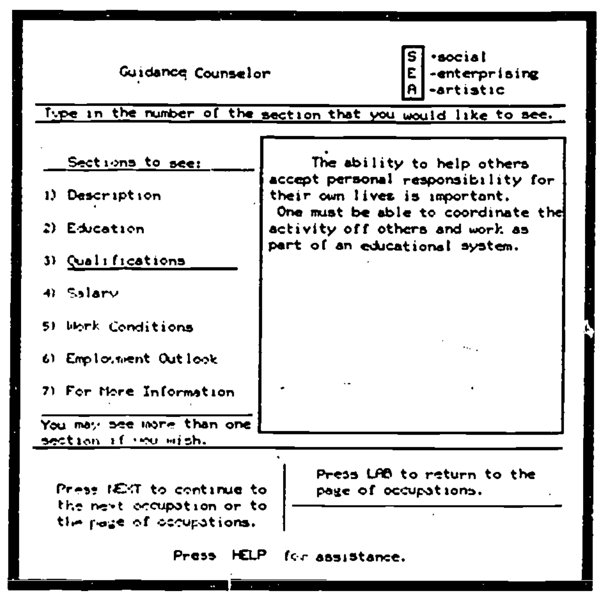


Figure 37. Occupational Search, by Richard Sharf. Copyright © 1977 by the University of Delaware PLATO Project.

This project differs from other computerized guidance projects in several ways. It begins with an assessment of the individual's interest and abilities using a well-validated inventory, rather than an exploration of a large data base of job information without any direction. Its data base includes occupations for college students and adults returning for further education. Access to the system has been made as simple as possible so that people who have never used a computer terminal can benefit from the system. PLATO is being used not only for the delivery of career guidance, but also for the creation of a data base of information on how people make career choices.

During the summer months, the Center for Counseling has given prospective new students the opportunity to explore occupations in its new PLATO package "The Occupation Arrow." "The Occupation Arrow," shown in Figure 38, allows users to type the title of any occupation they want information about. PLATO interprets what they have written and provides information about the occupation or about one like it. The seven categories of information available on each occupation are shown in Figure 39. If the occupational title that the user enters is too broad or vague, such as "engineer," the user is referred to an appropriate index of occupations, such as "careers in engineering."

Student response data about occupational information seeking is being generated and stored from this part of the career counseling package. Comparisons will be made between information seeking styles used with "The Occupation Arrow" and those used in "Career Search."

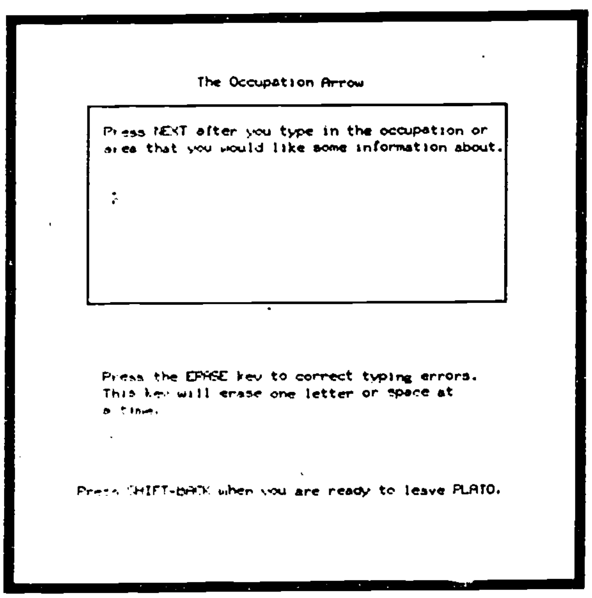


Figure 38. The Occupation Arrow, by Richard Sharf and Mark Laubach. Copyright © 1978 by the University of Delaware PLATO Project.

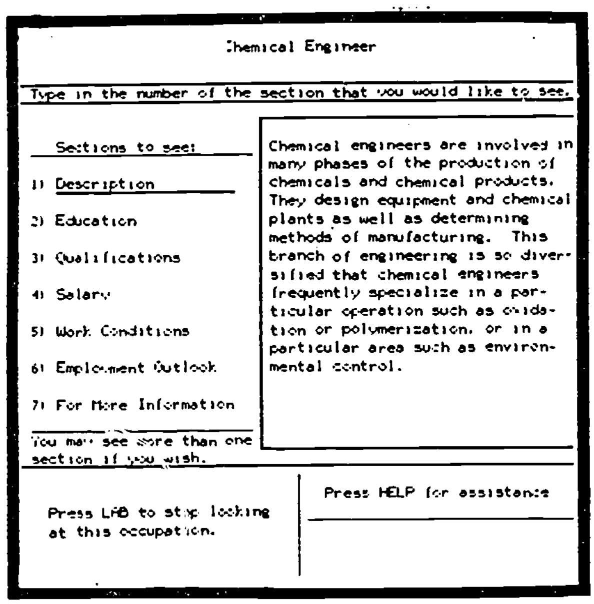


Figure 39. Occupational Lookup, by Richard Sharf and Mark Laubach. Copyright © 1977 by the University of Delaware PLATO Project.

Economics

Economics students use lessons developed at the University of Illinois to enhance their understanding of the concepts of both micro- and macroeconomics. Students can change economic variables such as income, employment, and price level, and they can observe the effects of these changes on graphs displayed on the screen. Each lesson includes a final quiz to measure student mastery of the concepts presented.

Reading about how autonomous consumption, induced consumption, autonomous investment, induced investment, government spending and the tax rate affect the economy can be very confusing for the beginning student. PLATO presents these concepts in an individualized, self-paced format, making sure that the student understands them before moving on to more difficult material. Figure 40 shows how PLATO uses graphs to teach the ways in which individual firms can influence prices. Firms operating under monopoloy, oligopoly, and monopolistic competition are presented. PLATO asks questions which both insure that the student is reading the graphs correctly and also understanding the basic concepts associated with each graph. Figure 41 shows how a display can be dynamically created while the student is working through a lesson. To make sure that the student understands the interaction of the cost curves, PLATO asks the student questions as the curves are drawn. When the student answers correctly, more of the curves are drawn.

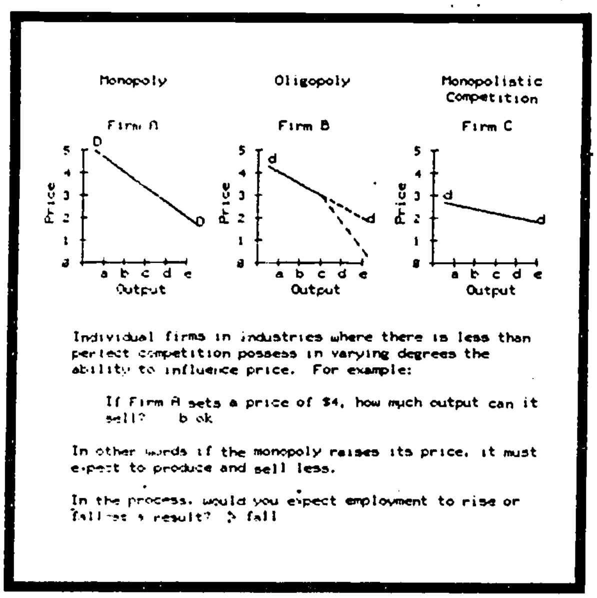


Figure 40. Imperfect Competition, by Donald W. Paden, James Wilson and Michael D. Barr. Copyright © 1975 by the Board of Trustees of the University of Illinois.

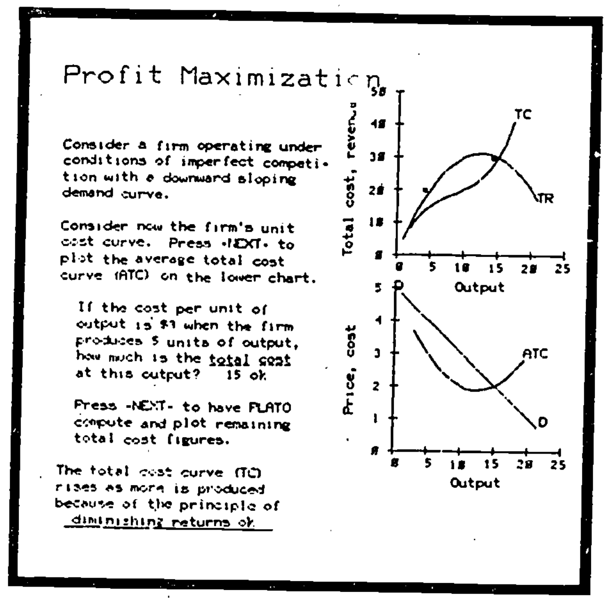


Figure 41. Imperfect Competition, by Donald W. Paden, James Wilson and Michael D. Barr. Copyright © 1975 by the Board of Trustees of the University of Illinois.

Education

A series of PLATO programs was developed by Dr. R. L. Venezky during the past year for studying different 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. Dr. Venezky is using this program to study the effects of peripheral vision in reading. A second program called "Field" maps the sensitivity of the human visual field by exposing dots of specified duration randomly 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 correspondences with a multiple-choice format.

A Text Study Package is currently under development by Dr. Victor Martuza that will allow researchers to study reading patterns exhibited by individuals who are confronted with various types of printed material under a variety of circumstances. With these lessons, the research subject is able to read through newspaper, magazine or text-like materials containing tables, graphs, or line drawings. As the system is being developed, detailed information on reading patterns will be stored by the computer and summarized in graphic form to facilitate analysis by the experimenter. Completion of this series of lessons will permit the study of reading patterns at a level of detail surpassed only by the use of sophisticated, delicate eye-tracking equipment.

The Multi-Dimensional Scaling Survey Package permits Dr. Martuza and other researchers to collect and edit data amenable to analysis by a state-of-the-art multidimensional scaling routine. The lessons present stimuli to the research subject, store the response data, and provide a number of visual displays which 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 B7700 system. Using this set of routines, research which 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 which 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.

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. The lessons follow a theme involving spies and secret passwords. The basic instructional lesson is called "SWAT" (Sight Word Attack Team).

Lesson "SWAT" teaches words in groups of four. Major activities in the lesson include:

1. Watching an animated "briefing" on the word -- an amusing illustrated story containing the password in each sentence. Figure 42 shows a story on the word "stop" in which a car has stopped too late and has crashed into a bicycle that gets away undamaged.

2. Selecting a password from among four foils to complete a "secret message." In Figure 43 the student is asked to touch the word "telephone."

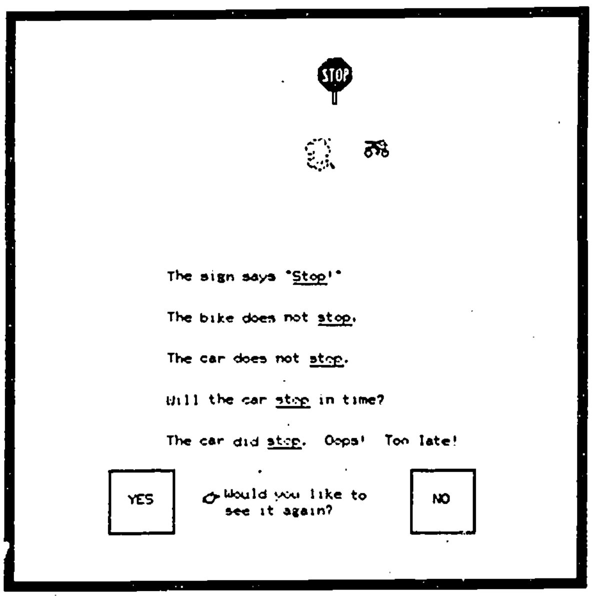


Figure 42. Animated Story from SWAT (Sight Word Attack Team), by Rosalie Bianco, Peter Pelosi, Jessica Weissman and Bonnie Anderson Seiler. Copyright © 1978 by the University of Delaware PLATO Project.

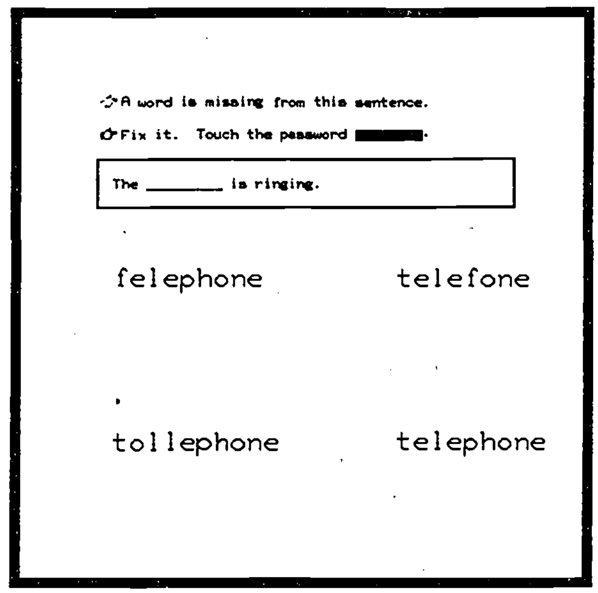


Figure 43. Touch the Password from SWAT (Sight Word Attack Team), by Rosalie Bianco, Peter Pelosi, Jessica Weissman and Bonnie Anderson Seiler. Copyright © 1978 by the University of Delaware PLATO Project.

3. Decoding a message through spelling the password by touching letters on the decoder machine. In Figure 44 the student is spelling the word "stop."

4. Finding the password in a scramble of words. Figure 45 shows how the screen looks after the student touches five occurrences of the word "stop."

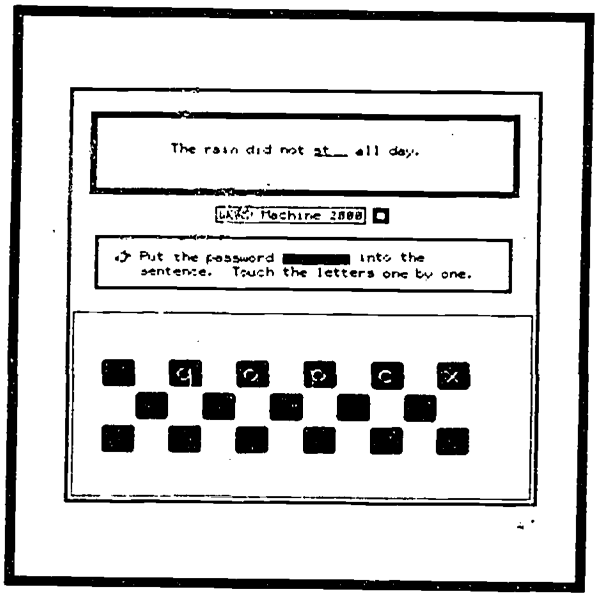


Figure 44. Spell the Password from SWAT (Sight Word Attack Team), by Rosalie Bianco, Peter Pelosi, Jessica Weissman and Bonnie Anderson Seiler. Copyright © 1978 by the University of Delaware PLATO Project.

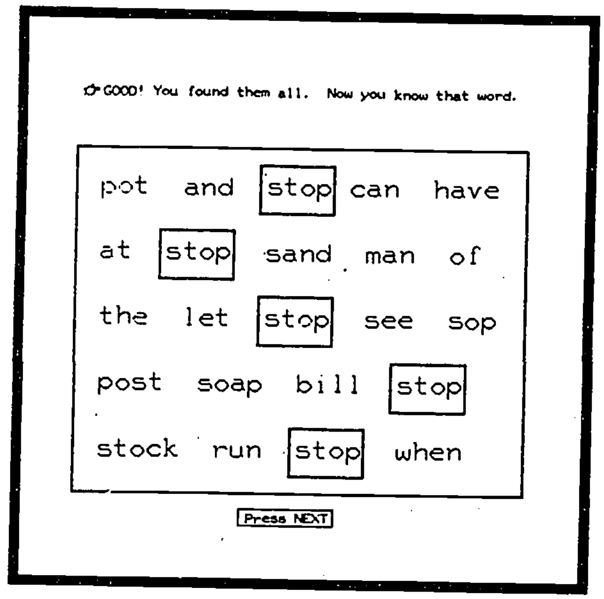


Figure 45. Finding the Passwords in SWAT (Sight Word Attack Team), by Rosalie Bianco, Peter Pelosi, Jessica Weissman and Bonnie Anderson Seiler. Copyright © 1978 by the University of Delaware PLATO Project.

5. Telling real spies from fake ones by deciding whether the sentence the spy is saying contains the password. In Figure 46 the student is being asked whether the spy is saying the password "bank."

The Reading Center has also developed instructional games in which the students practice distinguishing the 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 the screen when they are ready to listen. After the students have heard a message once, they are able to touch the messages in order to hear them again.

There are three advantages of learner-controlled audio over more conventional programming techniques. First, students are never surprised by messages which they are not ready to hear. Second, students can hear any message again if they need help. Third, since the messages are written on the screen, the students see them many times and become familiar with them. Eventually, the students learn how to read the messages by themselves.

The Hang-a-Spy lesson has been revised to allow a teacher to edit or to change the list of words used. This feature means that the teacher can individualize the lesson to meet the needs of the students.

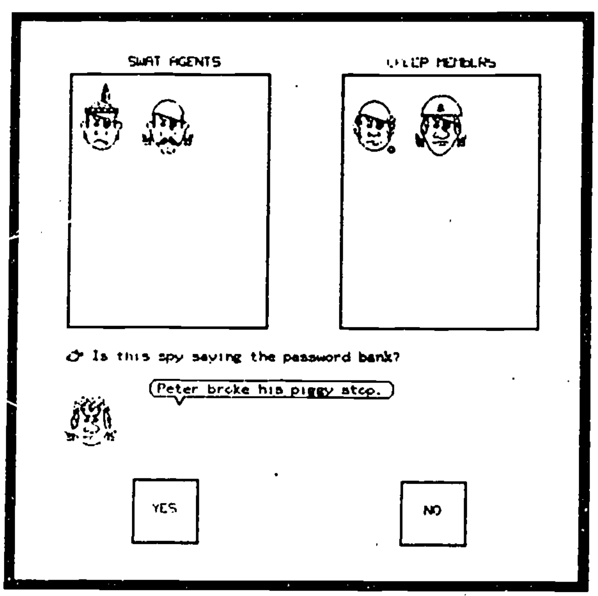


Figure 46. Identifying the Spy in SWAT (Sight Word Attack Team), by Rosalie Bianco, Peter Pelosi, Jessica Weissman and Bonnie Anderson Seiler. Copyright © 1978 by the University of Delaware PLATO Project.

English

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

During the 1978-79 academic year the Writing Center also coordinated the usage of PLATO lessons in English grammar and punctuation for students in the College of Education who had been recommended to the Writing Center as needing improvement in grammar, sentence structure, and punctuation. A curriculum of ten lessons, each geared to strengthen skills in one of five targeted weak areas, was set up for these students using the library of English lessons available on the Delaware PLATO system.

Figure 47 shows the introduction to an English grammar review developed by Professor Gerald Culley at the University of Delaware which was included in the curricula of both of the above groups.

The long-range goal of the Writing Center PLATO project is to complete a package of lessons designed to teach classroom English language skills. This package was begun during the 1978-79 academic year. After taking a diagnostic test of eight language features common to speakers of Black English vernacular (and also present in the speech of foreign students of English, especially those with a Hispanic background), the student will be routed to one of five lessons, each of which concentrates on

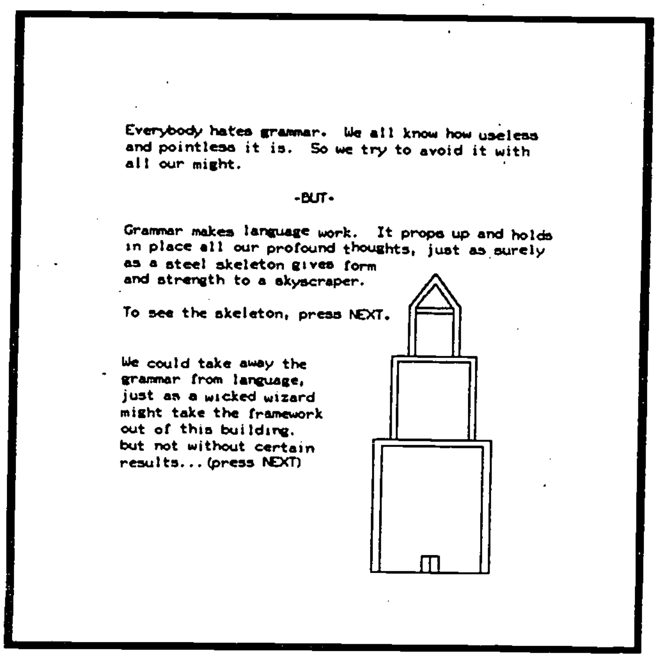


Figure 47. A Review of Grammar, by Dan Williams and Dr. Gerald R. Culley. Copyright © 1977 by the University of Delaware PLATO Project.

teaching part of the eight language features. At the time of this writing three of these lessons are completed and available for student use. It is projected that by the fall of 1980 the package will be complete and ready to be tested for effectiveness by groups of students.

Figure 48 shows an introductory screen display from a lesson which teaches third person singular indicative subject-verb agreement. This display introduces the key concept, common to all five lessons in the package, of the distinction between informal and classroom English, illustrating examples of acceptable settings for each.

Figure 49 shows a lesson which teaches students how to make classroom English negative sentences. In this lesson the students are asked to pick out sentences written with double negatives. The students are then told whether they have correctly spotted a double negative. The lesson's feedback then allows the students to change any incorrect response to a correct one, and when the students have successfully spotted all double negatives, the lesson changes the sentences that need changing to classroom English.

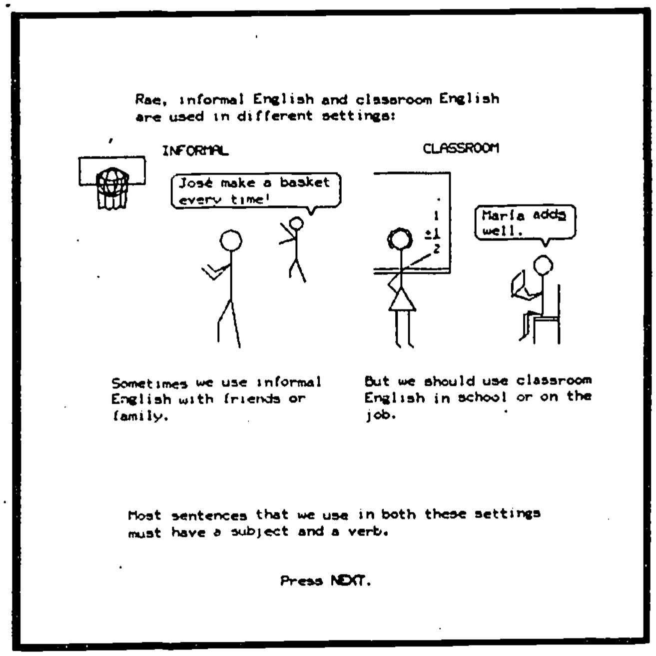


Figure 48. <u>Third Person Singular Verbs</u>, by Dr. Louis A. Arena, Phyllis N. Townsend, Jean Patchak Maia. Copyright © 1980 by the University of Delaware PLATO Project.

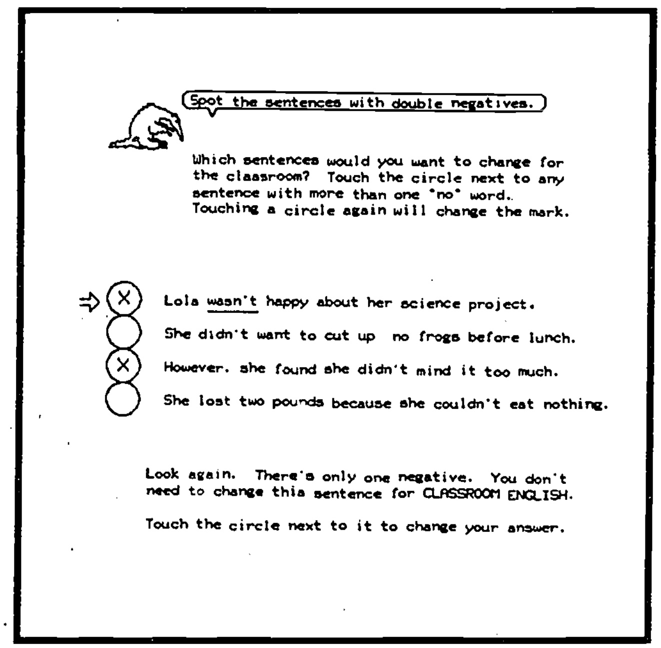


Figure 49. <u>The Power of Negative Thinking</u>, by Dr. Louis A. Arena, Sophie Homsey, Jessica Weissman, Rae D. Stabosz. Copyright © 1979 by the University of Delaware PLATO Project.

Health Education

The Health Education project officially started in November of 1979 by sponsoring a notesfile called "sexednotes" which is used to discuss any sexually-related questions. Specially trained sex-education peer educators read and respond to the notes regularly. Users of the file have the option of remaining anonymous when asking questions and responding to questions. Figure 50 shows an example of an index from the notesfile. The use of this file was so successful that in January of 1980 the Health Education project started a new file called "sosnotes" intended for discussions and questions relating to sexual offense concerns such as rape, harrassment, and sexual abuse. S.O.S. staff members are trained to respond to victims of sexual offenses and to people with concerns about the issues. S.O.S. staff members read and respond to notes in the file regularly. The anonymous option is also available in this notesfile.

Students enrolled in the University Studies 420 course, Foundations of Human Sexuality, are introduced to and encouraged to participate in both of these notefiles. The Health Education staff is presently compiling a questionnaire for the students to evaluate these files. The questionnaire will be administered on the PLATO terminals.

The Health Education project is also developing three lessons. The first one discusses basic information on contraceptive methods. Each topic includes information on how the method works, its effectiveness, advantages, disadvantages and reversibility. This will be a valuable resource for the Health Education project when it is completed. Another lesson lists current resources available that help deal

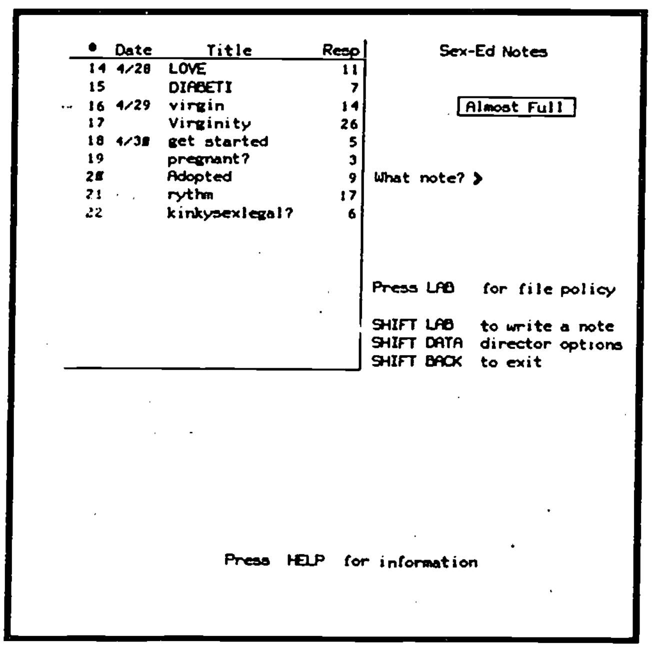


Figure 50. Sex Education Notes, by Anne Lomax and Sex Education peer educators. Copyright © 1980 University of Delaware PLATO Project.

with sexually-related problems. Figure 51 shows a list of topics that are listed in the Sex Education Resource Catalog. Agencies, organizations, clinics, private professionals, books and printed material are listed for each topic. The last lesson under development is a simulation directed toward improving communicative skills. This lesson will be used in the training sessions for the Sex Education peer educators.

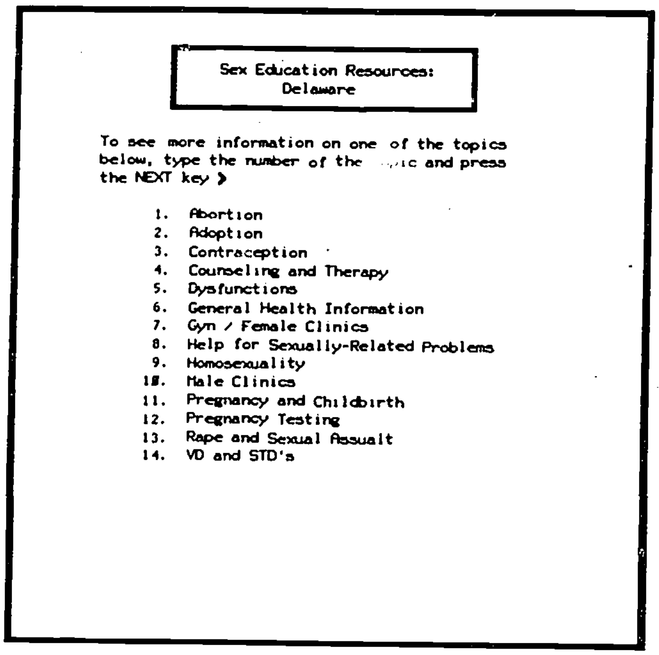


Figure 51. <u>Sex Education Resource Network</u>, by Anne Lomax, Mark Laubach and David Anderer. Copyright © 1980 University of Delaware PLATO Project.

Honors

PLATO 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 aspect of the program. Use among the students and staff took several forms. In addition to using PLATO in their classes, some of the students were interested in programming their own lessons. Fifteen Honors students became lesson authors. They learned to do drawings, compose music, and make animations. One of the students wrote a game called "Dive Bomber." The player is the commander of a ship which is being attacked by a dive bomber. The player is asked to give an estimate in meters of how far away the plane is. The object of the game is to shoot down the plane before it destroys the player's ship. Each time the player misses, he is told how far he overshot or undershot, and from that information he can calculate the proper distance for the next shot.

Several Honors faculty became PLATO authors and designed lessons to be used by their students. One lesson designed for class plots a vector field V = M(x,y)i + N(x,y)j. The student is asked to give functions M and N. Any valid expressions in x and y may be used. Figure 52 shows how PLATO plots the corresponding vector field. Another faculty lesson was written in a game format to teach polar coordinates. In this game the student must aim the cannon of a tank at a target and fire the proper distance to score a hit. The student aims the tank by giving the polar coordinates (r,Θ) of the target. If the target is hit, points are given to the student with the goal being to win 4000 points in 20 shots. Some targets are worth more than others, based on the difficulty of the coordinates and the size of the target. Figure 53 shows the result of hitting a target with coordinates (-36,252).

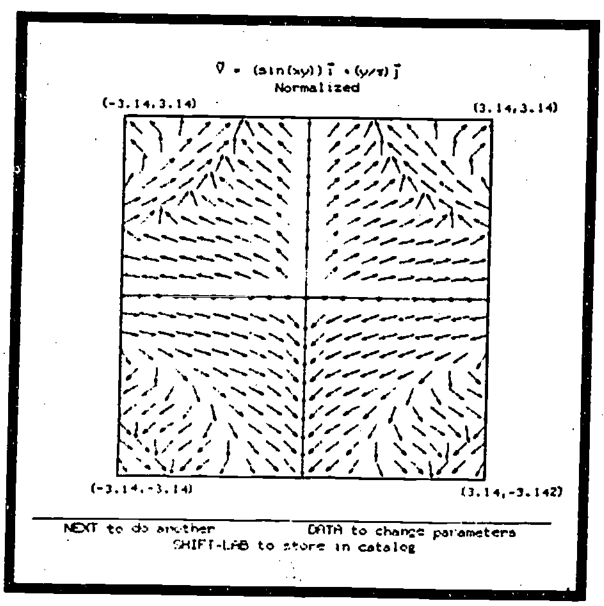


Figure 52. Vector Field Plotting, by Morris Brooks. Copyright © 1978 by the University of Delaware PLATO Project.

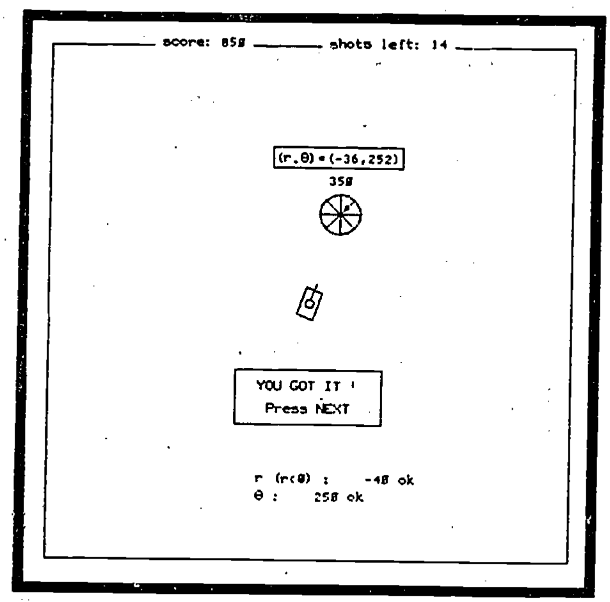


Figure 53. Polar Coordinate Game, by Alan Stickney. Copyright © 1978 by the University of Delaware PLATO Project.

During the 1978-79 academic year, Honors students began to receive academic credit for lessons which they researched, designed, and programmed using topics suggested by faculty members. Two examples are PLATO lessons in logic and differential equations.

Figure 54 shows a sample display from the logic lesson. The user types in the premises and conclusions in standard logical notation. PLATO then analyzes the logical argument, tests its validity, and responds with the judgment on the validity of the argument. This lesson also reviews basic concepts in symbolic logic.

Figure 55 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. The user is asked to supply a function of two variables f(t,x) and initial conditions. PLATO 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.

PLATO has also been used extensively in a Mathematics curriculum developed by Professors Brooks and Stickney. Partially funded by an Improvement of Instruction grant, this curriculum includes the basic properties of the integral, differentiation, sigma notation, numerical approximation, and root finding. Students are able to use PLATO to see their test scores, semester averages, and relative standing in the class.

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

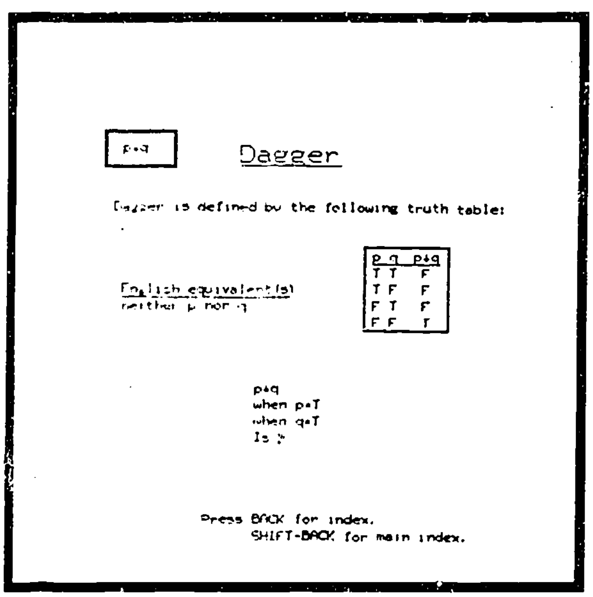


Figure 54. Logic, by Gerard C. Weatherby and Robert Scott. Copyright © 1978 by the University of Delaware PLATO Project.

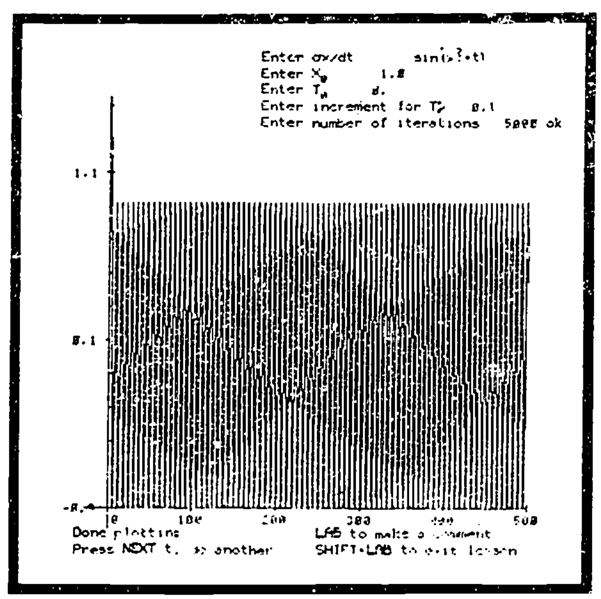


Figure 55. The Cauchy-Euler Method of Approximating Differential Equations, by Tanner Andrews and Stan Samsky. Copyright © 1979 by the University of Delaware PLATO Project.

various courses on PLATO, programmed lessons, and used PLATO as a resource for independent or remedial study.

To encourage this independent study, Professor Brooks has written a package of Basic Skills Calculus lessons which allow 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 trigometric functions are included. Figure 56 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. The problems are divided into groups of similar kind, for example, monomials, polynomials, and signed exponents. Figure 57 illustrates a test session on exponentials. Students are given two tries to correctly answer each question, and they are considered to have mastered a topic if they have attained a score of 80 or higher.

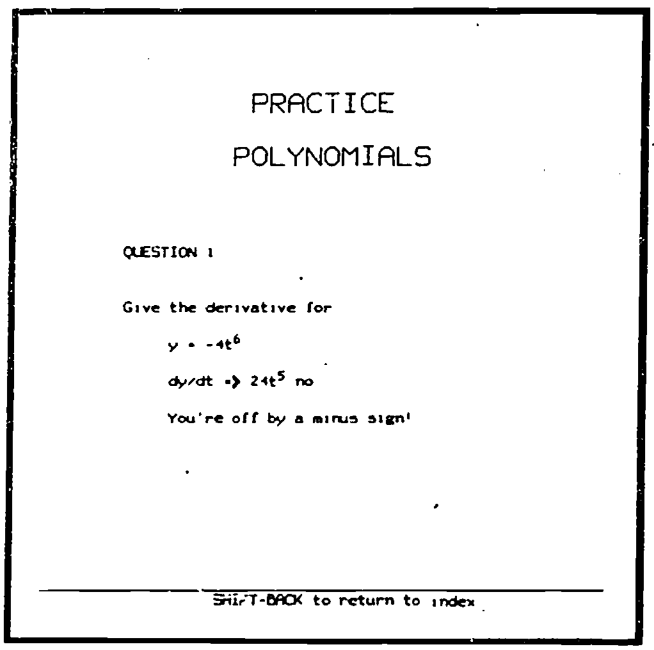


Figure 56. Calculus Basic Skills I, by Morris W. Brooks. Copyright © 1978 by the University of Delaware PLATO Project.

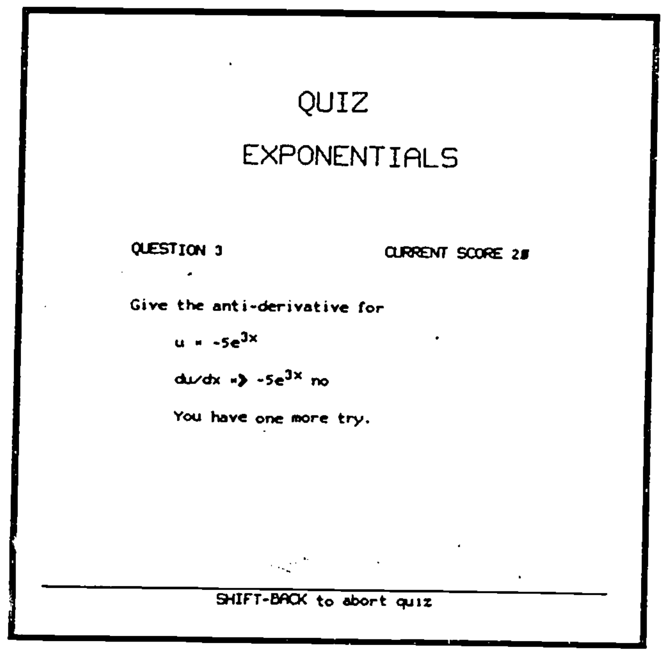


Figure 57. Calculus Basic Skills II, by Morris W. Brooks. Copyright © 1978 by the University of Delaware PLATO Project.

Human Resources

Faculty members in the areas of clothing construction, consumer economics, and consumer education have become interested in the teaching and research potential of the PLATO system. They are developing 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. A guide to available resources on consumer education is being developed on-line for use in the state. In the area of consumer economics, a series of fifteen lessons is under development dealing with the consumer in the marketplace.

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. In this lesson, the student is presented with a line drawing of a male or female figure with three sets of points, as shown in Figure 58. 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 fifteen 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 59. The student learns to make wise purchasing decisions to maximize satisfaction by using a consumption plan model.

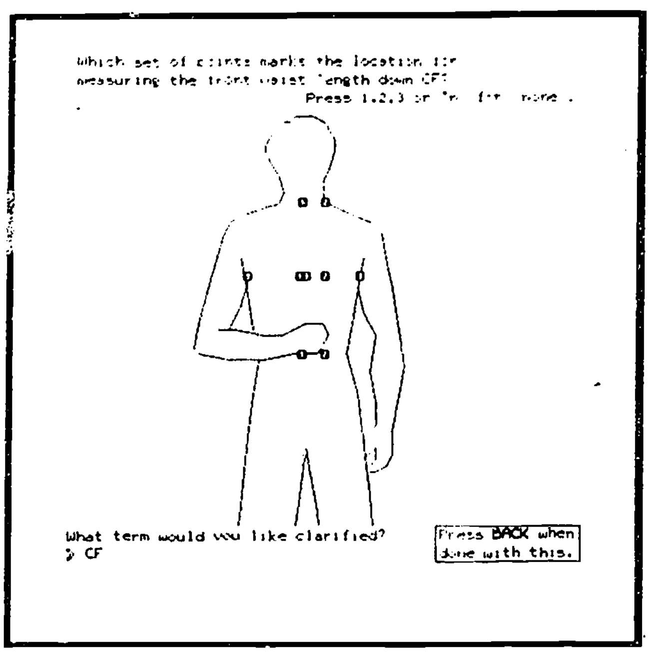


Figure 58. Body Measurement, by Dave Anderer, Kathy Bergey, Dorothy Elias, Frances W. Mayhew, Bonnie Seiler, Frances Smith. Copyright © 1977, 1978, 1979, 1980 by the University of Delaware PLATO Project.

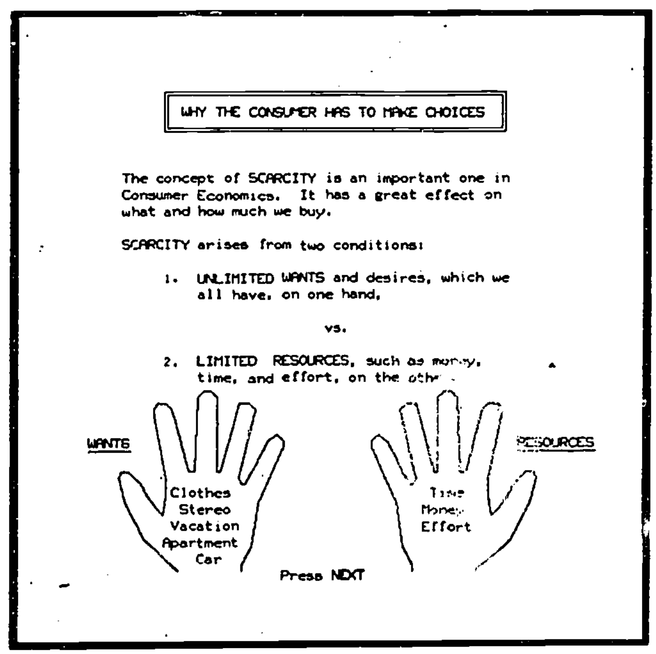


Figure 59. Consumer Education, by Kathy Bergey, James Morrison, Deborah Mellor. Copyright © 1980 by the University of Delaware PLATO Project.

Institutional Research

The University of Delaware's Office of Institutional Research and Financial Planning is using PLATO to produce line and bar graphs for its reports. This year it has produced over 100 different graphs, examples of which include enrollment projections, tuition comparisons with other schools, and budget information used in the University's request for state funds.

The advantages of the PLATO graphing package are its flexibility and ease of use. Data for graphs are entered into the PLATO computer via the terminal keyset with the assistance of a powerful editor. No previous computer experience is needed by the user. The information entered can be displayed and labeled in a variety of ways, and printed displays can be obtained using the PLATO Project's Tektronix screen copier. As a result, the time required to produce attractive, publication-quality illustrations for Institutional Research is reduced from many hours when hand-drawn to just a few minutes. Graphs can be stored and easily updated in subsequent years, a capability that greatly improves efficiency and permits easy analysis of historical trends.

It is planned to link the PLATO graphing package to other data bases in the University's administrative computer system. A way of combining the graphing package with programs that calculate statistical descriptions and permit statistical analyses of data is also being explored. An even more powerful tool for analysis will be developed when these plans are carried out.

Examples of the output from this project are seen in Figure 60 which shows the fall

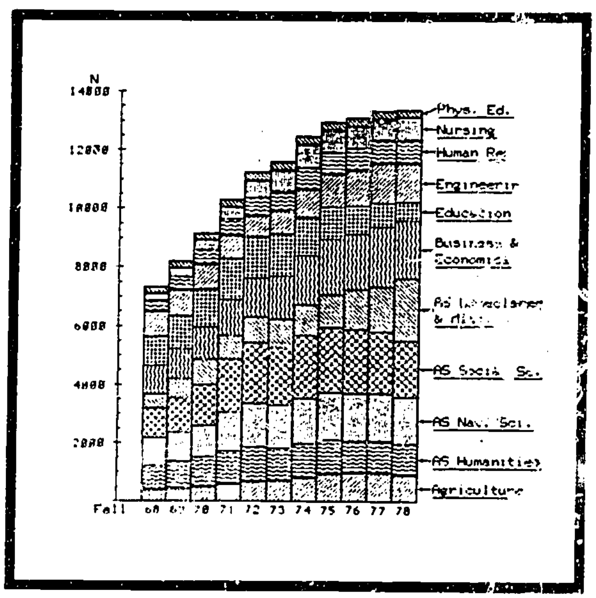


Figure 60. Institutional Research Graphics Program, by Carol Pemberton, Brand Fortner and Aart Olsen. Copyright © 1979 by the University of Delaware PLATO Project.

undergraduate enrollment at the Newark campus by College and Division, and in Figure 61 which shows the fall undergraduate enrollment in the Physical Science Departments of the College of Arts and Science.

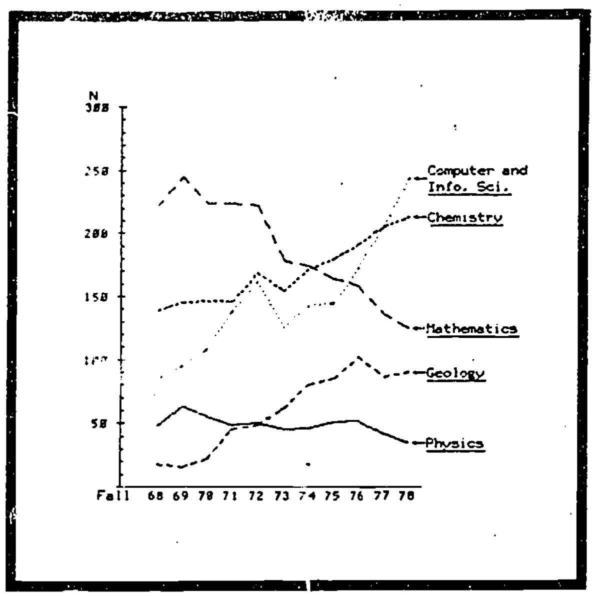


Figure 61. Institutional Research Graphics Program, by Carol Pemberton, Brand Fortner and Aart Olsen. Copyright © 1979 by the University of Delaware PLATO Project.

Languages

Languages faculty members have worked very hard to successfully improve instruction in Latin, Spanish, French, German, and ancient Greek.

One lesson of benefit in learning almost any foreign language is a substitution drill driver being developed by Dan Williams. Its outstanding feature is an editor that guides teachers through the steps of creating their own curricula of drills without having to learn programming or to provide a programmer. The teacher can insert drills in almost any alphabetic language.

Figure 62 shows a drill being written by a teacher of ancient Greek. The lesson has separated the teacher's sentence into a column of words so that the teacher can indicate what the student should do with the sentence. The teacher has underlined the third word, to show that the student will be asked to substitute a different word, and is now putting boxes around the words that the student should change grammatically as a result of the substitution.

The completed drill, as a student sees it, is shown in Figure 63. The model sentence is shown, with an underlined word and the word (in brackets) that the student should substitute. The student has typed the resulting sentence but has made three mistakes. The lesson shows that the first word ends with the wrong kind of letter "s," and that the second word has been given a smooth breathing mark instead of a rough one. The x's under the fifth word mean that it is also incorrect.

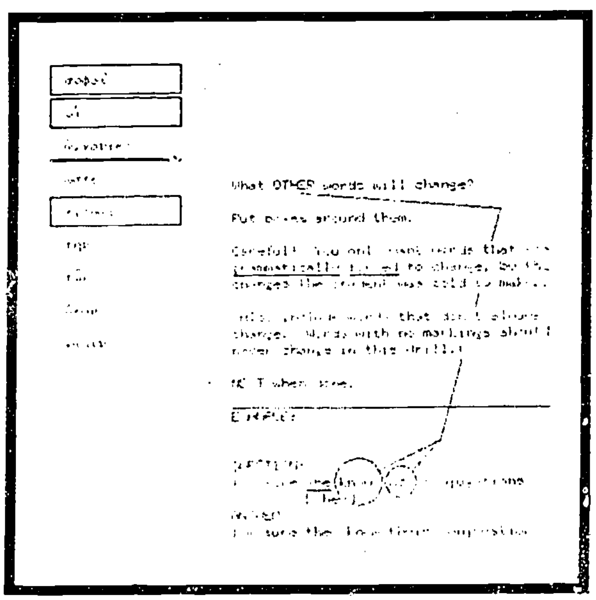


Figure 62. Substitution Drill Editor, by Dan Williams. Copyright © 1977, 1978 by the University of Delaware PLATO Project.

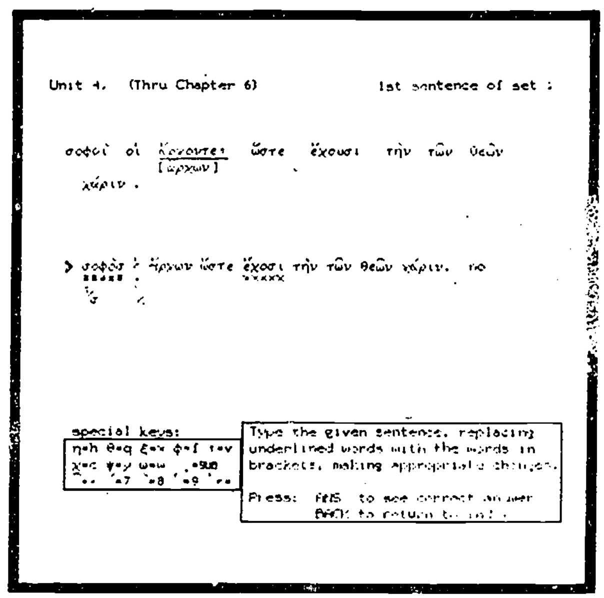


Figure 63. Substitution Drill, by Dan Williams. Copyright © 1977, 1978 by the University of Delaware PLATO Project.

Professor Culley has nearly completed a five-lesson Latin curriculum which uses routines to inflect the variable parts of speech. This technique permits PLATO lessons to be very flexible in their responses to student errors because they "understand" the structure of Latin forms. Figure 64 shows a display from "The Verb Factory;" here the student has tried to write the Latin translation of the phrase "you (singular) are well." The typed form "valetis" has been 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 called "Cursus Honorum" which builds skill in producing and parsing verb forms. The content and skill level are set by the student, a feature which permits continued use of the lesson throughout the year. Both of these lessons have been published.

A third lesson called "Mare Nostrum" applies features analogous to those in the verb lessons to noun-adjective phrases, and a fourth called "Translat" deals with sentence translation. For any word from the 180 sentences it contains, a 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 book, the student can concentrate on the translation process itself.

Figure 65 is from the fifth lesson, "Artifex Verborum," in which a student practices analyzing the words in Latin sentences. After correctly parsing the first six words in this sentence, the student has encountered "milites" and has identified it correctly as a "simple" noun, but then has touched boxes to mark it as masculine

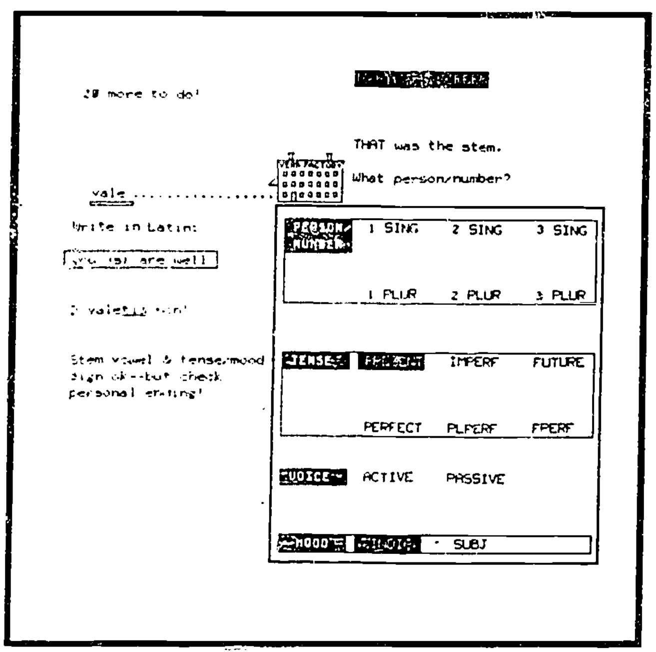


Figure 64. The Verb Factory, by Gerald R. Culley. Copyright © 1978 by the University of Delaware PLATO Project.

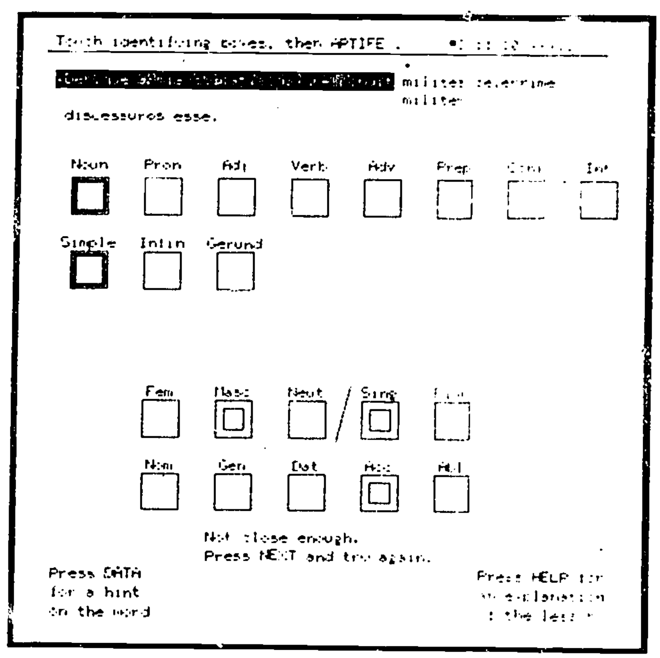


Figure 65. Artifex Verborum: An Exercise in Latin Sentence Analysis, by Gerald R. Culley. Copyright © 1979 by the University of Delaware PLATO Project.

singular accusative, which is incorrect. The lesson has illustrated the error by figuring out what the masculine singular accusative of the word really looks like, and displaying it below the form that the student is trying to analyze.

Touché, a word-order lesson developed by Professor George Mulford, uses the touch panel to help students learn word order in a foreign language. Figure 66 shows how this lesson presents the students 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 words in the right order. Figure 67 shows the sentence almost complete. 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.

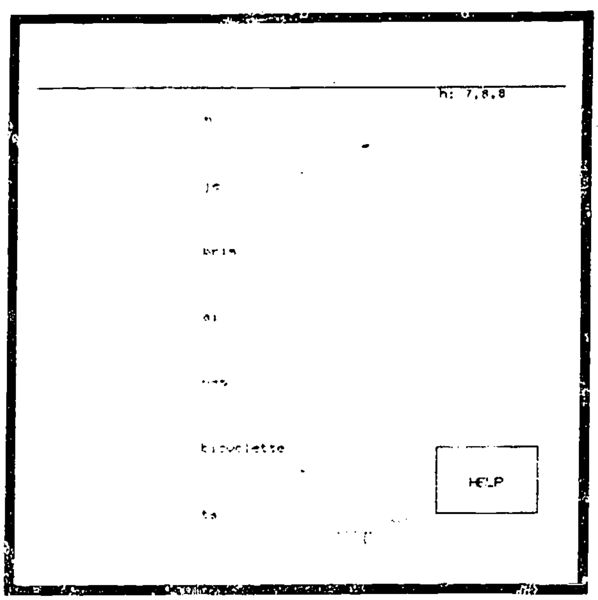


Figure 66. Touché: A French Word Order Touch Lesson, by George Mulford and Dan Williams. Copyright © 1978, 1979 by the University of Delaware PLATO Project.

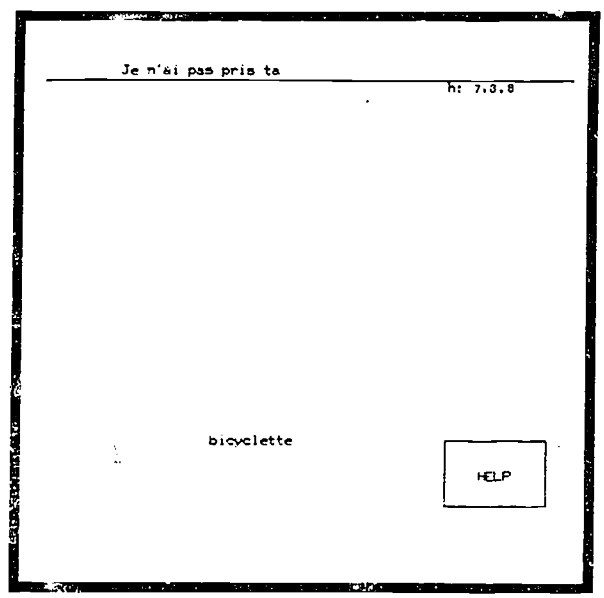


Figure 67. Touché: A French Word Order Touch Lesson, by George Mulford and Dan Williams. Copyright © 1978, 1979 by the University of Delaware PLATO Project.

Mathematics

The Department of Mathematical Sciences has developed a multiple choice drill lesson which utilizes several approaches to present a variety of problems to students enrolled in the University's new pre-calculus course, Math 115. For this one-semester pass/fail course, students attend two lectures each week presented by senior faculty and two problem workshops supervised by senior mathematics students. During the 1979-80 academic year, an experiment was conducted in which some workshop sections spent a significant portion of their time working problems presented by the PLATO system. Problems were taken from previously administered exams and were available in the following three formats:

1. Specific Problem Mode -- students could request to work through a specific problem contained in a Sample Exam Test Booklet for sale in the University Bookstore. Solutions to the problem were available in steps.

2. Practice Problem Mode -- students could choose sections from the Math 115 text and work through selected problems related to these sections. Solution steps were also immediately available in this mode.

3. Test Mode -- students could take a complete test under timed test conditions. Solution steps were not available until test completion.

In Figure 68, a student has chosen the problem to find cos(-pi). He has indicated choice "d," and his response 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 depicted in Figure 69. The student has stepped through all of the steps of the

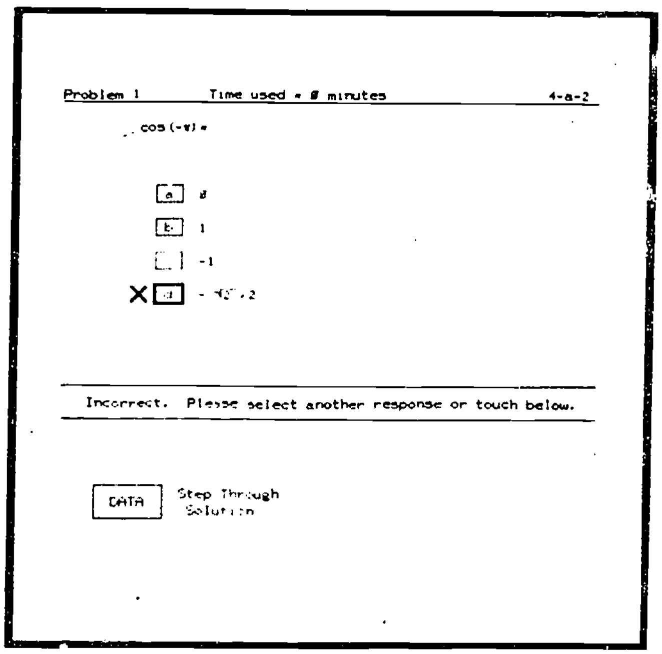


Figure 68. Pre-Calculus Diagnostic Test, by Ron Wenger and Keith Slaughter. Copyright © 1978, 1979 by the University of Delaware PLATO Project.

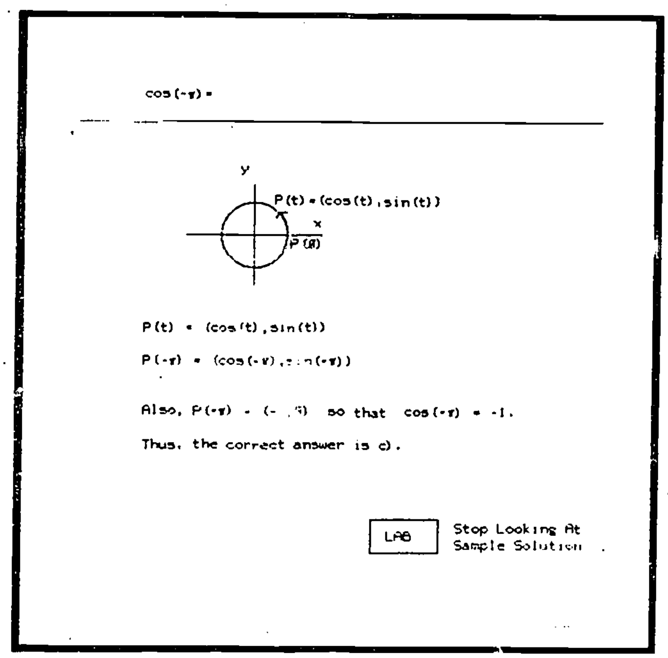


Figure 69. Pre-Calculus Diagnostic Test, by Ron Wenger and Keith Slaughter. Copyright © 1978, 1979 by the University of Delaware PLATO Project.

solution, the last of which gives the correct answer, "c." The student may return to the main problem display to change his answer at any time during the presentation of the solution steps, as is shown in Figure 70.

Initial findings indicate that although the mathematics background of the students in the sections using the problem driver was weaker than 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 use of the PLATO system were extremely positive.

Partly as a result of the success of this experiment, the establishment of the University of Delaware Center for Mathematics Teaching and Learning has been approved for the fall of 1980. The purpose of the 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 Center will utilize a variety of materials and strategies. Plans call for use of the PLATO system both to provide and to manage instruction.

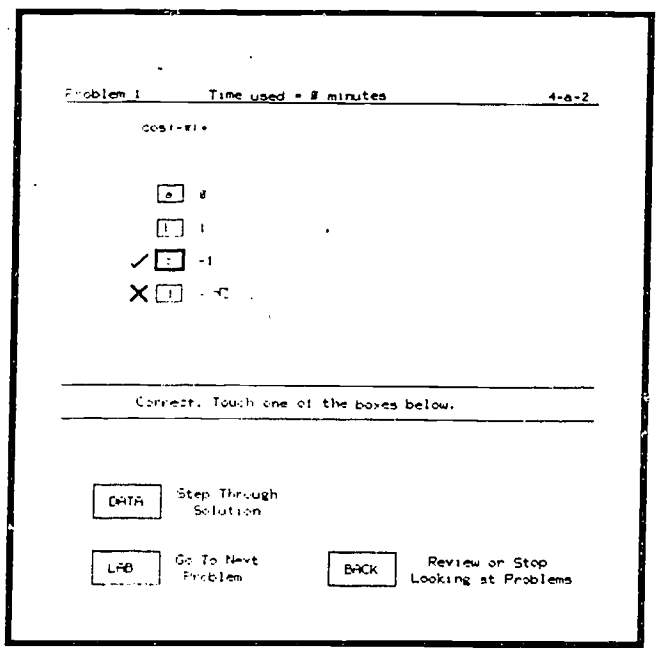


Figure 70. Pre-Calculus Diagnostic Test, by Ron Wenger and Keith Slaughter. Copyright © 1978, 1979 by the University of Delaware PLATO Project.

Military Science

The Military Science Department is using PLATO in senior level courses which stress empirical analysis of data bases. The students have a wide variety of entry level skills. Some are able to handle fairly sophisticated statistical problems; others have never had a statistics course before. PLATO helps the less experienced students bring themselves up to the class standard.

Students are using two types of PLATO lessons. First, tutorials are helping them learn how to do statistics, such as the example shown in Figure 71, where the learner is asked to find the standard error of the mean. Second, PLATO's computational packages are helping the students perform statisitcal analyses of their own data.

The Department is now developing a package to teach a particular problem-solving heuristic employing quantitative analysis. Known as "The Yellow Brick Road," it will enable students to work assigned military science problems or to solve their own problems. In Figure 72, the student is presented with data in order to determine whether it is cheaper to move an armored battalion by road or by rail. The program will connect to PLATO's existing instructional and computational statistical packages.

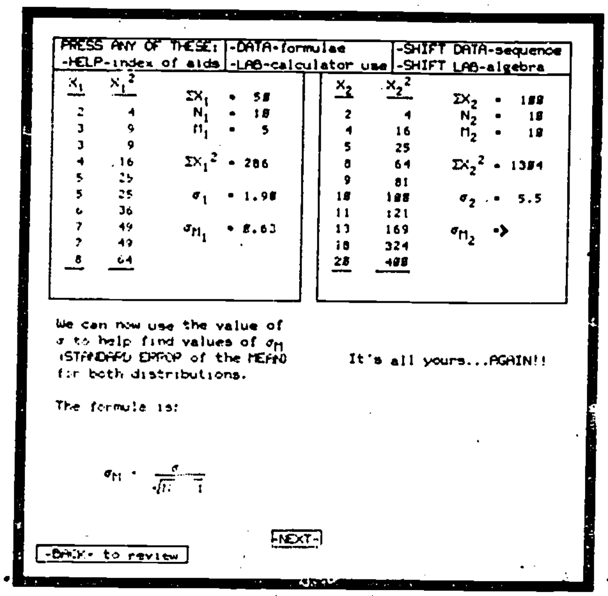


Figure 71. An Introduction to t-Test, by William H. Sanders. Copyright © 1974 by the Board of Trustees of the University of Illinois.

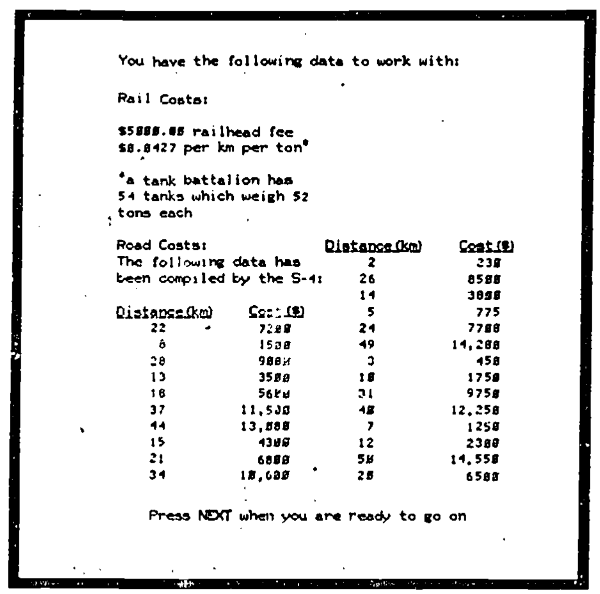


Figure 72. The Yellow Brick Road, by Lt. Col. George Bailey and Capt. Tom Reinhardt. Copyright © 1978 by the University of Delaware PLATO Project.

Music

The Music Department is developing PLATO materials which teach both aural and written skills. In the aural skills area, a package of ear-training programs called "GUIDO" has been developed, tested, and submitted for publication. Guido d' Arezzo is the eleventh century musician and music educator who invented the staff and established the principles of solmization. The ear-training programs are named after him, using his first name as an acronym for Graded Units for Interactive Dictation Operations. 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 GUIDO programs consists of a three-part process whereby PLATO 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. PLATO keeps track of how well the students are doing and issues weekly progress reports to the instructors.

Figure 73 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 rows of boxes which contain the names of musical intervals. When the student wants to hear an interval, all he has to do is touch one of the boxes. When he does, the box lights up and the interval designated by the box is played by the computer-controlled

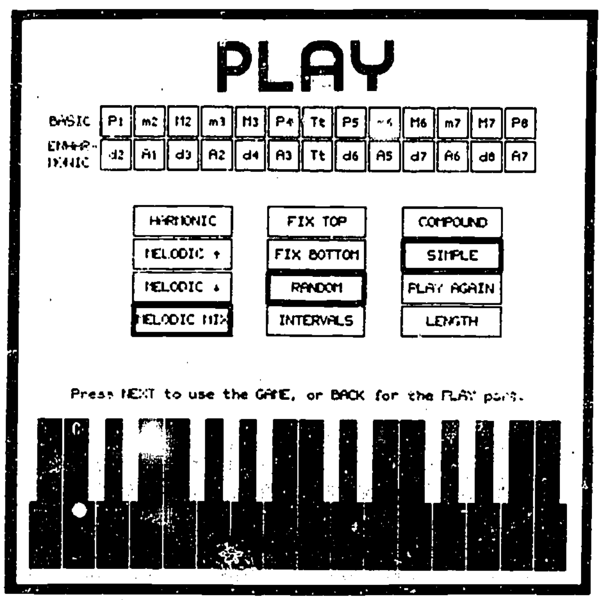


Figure 73. GUIDO Intervals Program, by Fred T. Hofstetter and William H. Lynch. Copyright © 1977 by the Delaware PLATO Project.

synthesizer. Conversely, when the student is going through one of GUIDO's formal units, the computer plays an interval, and the student responds by touching the box which contains the interval he thinks 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 note of the intervals, or to have them selected at random. The box marked "intervals" allows the student 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 the student 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 student is 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.

Under a grant from the University's Center for Teaching Effectiveness, the Music Theory Division designed a complete course in written theory based on PLATO learning management. So far, eleven programs have been written and readied for testing with students during the fall of 1980. Dealing with the fundamentals of music, these lessons cover the following topics:

1. Pitch Identification
2. Note Reading
3. Octave Designation Identification
4. Half Steps and Whole Steps
5. Beat Units and Divisions
6. Meter and Time Signatures
7. Intervals
8. Scales
9. Key Signatures
10. Triad Identification and Construction
11. Transposition

Each of these topics represents one module of instruction. For each module, a student has the choice of taking a mastery test, working on drill materials, or reading prescribed pages in a text book. All of the mastery tests and drills are delivered by PLATO lessons.

Figure 74 shows a display from the key signature drill. PLATO shows a key signature and asks the student to touch the tonic on the expanded staff. Figure 75 is from the drill on triad construction. PLATO has given the student the root of a chord and has asked the student to make an augmented chord by touching the right accidentals and notes on the expanded staff. PLATO gives feedback on incorrect responses, gradually helping the student discover the correct answer.

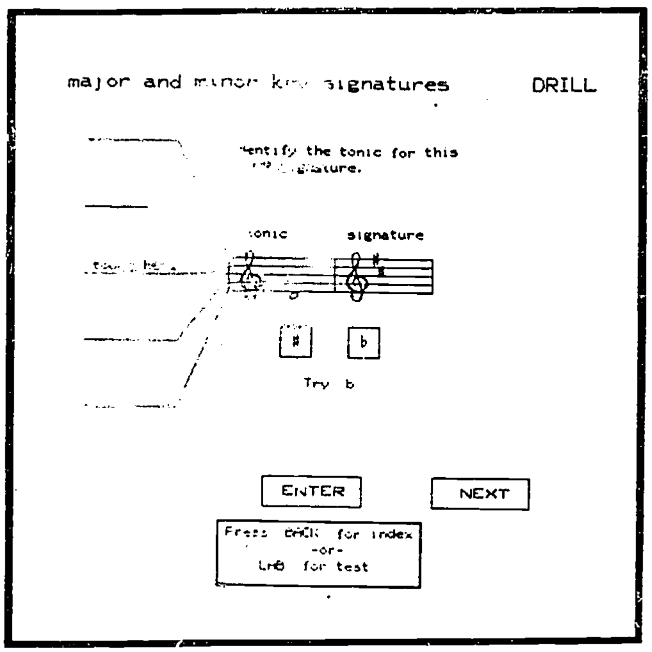


Figure 74. Key Signatures, by Michael Arenson and Patricia Bayalis. Copyright © 1979 by the University of Delaware PLATO Project.

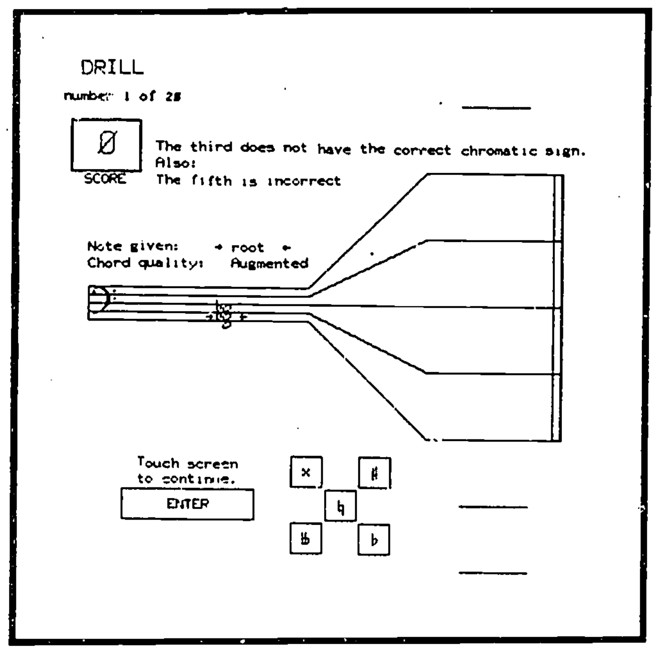


Figure 75. Triad: Identification and Construction, by Michael Arenson and Gary Feurer. Copyright © 1979 by the University of Delaware PLATO Project.

Nursing

The College of Nursing has developed client simulations for use in conjunction with 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 to simulate delivery of 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, which makes 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 depicted in Figure 76, a client has returned to his room from the operating room following an abdominal perineal resection. A student has been asked to identify the first in a series of steps which should be taken in response to the needs of the client. The student has chosen a step from a list of steps possible at that point in the care of the patient. The simulation has advised the student that another response would be more timely. In Figure 77, the student has identified an appropriate step and the simulation has indicated a reason for performing that step.

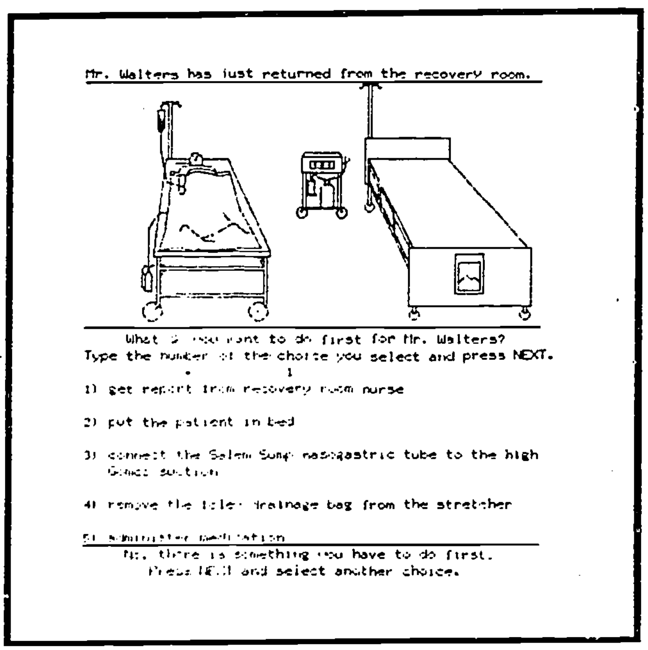


Figure 76. Abdominal Perineal Resection: A Patient Care Simulation, by Mary Anne Early and Monica Fortner. Copyright © 1979,1980 by the University of Delaware PLATO Project.

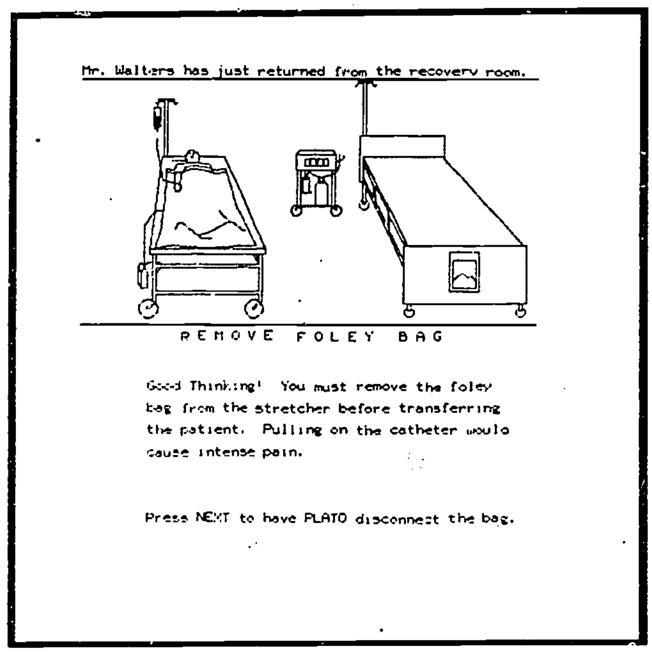


Figure 77. Abdominal Perineal Resection: A Patient Care Simulation, by Mary Anne Early and Monica Fortner. Copyright © 1979,1980 by the University of Delaware PLATO Project.

In Figure 78, a clinical situation is described in which a client is denying her illness. A student has responded with an appropriate intervention which will help the client avoid irresponsible use of her psychotropic medication. The student is later asked to identify other interventions which may also be appropriate to help the client overcome her denial of her illness.

Three client simulations have been implemented on the PLATO system to date. Three more have been designed by Nursing faculty and are awaiting implementation. A research study of the effectiveness of two of the simulations has been conducted and is currently being submitted for publication.

The Nursing College continues to use the PLATO system to allow registered nurses to challenge nursing courses for credit by examination. During the past academic year, thirteen registered nurses have completed multiple choice tests on the PLATO system to challenge the theoretical portions of the first and second courses in Adult Physical Health and Illness.

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

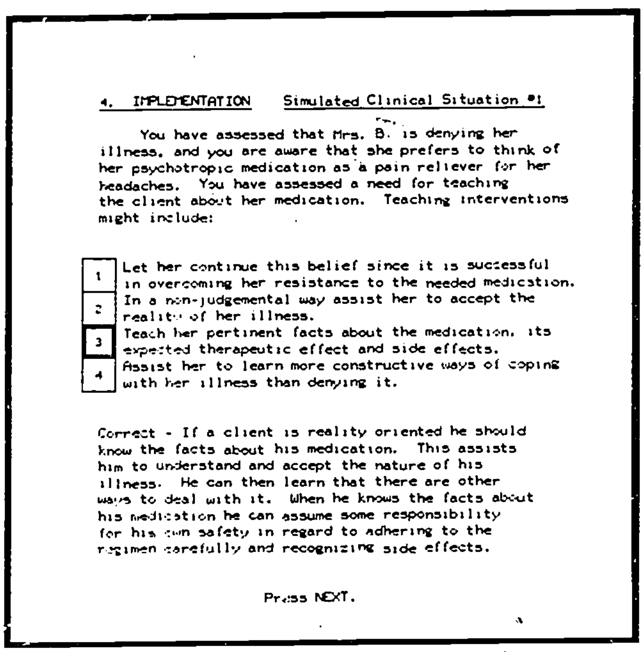


Figure 78. <u>The Use of the Nursing Process in Psychopharmacological Nursing</u>, by Sylvia Alderson, Elaine Boettcher, Kim Buckman and Monica Fortner. Copyright © 1979 University of Delaware PLATO Project.

Physical Education

During the 1979-80 academic year, the Division of Physical Education has expanded lesson development into several new areas, namely, health, physiology and anatomy, sport science, and sport skills.

In the health area, a calorie lesson is under development which compares calories and nutritional values of a student's daily diet to the recommended daily allotment (RDA) for a particular age group and sex. In the physiology area, the Physical Education project has just completed a lesson using microtutor. Called "Muscle Physiology," this lesson contains an intricate animation of how a muscle contracts anatomically and biochemically. This animation illustrates the sarcomere which is the smallest contractile element of a muscle fiber.

There has been extensive development in the area of sport science where the Film Motion Analysis lesson has been submitted for publication. Figure 79 shows how the coordinates of the nineteen segmental body endpoints are used to provide the student with a graphical representation of the body, location of center of gravity positions, and kinematic compounds of both linear and angular velocities. Another lesson uses a modified version of Film Motion Analysis. This modified version uses a peripheral device called a Bitpad to digitize the coordinates of the nineteen segmental endpoints. The student does not enter the values of the endpoints manually but uses the Bitpad to determine the values and enter the data. A series of drill-and-practice lessons in mathematics and basic trigonometry are also under development in the sport science area. These lessons are intended to give students the background necessary to solve application problems in biomechanics.

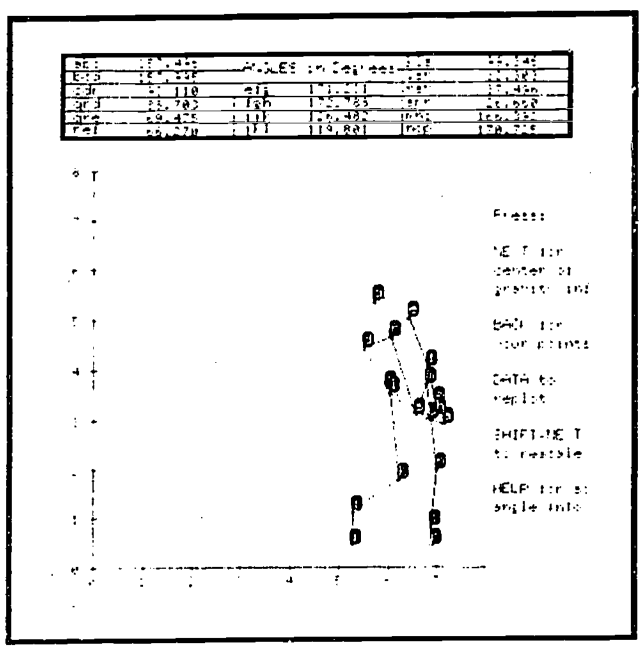


Figure 79. Film Motion Analysis, by Dr. David A. Barlow, Stuart Markham and James Richards. Copyright © 1979 by the University of Delaware PLATO Project.

Another developmental area is sport skills. The first lesson developed by the Physical Education PLATO project, Strategies for Volleyball, has been submitted for publication. There are two more lessons devoted to volleyball strategies which have been completed. There is also a series of lessons on doubles racquetball strategies. Figure 80 shows the student feedback given when a student positions a player incorrectly. A series of lessons on social dancing is also under development. A musical example is played on a music synthesizer and the student identifies the dance step that would be appropriate for that example.

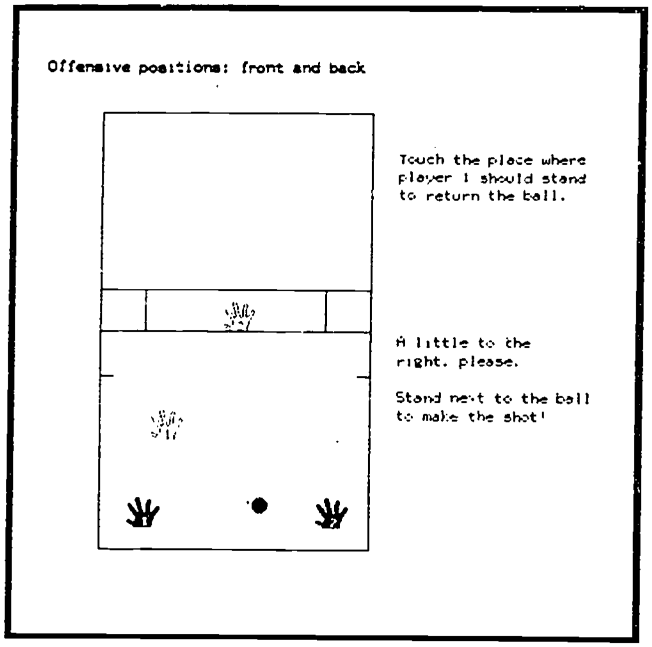


Figure 80. Basic Racquetball Strategies for Doubles Play, by Dr. James W. Kent and Patricia Bayalis. Copyright © 1980 by the University of Delaware PLATO Project.

Political Science

Dr. Richard Sylves of the Political Science Department has been awarded a Local Course Improvement grant by the National Science Foundation to develop four PLATO simulations. Three of these will be based on lessons currently in various stages of completion on the CERL system; the fourth will be developed by Dr. Sylves. All four simulations will allow students to make strategic decisions in the policy process while assuming the role of a key actor in the policy subsystem.

In Dr. Sylves' Environmental Policy simulation the students will assume the role of a state environmental construction grants administrator. As such they will approve or reject grant applications for the construction of municipal waste water treatment plants. Decisions will be based upon certain conditions of eligibility and constrained by state and federal funding limitations. In their administration of the program students will have to reconcile their efforts to allocate the available funds in terms of objective need with their efforts to respond to a political environment which provides critical agency resources. Partisan influence, committee pressures, legislator seniority, and accountability to the interests and person of the governor are all factors with which the students must contend, as well as various pressures from federal and municipal governments.

At the end of the simulated fiscal year the students will be able to observe how their cumulative grant decisions over the course of the "year" affected the state environmentally, economically, and politically.

Psychology

The Psychology Department uses PLATO both for instruction and for research. During the 1979-1980 academic year, several new instructional lessons have been written. "Mental Images" is a lesson which takes the student through a simulation of an experiment in iconic perception. A single letter is presented which is either backwards or frontwards and is rotated in one of six positions. The student's task is to decide as quickly as possible whether the letter is frontwards or backwards. Most trials are preceded by a hint which would tell either the angle of rotation of the upcoming letter, which of three letters the one to come will be, or a combination of the two bits of information. Students compare their responses with those of the original subjects. After the students have completed sixty trials, they are given a tutorial of Cooper and Sheppard's original research. Figure 81, found in the tutorial, illustrates the difference between subjective and objective images.

This experiment is used in a self-contained student laboratory in sensation and perception and is included in the curriculum as a requirement for the 450 psychology majors at the University of Delaware. The basic plan of instruction is to present the student with classic perceptual demonstrations followed by a review of known facts. These facts will provide information about the structure and function of perceptual systems demonstrated through the use of a simulation wherein parameters may be controlled by the student. This will be completed with a discussion of how the experiment can be applied to other areas of perception.

These ideas are now being used in a package of five lessons. "Direct Scaling," "Reaction Time," "Iconic Memory," and "Geometric Optical Illusions" are completed, and

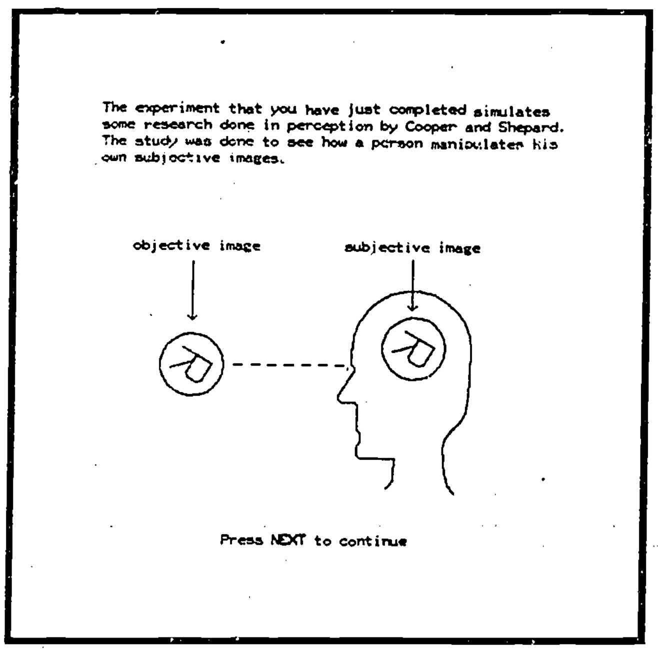


Figure 81. Mental Images, by John McLaughlin, Rae Stabosz and Clare Berrang. Copyright © 1979, 1980 by the University of Delaware PLATO Project.

"The Visual System" is still under construction. Various aspects of sensation and perception are included, from the classic perceptual illusions to the physiology of the eye. Figure 82 illustrates a cross modality matching experiment which develops the technique of magnitude estimation. This lesson requires the students to produce direct estimations of their psychological magnitudes. Figure 83 is one of the lesson's five geometric optical illusions. Two lines on a radial field are presented and it is the student's task to make them equal in length.

In psychological research, the PLATO system has played a crucial role in a two-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.

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." These results were presented at the Twentieth Annual Meeting of the Psychonomic Society and are available from Dr. Hoffman in a technical report entitled "A dual task analysis of controlled and automatic detection."

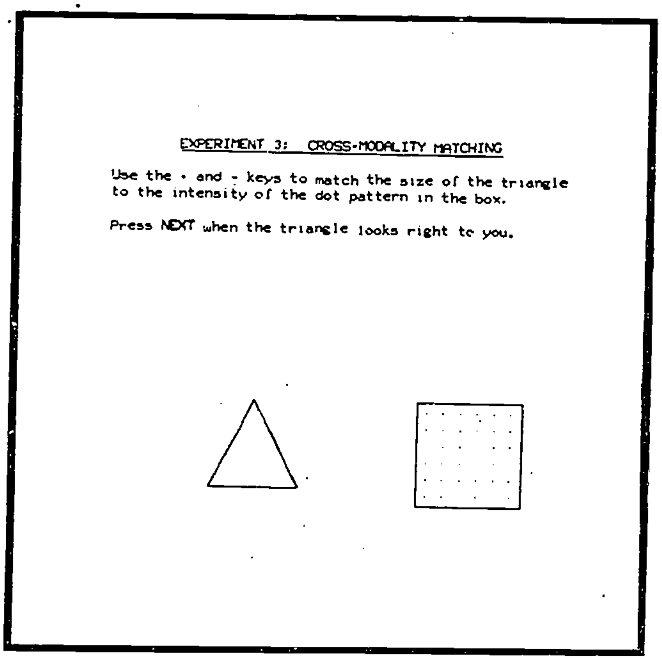


Figure 82. Direct Scaling, by Jessica Weissman and Dr. James Hoffman. Copyright © 1979 by the University of Delaware PLATO Project.

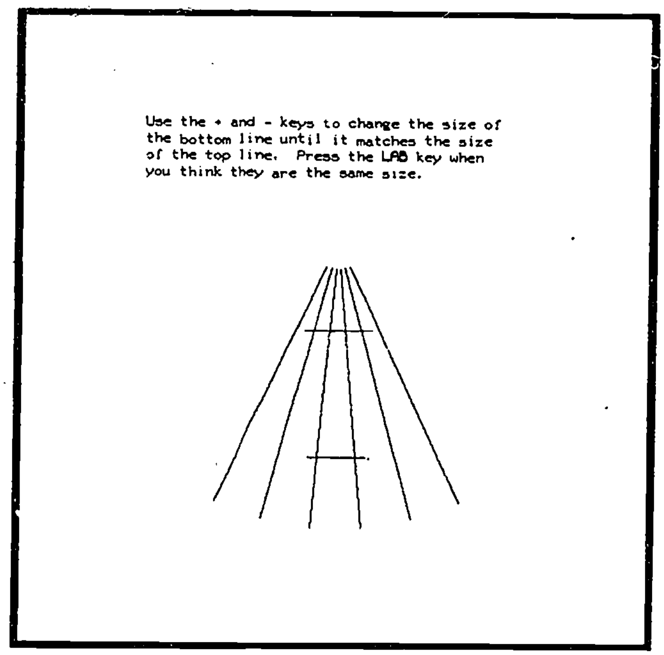


Figure 83. Geometrical Optical Illusions, by Dr. James Hoffman and Jessica Weissman. Copyright © 1979 by the University of Delaware PLATO Project.

Current plans call for extending the capabilities of the PLATO system into the area of psychophysiology. Electrical activity of the brain will be recorded from the scalp in response to computer-generated visual and auditory stimuli. These data will be digitized, stored, and analyzed on the PLATO system. The resulting "average evoked response" should reveal important clues concerning those brain structures involved in attention and learning.

Security

The Security Department is currently using PLATO to supplement its training program for new employees. It is now used exclusively by the Student Service Officers, but future plans include the use of PLATO in all aspects of training in the Department. All materials are developed by Security personnel. Through the use of PLATO's computer-managed instruction (CMI) package, PLATO determines the officers' problem areas and directs them to the appropriate sources for obtaining additional information on those subjects. In many cases the students are sent directly to an instructional lesson on PLATO for remediation; for other deficiencies they are told to study a particular code book or officer manual.

Figure 84 shows part of the lesson on proper completion of a notice of violation or ticket. The lesson presents the ticket block by block, showing the officers how to fill in the information required for each block. Upon completing the instructional portion of the lesson, the officers are evaluated on their abilities to complete an entire notice of violation for each of several simulated traffic violations.

Figure 85 illustrates part of a lesson intended to familiarize new officers with the Public Safety Code. The lesson introduces five safety codes at a time, and it immediately quizzes the officers following the display. Upon completion of the instructional portion of this lesson, the officers may opt for a final testing of all of the safety-codes, randomly chosen and timed by PLATO.

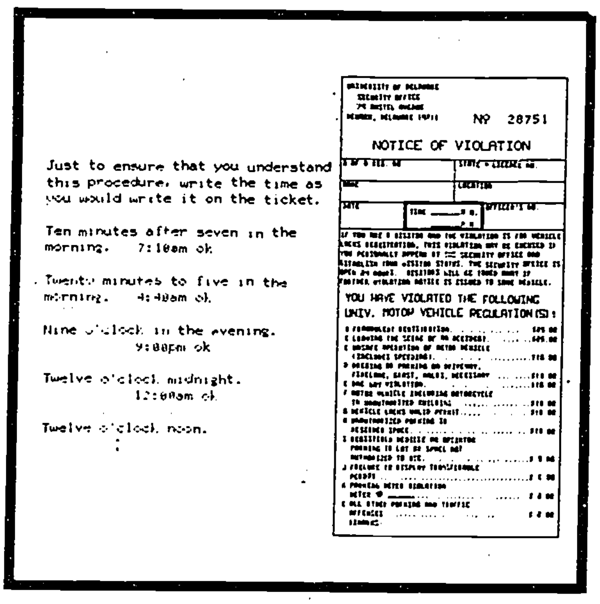


Figure 84. Ticketing, by Steven Swain and Raymond Schwartz. Copyright © 1978 by the University of Delaware PLATO Project.

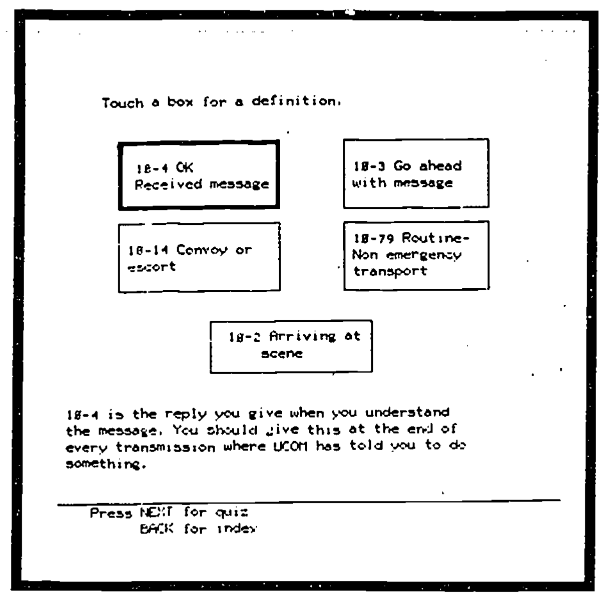


Figure 85. Tencode, by Steven Swain and Robert Krejci. Copyright © 1979 by the University of Delaware PLATO Project.

Sociology

During the Spring Semester of 1979 the Sociology Department began using PLATO as an educational aid in a course on population dynamics. This course used a group of lessons developed by the Population Dynamics Group at the University of Illinois. These lessons interact with a large data base of information on population growth, energy consumption, food supply, and many other sociological variables related to population dynamics, for different time periods and countries. In many of these lessons the student can change certain parameters and observe how these changes effect the population over time.

The two displays shown below are from a lesson on population projection. Figure 86 shows how a student can change a population variable and observe the results in bar graphs. Following the student's instructions, PLATO has shown on the left side of the display what the population of Belgium would be in 1990 if a dramatic increase in the fertility rate were to occur, whereas the projection of the population of Belgium given the present value of that parameter is shown on the right side of the display.

Figure 87 shows how the student can compare the projections for two different countries. In this case the student has asked to see the projections for the populations of Belgium and Afghanistan using current demographic parameters. As with the previous example, the student can change the demographic parameters and observe how these changes effect the populations.

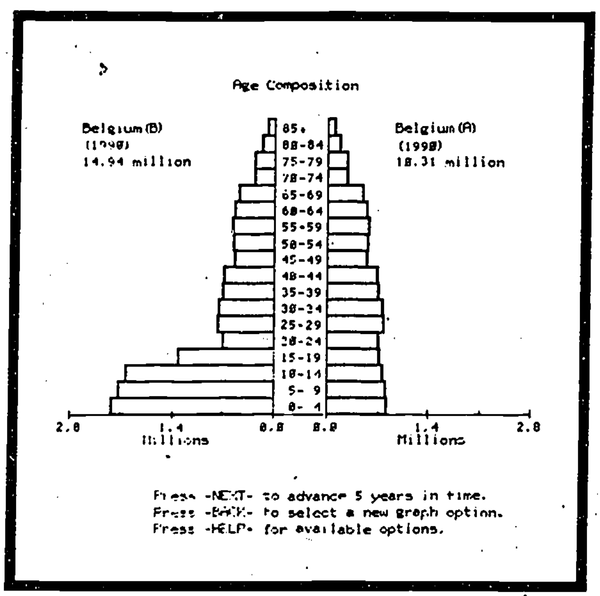


Figure 86. Population Projections, by the Populations Dynamics Group. Copyright © 1975 by the Board of Trustees of the University of Illinois.

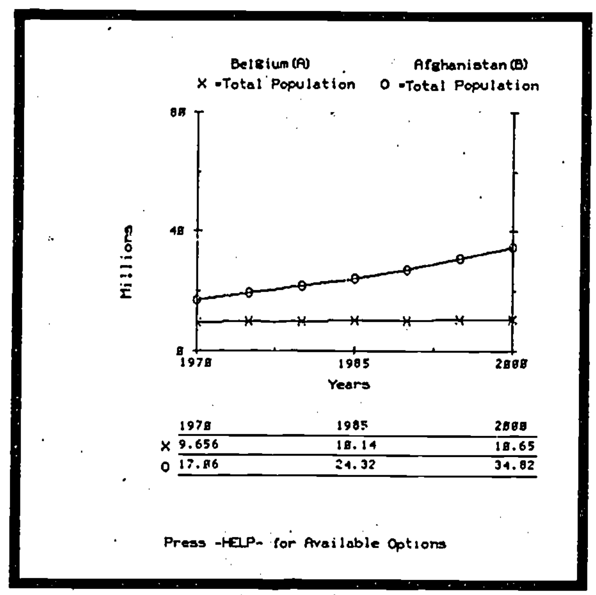


Figure 87. Population Projections, by the Populations Dynamics Group. Copyright © 1975 by the Board of Trustees of the University of Illinois.

Statistics

In recognition of the expanded use of statistical information in all scientific and many non-scientific disciplines, the PLATO Statistics project originated this past year to provide improved statistics instruction and statistical data services to users of the Delaware PLATO system.

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 also use statistical packages developed at the University of Illinois 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 may be obtained from the statistical packages for projects which involve small amounts of data.

Figure 88 shows one index from a Statistics lesson currently under development at Delaware. In this lesson, users enter data into a "worksheet" of rows and columns. In this format data can be conveniently indexed, cross-referenced, transformed, inspected, statistically tested and compared, and graphically displayed in various ways. Students will be able to sample from libraries of stored populations with typical and realistic characteristics and thereby learn how to perform meaningful analyses. The example shows how easy it is to generate random, normally-distributed variates without using computer command syntax.

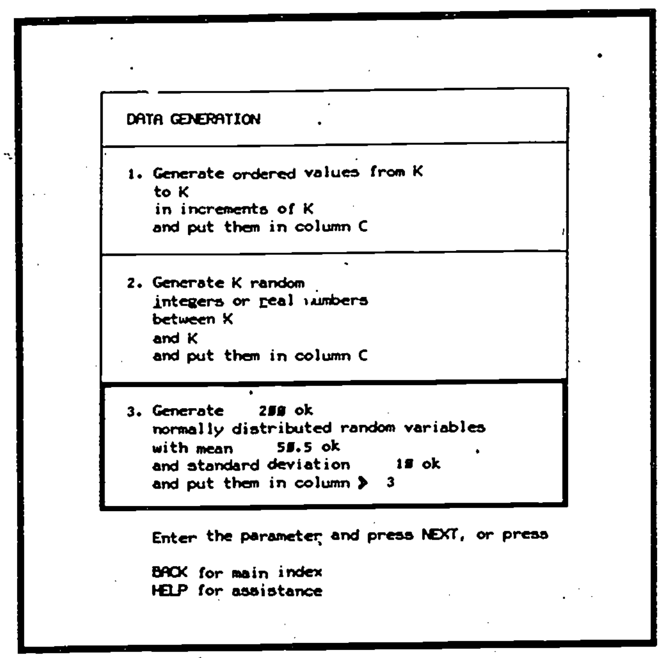


Figure 88. Statistics Worksheet, by Victor Martuza and Aart Olsen. Copyright © 1980 by the University of Delaware PLATO Project.

University of Delaware English Language Institute

The University of Delaware English Language Institute (UDELI) offers an extensive English program including thirty-two hours of instruction per week to 150 students 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 Figure 89 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. A group notesfile called "UDELI News" is used by students with the stipulation that all notes must be written in English.

PLATO is a great success in the Institute. The students who come from traditional educational backgrounds view PLATO as the type of technological methodology that they have come to the United States to experience. They further appreciate the opportunity PLATO offers them to learn at their own pace and in their own subjects. The Institute faculty perceives PLATO as a valuable tool which supplements their teaching and maintains student interest.

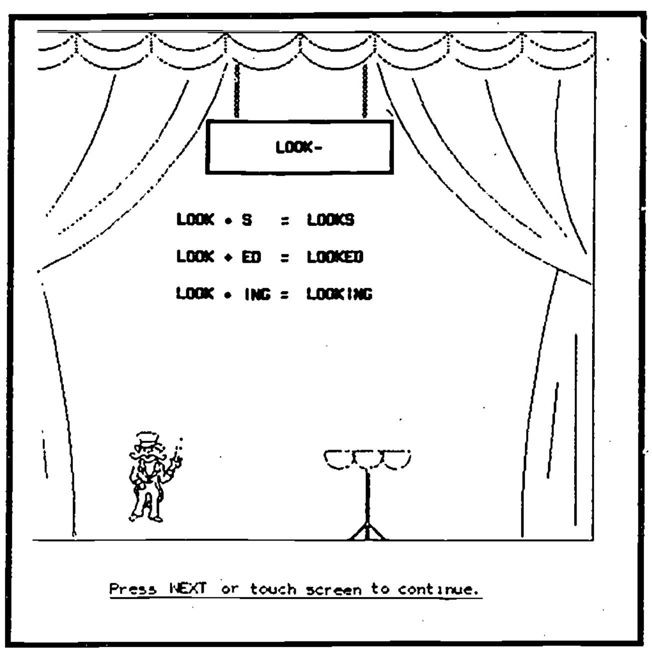


Figure 89. Simple Verb Endings, by Robert Caldwell and Research for Better Schools. Copyright © 1979 by CDC.

Utilities

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

A utility lesson which has proved very helpful both to faculty and to their students who are new to the PLATO system is one entitled "How to Use PLATO." This lesson offers an interactive introduction to many features of the PLATO system, including the special function keys on the terminal keyset and the terminal touch panel. 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 his students how to specify vowel and consonant markings in their responses, whereas a professor of Mathematics would want his students to learn how to type complex numerical expressions. Figure 90 shows a sample display from the lesson in which students are taught how to use the DATA and LAB special function keys.

Another utility which faculty members find useful is the "Questionnaire System," which allows easy entry of survey items in both multiple-choice or open-ended formats. Questionnaires constructed and administered on the PLATO system typically ask students to evaluate specific instructional lessons or, at the end of an academic term, the appropriateness and usefulness of incorporating PLATO lessons into the syllabus for a given course. Figure 91 shows a student responding to an open-ended question which asks what he liked about using the PLATO system.

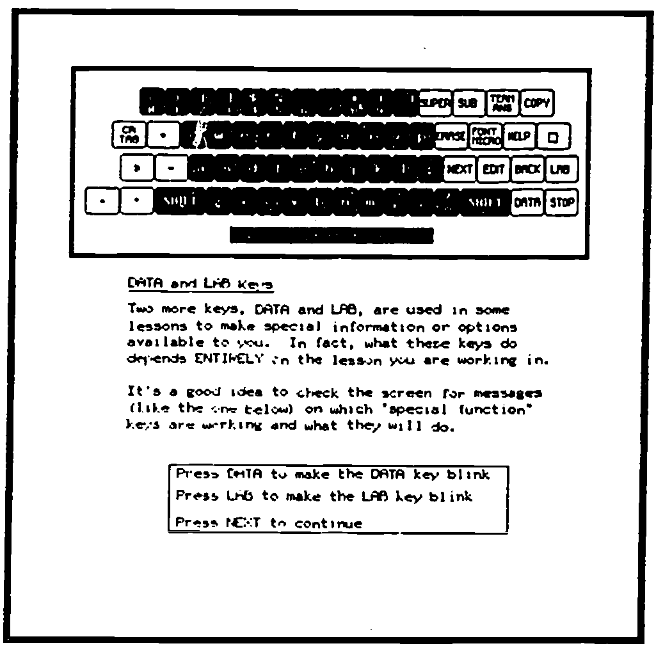


Figure 90. How to Use PLATO, by Jessica Weissman. Copyright © 1976, 1977, 1979 by the University of Delaware PLATO Project.

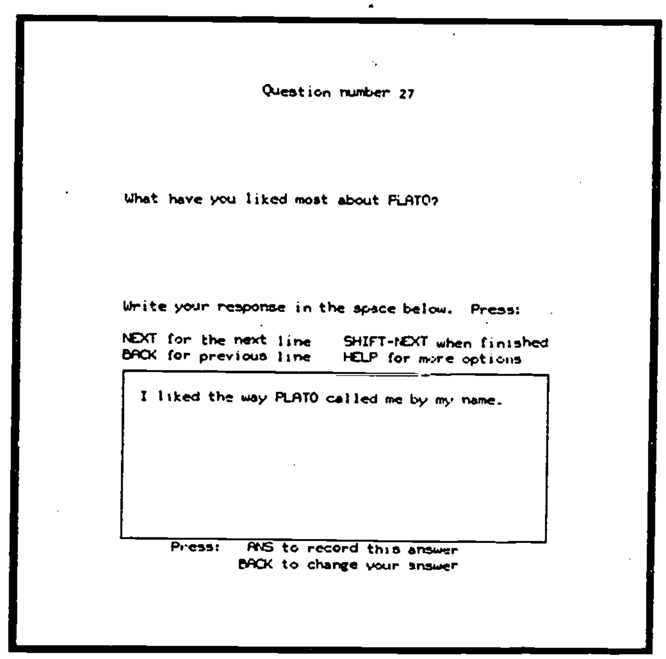


Figure 91. PLATO Users Question Survey Package, by Daniel Tripp and Bonnie Seiler. Copyright © 1978, 1979, 1980 by the University of Delaware PLATO Project.

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.

One set of utility lessons developed at the University is used extensively by students, faculty, and staff. Entitled "The UD Catalog System," these lessons allow PLATO users to create, maintain, and utilize lesson catalogs. Each catalog can be a simple index of lessons or may contain a major index with several sub-indices; multi-page descriptions of each lesson may be included. The catalog system provides 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 in the lessons chosen.

More than fifty catalogs grouping lessons by subject matter have been compiled on the Delaware PLATO system to aid users in locating lessons they would like to use. Figure 92 shows the first page of a catalog which consists of lessons developed at the University. The catalog has been divided into several sub-indices (called "categories") to make it easy to find lessons in a particular academic discipline. If a user chooses option "a," Accounting lessons, he will be taken to an appropriate sub-index display where he may choose to see a particular Accounting lesson.

The "Classroom Scheduler System" is a set of utility lessons used by PLATO staff to coordinate group and individual reservations to use terminals in the three major PLATO

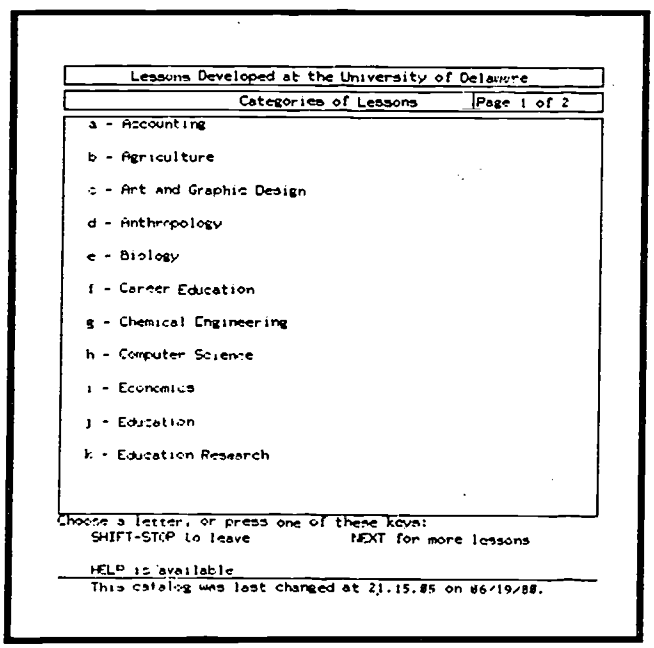


Figure 92. UD Lesson Catalog Package, by Dave Anderer and Bonnie Seiler. Copyright © 1978, 1979, 1980 by the University of Delaware PLATO Project.

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 set of utility lessons collects data on the numbers 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 93 shows a sample display of terminals used, memory used and memory allotted on one day. This set of lessons is being expanded to interface with the classroom scheduling lessons in order to facilitate comparisons of scheduled usage and actual usage.

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 which make it possible to locate any terminal in the University PLATO network.

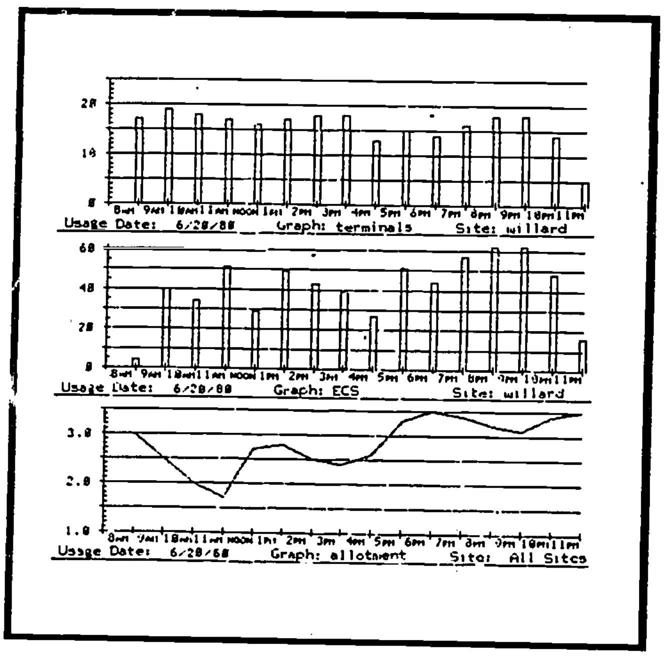


Figure 93. UD Usage Summary, by James Wilson. Copyright © 1978, 1979 by the University of Delaware PLATO Project.

CHAPTER III. OUTSIDE USER APPLICATIONS

In addition to supporting campus use, The University of Delaware PLATO Project offers a variety of PLATO 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:

- Subscriptions for computer services
- Program development
- PLATO workshops
- Consulting services
- Demonstrations
- Use of University classroom facilities
- Programming and design courses for junior and senior high school students

Detailed information about these services is contained in a brochure which can be obtained from our User Services Coordinator by calling (302) 738-8161. Information about what some of the University's outside users have been doing with PLATO is reported in this section as follows.

Pre-College PLATO Activities

Howard Careers Center

The Howard Careers Center's Title I Academic Skills Center under the direction of Ms. Vicki Gehrt has been using the PLATO system since July of 1978. In addition to the Basic Skills Learning System, the students are also using vocational lessons such as the group of lessons available in the package titled "How to Select and Get a Job." Figure 94 is a display from a lesson that teaches students how to properly fill out a

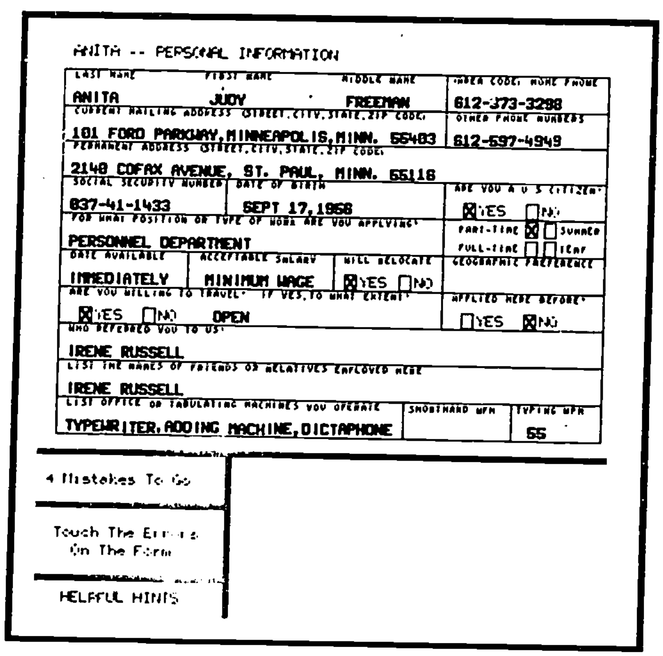


Figure 94. <u>How to Select and Get a Job</u>, by Jimmy Vetsch, Karen Newhams, Ken Burkhardt and others. Copyright © 1978 by the Control Data Corporation.

job application form. In this part of the lesson the student is asked to identify the mistakes on the job application form.

Because this program has been so successful, Ms. Gehrt will be placing another PLATO terminal at the Delcastle Vocational School in September of 1980.

Martin Luther King, Jr. Elementary School

PLATO was again used in the Academically Gifted Program at Martin Luther King, Jr., Elementary School this year. Parents sought private funding when district funds ran out at the end of February. There was a stipulation, however, that children other than gifted be given the opportunity to use the PLATO terminals. A "buddy system" went into operation, whereby the gifted student "hosted" a classmate on the terminal for half an hour. The host explained how to sign on and helped in the selection of lessons to try. Several children also learned how to program, and they designed their own PLATO lessons which were on display at an Open House for parents and friends.

New Castle County PLATO Project

On Monday, January 28, 1980, the Magnet PLATO Project became operational in the New Castle County School District. Funded under HEW's Emergency School Aid Act, twenty-five terminals are being used to deliver remedial instruction in Mathematics, Reading, and Language Arts. The major thrust of the program is to improve student achievement scores in the basic skills areas, thus enhancing the remedial learner's self concept and fostering more positive interracial relationships.

Approximately sixty students have been selected and scheduled into the program at each of the five PLATO Learning Centers located in Conrad Junior High School, Gauger Middle School, Gunning Bedford Junior High School, Ogletown Middle School and P. S. du Pont Junior High School. Each PLATO Learning Center has five terminals and a PLATO teacher. The New Castle County PLATO Project also includes an extensive evaluation component wherein the effects of the Basic Skills Learning System are being carefully measured. Figure 95 shows a sample display from a lesson in the Basic Skills Learning

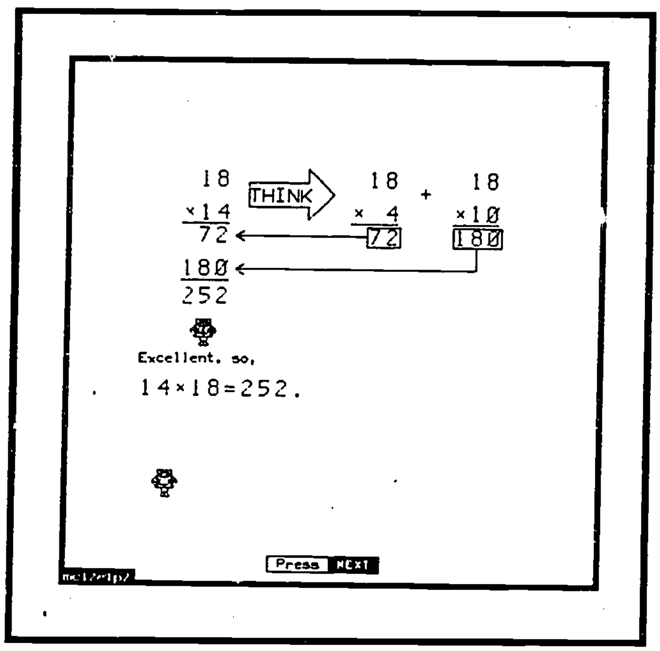


Figure 95. Basic Skills Learning System: Multiplication Skills, Part 7, Cluster 12, Tutorial by Ralph Heimer. Copyright © 1978, 1979 by the Control Data Education Company.

System Mathematics curriculum. Students are able to proceed through the material at their own pace. They receive positive feedback from Clever, a cartoon character who takes the role of the teacher in this curriculum.

As students learn, the PLATO system tracks their progress on a chart as shown in Figure 96. This progress profile is copied and sent home for the parents to discuss with the child.

Upward Bound

During the summer of 1979, the University's Upward Bound program made individualized instruction via PLATO a regular part of its concentrated on-campus program for academically promising urban high school students. Each student used PLATO in the Willard Hall classroom several times a week for English.

The objectives set for the PLATO program by Upward Bound's director, William Morris, included:

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

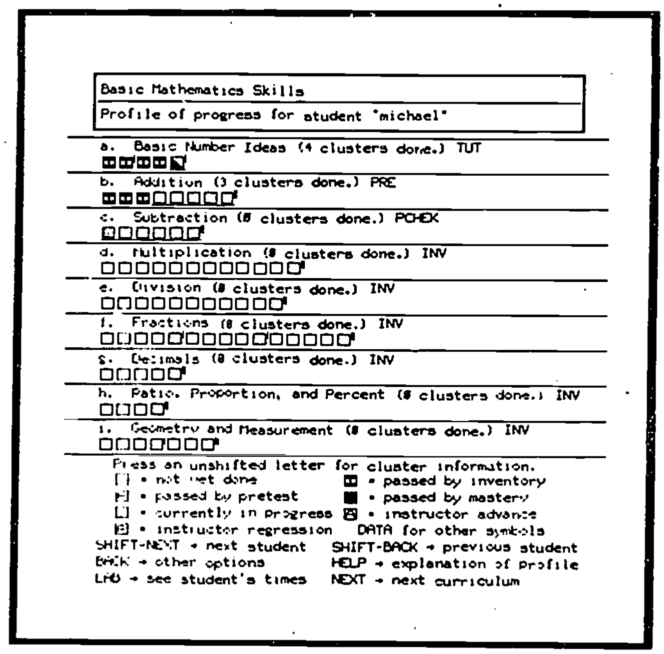


Figure 96. Basic Skills Learning System: Student Profile. Copyright © 1978, 1979 by the Control Data Education Company.

Students were individually assigned to lessons by instructors in their regular classes. English topics included grammar, punctuation, spelling, and composition. Figure 97 shows how a student is asked to group words beginning with "re" according to the meaning which "re" has in them.

The English instructors also used PLATO to add a new excitement to communicating; using PLATO's notes sending and receiving capabilities (notesfiles), students wrote notes on-line to their instructors and classmates. This increased students' motivational momentum and also gave them an opportunity to generate their own sentences and creatively test their newly acquired language knowledge in grammar, punctuation, and spelling. Observers of the program were especially impressed by the students' intense concentration while working with PLATO.

Junior High and High School Programming Project

For the past four summers the Delware PLATO Project has sponsored a five-week TUTOR programming course for high school students. Participants were chosen from Delaware high schools to come to the University twice a week for instruction and supervised programming practice. Many of these students had no prior computing experience or had experience only in BASIC.

During the five-week course each high school student planned and programmed a lesson in an area of personal interest. Lessons have covered such topics as algebraic

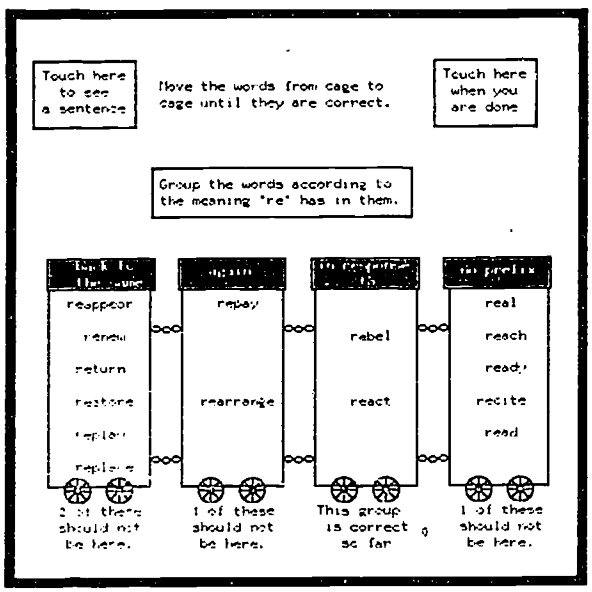


Figure 97. Word Zoo, by Steve Hansell and Jessica Weissman. Copyright © 1978 by the University of Delaware PLATO Project.

equations, units of measurement, and music. Several games have been written, as well as a test grade averager. One high school programmer is working with the Mathematics project in developing remedial math programs to be used by freshman University students.

Student Science Training Program

In January of 1980, the University of Delaware received a grant from the National Science Foundation's Student Science Training Program to have thirty-three gifted high school students come to the University to study Math and Science. For six weeks the students will concentrate on the applications of Mathematics to Physics, Chemistry, Genetics, Agriculture, Chemical Engineering, Psychology, Ecology, Physiology and Veterinary Medicine. The daily schedule consists of lectures by faculty members, PLATO labs where students interact with lessons using Mathematical models in the various sciences, and a programming seminar where students learn how to program Mathematical models on the Delaware PLATO system.

Class Demonstrations and Public Use

During the 1979-80 academic year, teachers of more than 1000 pre-college students arranged to have their groups visit the University campus in order to use PLATO. In addition to regular elementary and high school classes, there were groups of students from science clubs, special education groups, gifted student programs, and nursery schools. One teacher offered the prize of visiting PLATO to the class that turned in the most homework assignments.

Many more students used PLATO 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. A teacher from lower Delaware arranged a 200-mile round trip to bring his gifted and talented students up to the University to use PLATO one Saturday.

The Du Pont Experimental Station

The Du Pont Experimental Station has made the PLATO system an integral part of a newly developed 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. As of now there are seven PLATO terminals located at the Experimental Station which are connected to the Delaware PLATO system. The plans are to expand to sixteen by February of 1981.

PLM will assist Du Pont in keeping track of trainees as they progress through the program. The Experimental Station Tehnician Training Program is making use of the University's PLATO consulting services as PLATO lessons and PLM strategies are developed.

Federal Aviation Administration

The FAA Academy at Oklahoma City initiated a feasibility study of computer-based instruction in late 1974 with the installation of four terminals on the CERL PLATO system. Initial tests indicated that PLATO could provide cost-effective training to FAA employees. In 1978 the University of Delaware started to provide PLATO computing services to the FAA under a General Services Administration contract. At present there are nineteen terminals at Oklahoma City and six additional terminals at remote sites across the continental United States. The Academy supports a staff of five in its CBI Project and coordinates its activities with the rest of the instructor staff.

The first continuous use of PLATO in a resident course started in February 1976 with one lesson in a course called "Flight Inspection Procedures and Techniques." Since that time additional lessons were written and in 1978 the entire course was converted to use the PLM system and put on-line at seven FAA Flight Inspection Field Offices. The course has been in use ever since and is producing about ten graduates each month. Figure 98 is a display from "RNAV Flight Plan," a lesson which teaches the operation of the area navigation computer in FAA aircraft through simulation of the computer's display panel.

In 1979 a larger study was initiated in the FAA to determine the feasibility of large-scale use of CBI to improve the Agency's training capability. A course in Electrical Principles was converted to the PLM system and successfully implemented at the

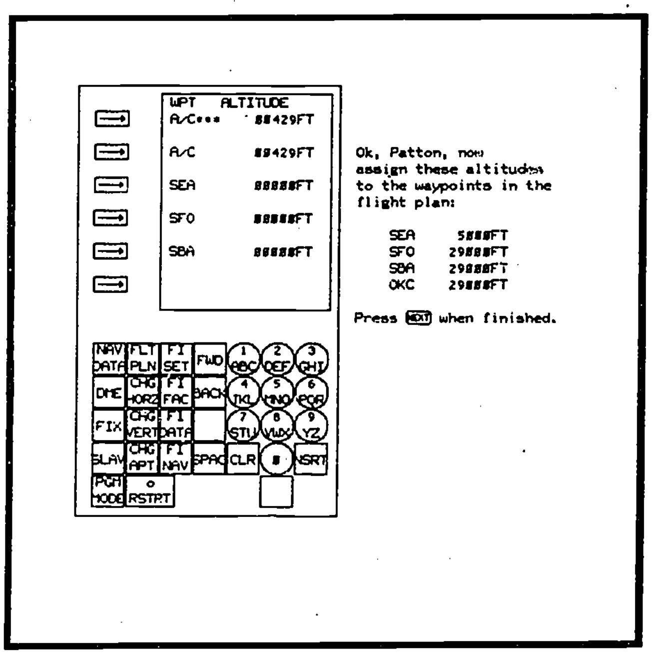


Figure 98. RNAU Flight Plan, by Craig Burson and Jim Dueg. Copyright © 1978 by the FAA Academy.

Academy; future plans call for remoting it to several FAA field facilities shortly. Figure 99 is taken from a lesson which describes the operation of flip-flops in FAA electronics equipment.

Approval has been obtained to continue curriculum development in several areas to further study the cost-effectiveness of CBI and to determine the requirements for an Agency CBI system. FAA courses to be converted to CBI include radar, communications equipment, and electronic technician qualification.

Delaware PLATO users may inspect the FAA's catalog of instructional lessons called "faacat."

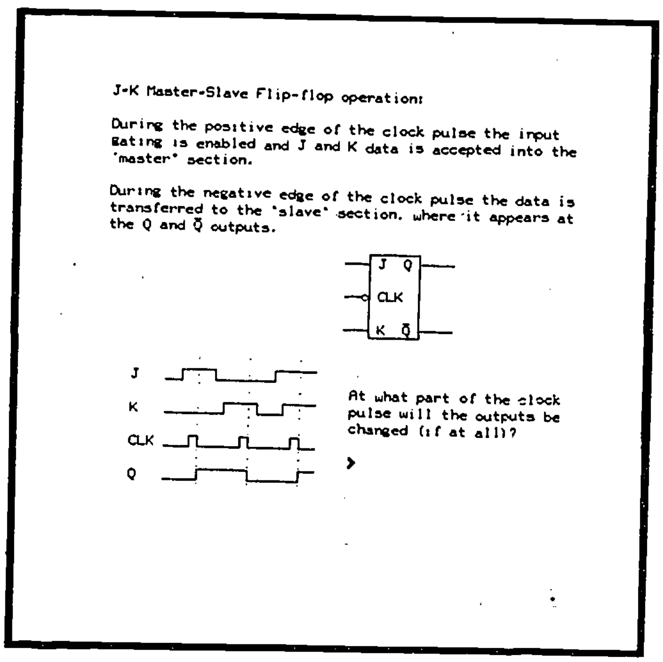


Figure 99. <u>Flip-Flops II</u>, by Craig Burson.
Copyright © 1979 by the FAA Academy.

The Urban Coalition of Metropolitan Wilmington

In January of 1980, the University of Delaware placed three PLATO terminals in three of the eight 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 looking forward to using the GED package that will be available to them this fall. The Urban Coalition is seeking funds from other sources to provide monies for additional terminals. They hope to have several PLATO terminals in all of their community centers.

In January of 1980, the University of Delaware PLATO Project and the Urban Coalition of Metropolitan Wilmington jointly established a PLATO training program to help unemployed and underemployed minority group members be placed in computer-related occupations. In February of 1980, a six week experimental training program began. The main goal was to find out if a program of this type could be successful with the provisions the University of Delaware PLATO Project and the Urban Coalition made, and if so, to seek funds for establishing an on-going training program.

The training program consisted of the following three components:

1. Orientation to the PLATO system,
2. Design and programming of PLATO lessons,
3. Terminal maintenance and electronics classes.

The students had their choice of either concentrating on design or programming their own lessons.

The classes met Monday through Friday from 9:00 am to 5:00 pm. They consisted of lecture/demonstrations, practice programming or equipment maintenance, and PLATO lessons that teach programming and basic digital electronics. Of the seven students involved in the program, four obtained jobs involving computers as a result of their training. Because of the success of the training program, the Urban Coalition with assistance from the University will seek funding to support a program of this kind on a larger scale. With the field of computer-based education rapidly expanding, the need for programmers, designers, assistants, maintenance engineers, and data entry clerks will grow. A program of this kind offers a wonderful opportunity for the unemployed and underemployed to obtain professional jobs in computer-related fields.

CHAPTER IV. RESEARCH AND EVALUATION

Because of its developmental nature, the Delaware PLATO Project 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 which are used in monitoring program development throughout the year. And a list of the principal values that PLATO has for the University is maintained. The manner in which these components interact is explained in the model for project evaluation.

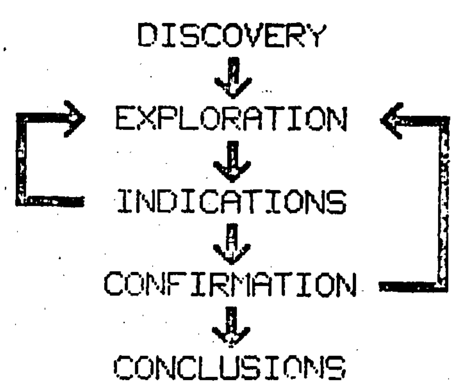
Model for Project Evaluation

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 PLATO at our University fits into one of these categories, both at the overall Project level and within each individual department. At the Project 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.

Each department goes through these stages individually when it begins a PLATO project. Discovery usually takes place at one of the periodic PLATO demonstrations or through a colleague who personally shows his work to a new person. Exploration consists of reviewing existing PLATO lessons, learning about the capabilities of the PLATO system, and reading literature about uses of PLATO. This phase is facilitated by the orientation seminar (above, p. 20), the lesson review process, (above, p. 23), and materials in the PLATO library (above, p. 19). Indications are discussed and codified in meetings with peers, PLATO 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 conrolled studies of educational effectiveness. A continuous cycle of exploration, indications, and confirmation occurs in most departments, as shown in Figure 100.

Figure 100.

Process of Inquiry in Departments Using PLATO



Student Questionnaires

A very important component in the evaluation of the Delaware PLATO Project is the opinion of the students. The instructor of every PLATO course is required to have the students complete a questionnaire. Figure 101 shows a standard questionnaire which 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 want 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 that they were glad that the computer never gets tired of helping them. The most frequent comment concerned the self-paced, individualized learning format. Students feel that PLATO helps them most by providing individualized, immediate feedback to their answers.

Figure 101.

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.

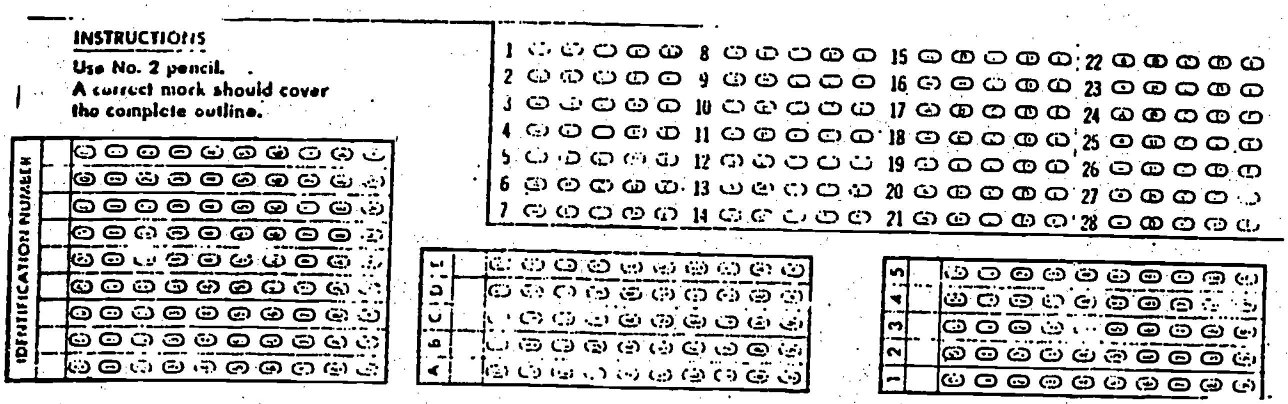


Figure 101 (Continued).

24. How many hours have you spent on PLATO in this course? (Circle one)

2 or less	3-5	6-10	11-15	16 or more

25. Have you used PLATO in any other courses? (Circle one) Yes No

26. Have you ever used a computer (other than PLATO) before? (Circle one) Yes No

If so, in what ways is PLATO different from other computers?

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.

Experimentation

Experimentation in the Delaware PLATO Project has taken four directions. First, faculty members have conducted controlled experiments comparing the use of PLATO to more traditional forms of instruction. Second, they have conducted perceptual research, where PLATO serves as a multi-faceted stimulus presentation and response recording device. Third, experiments have been conducted into the effects of alternative learning strategies upon student achievement and student attitudes. Fourth, PLATO has been used as a tool to compile accurate data to be used in research. The remainder of this section presents abstracts from articles dealing with student achievement, perceptual research, alternative learning strategies, and the development of research tools, respectively.

Student Achievement

Hofstetter, Fred T. 1980. Computer-Based Recognition of Perceptual Patterns in Chord Quality Dictation Exercises. Journal of Research in Computer-Based 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; third, 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 diminshed 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., A. Stuart Markham, Jr., and James G. Richards. 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 achievment 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, and Mark Laubach. 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 characterictics. First, precise timing of visual displays and human responses demands a dedicated microprocessor. Second, the quantity and complexity of the resulting data base 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., Billie Nelson, and Mark Laubach. 1980. A Dual Task Analysis of 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., Billie Nelson, and Mark Laubach. 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, 1979.

This study attempted (a) to compare the relative effects of experimental design and orthographic structure on the speed of letter search and (b) to determne 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, 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 data base 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 sevenths, 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 Richard S. Sharf. 1977. CAREERS: A Computer-Based Career Guidance System. Presented at the 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, it was developed at relatively little expense, aided by a small internal grant from the Division of Continuing Education at the University of Delaware. Second, 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 data base of job information without any direction. Another difference is that the data base 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 data base of information on how people make career choices.

Alternative Learning Strategies

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. IN: Computers in Music Education, Edited by Robert John (Reston: Music Educators National Conference).

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 technique, 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.

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, a mixture of ascending and 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. <u>The PLATO Display In The Teaching Of Optical Letterspacing.</u> 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 o the advertisement, and

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.

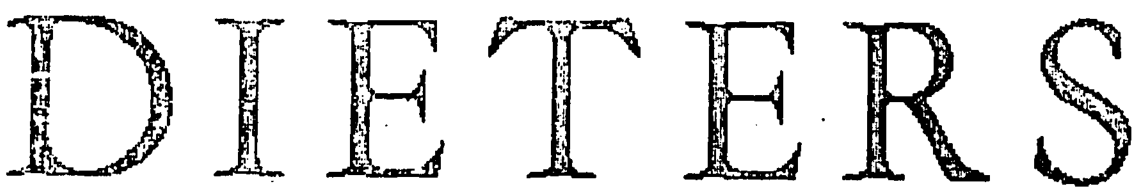
An example: **LARGE**

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 'LARGE' as two words, 'L', and 'ARGE', 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 judgements, 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:



This is the form in which PLATO displays the desired word, in this case DIETERS in the typeface Garamond.

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:

1. technical or hand skills necessary to implement and present an idea to some viewer, and

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 instuctor'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.

Wilson, James H., and Elaine P. Paden. 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.

Culley, Gerald R. 1978. Beyond Flashcards: Using the Computer's Power. American Philological Association, Vancouver, B.C.

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.

Nichols, Raymond D., and James H. Wilson. 1977. The Computer Display as a Medium in the Teaching of Aesthetics in Visual Design. Proceedings, ADCIS Winter Conference, Wilmington, Delaware, February 21-24, 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 profitted 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

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 racquet-ball. 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 relation-ships between ball velocities and selected biomechanical factors. Successful trials (3) were filmed for each per-former. 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 con-sistently 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 males (.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.

Overall Educational Value of PLATO for the University of Delaware

As the Delaware PLATO Project has grown from the installation of its first terminal on March 14, 1975 to the purchase of its own PLATO system, and as the number of departments using PLATO has increased from the original three to the present thirty, the faculty and students have identified many benefits of PLATO to the University of Delaware. It is through the realizaton of these benefits that PLATO has received a 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 PLATO 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. PLATO could allow students to 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 PLATO 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, PLATO 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. PLATO 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 groupnotes file 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. Micro-electronic technology has progressed to the point at which practically any electronic device can be connected to a PLATO 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 micro-processor, the latest development in computer hardware, which secures product flexibility for the foreseeable future.

APPENDIX

Catalog of Programs Under Development in the Delaware PLATO Project

CATALOG OF PROGRAMS UNDER DEVELOPMENT IN THE DELAWARE PLATO PROJECT

Instructional Lessons

Department	Title	Filename	Developer	Programmer(s)
Accounting	What is a Break-even Point	brkeven	A. Di Antonio	Louisa Bizoe
	The Balance Sheet Equation	bsheet	A. Di Antonio	George Betz Keith Slaughter
	Costing Methods	costing	J. Gillespie	William Childs
	Accounting-Sample Test Driver	nactgtes	Monica Fortner Keith Slaughter	Louisa Bizoe William Childs Monica Fortner Carol Leefeldt Keith Slaughter
Accounting:PLM	Financial Accounting	acc207cu	A. Di Antonio	Carol Leefeldt
	Managerial Accounting	acc208cu	A. Di Antonio	Carol Leefeldt
	Intermediate Accounting	acc316cu	A. Di Antonio	Carol Leefeldt
	Advanced Accounting	acc415cu	A. Di Antonio	Carol Leefeldt
	CPA Review	cpareview	A. Di Antonio	
	CMA Review	acccumacu	A. Di Antonio	
Agriculture	APS101: Sample Test Questions	apsintro	Paul Sammelwitz	Paul Sammelwitz
	The Endocrine System	endocrine	Paul Sammelwitz	Paul Sammelwitz Daniel Tripp Sue Waeber
	Relations	relation	George Haenlein	Craig Lewis Daniel Tripp
	APS134	agplato	Paul Sammelwitz	David Anderer
Agriculture:PLM	Respiratory System	apsmod	Paul Sammelwitz	
	Life Organization	apsmod1	Paul Sammelwitz	
	Endocrine System	apsmod2	Paul Sammelwitz	

Department	Title	Filename	Developer	Programmer(s)
Agriculture:PLM (Continued)	Reproducation	apsmod3	Paul Sammelwitz	
	Digestion	apsmod4	Paul Sammelwitz	
	Skin and Bones	apsmod5	Paul Sammelwitz	
	Muscles	apsmod6	Paul Sammelwitz	
	Metabolism	apsmod7	Paul Sammelwitz	
	Nervous Systems	apsmod8	Paul Sammelwitz	
Agricultural Engineering	Beginning Drafting	engdraft	Louisa Bizoe	Louisa Bizoe
Anthropology	Cellular Structure	phsyanthro	M. Hamilton	Monica Fortner
	Anthropological Descent Theory	ndescent	Norman Schwartz Monica Fortner	Charles Collings Karen Sims
	Anthropological Residence Theory	nresiden	Norman Schwartz Monica Fortner	Charles Collings Karen Sims
Art	Aesthetic Value	value	Raymond Nichols	Joseph P. Maia
	Composition Using Grey Scale Tones	gscale	Raymond Nichols	Joseph P. Maia Ben Williams
	Design Aesthetics and Creation	unitdesign	Raymond Nichols	Charles Wickham James Trueblood
	Letter Spacing	spacing	Raymond Nichols	Charles Wickham James Trueblood
	Newspaper Copy Fitting	copyfit	Raymond Nichols	Stephen Cox
	Painting on a Computer	modpaint	Raymond Nichols Ben Williams	Ben Williams
	Rotating Squares Generator	squares	Raymond Nichols James Wilson	James Wilson
	Random Dot Pattern Generator	random	Raymond Nichols	Klaus Abele
	Slide-Tape Presentation Editor	artslide	Raymond Nichols	James Trueblood

Department	Title	Filename	Developer	Programmer(s)
Biology	A Temperature Sensitive Morphological Mutant of Drosophila Melanogastor	tsfly	David Sheppard	Kathleen Bergey
	Gene Mapping in E. coli by Conjugation Analysis	conjug	Aart Olsen	Aart Olsen
	Human Karyotype Analysis	karyo	Aart Olsen	Aart Olsen
	Genetics of Operons	operona operonb opernonc	David Sheppard	Kathleen Bergey Phil Bernosky John Beyer
	Population Genetics	beans	Arnold Clark Aart Olsen	Aart Olsen
Chemical Engineering	Expansion of an Ideal Gas	thermo1	Stanley Sandler	Douglas Harrell
	Modeling of Binary Mixtures	thermo2	Stanley Sandler	Douglas Harrell
	Desuper Heater	thermo3	Stanley Sandler Douglas Harrell	Douglas Harrell Dan Williams
	Repressurizer	thermo4	Stanley Sandler	Douglas Harrell
	Vapor-Liquid Equilibrium	azeotrop	Stanley Sandler	Jay Tuthill
	The Rankine Refrigera-tion Cycle	freon12	Stanley Sandler	Robert Lamb
	Corresponding States Principle, Compress-ibility Factor Diagram	states1	Stanley Sandler	Andrew Semprebon
	Corresponding States Principle, Compress-ibility Factor Diagram	states2	Stanley Sandler	Andrew Semprebon
	Corresponding States Principle, Lesson III: The Enthalpy Departure Diagram	states3	Stanley Sandler	Andrew Semprebon
	Chemical Equilibrium	react1	Stanley Sandler	Jeffery Davis

Department	Title	Filename	Developer	Programmer(s)
Chemical Engineering (Continued)	Chemical Equilibrium Calculation Program	reactul	Stanley Sandler	Jeffery Davis
	Modeling: The Draining of a Tank	beerl	Stanley Sandler	Barry Schwartz
	Introduction to Mass Balance	massball	Robert Pigford	Brian Russell
	Dryer-Recycle Mass Balance	massbal2	Robert Pigford	Brian Russell
	Mass Balance With Chemical Reaction	mb3	Robert Pigford Stanley Sandler	Joseph Ayres
Civil Engineering	Shear and Moment	civengl	E. Chesson	Jeffery Snyder
Computer Science	Turing Machine Simulator	tmsin	R. Weischedel	Joseph P. Maia
	Push-Down Automata Simulator	pdsim	R. Weischedel	Joseph P. Maia
Counseling	Holland's Self-Directed Search and Career Inventory	searchl	Richard Sharf William Mahler	William Mahler Mark Laubach
	Job Aids	jobroute	Richard Sharf Mark Laubach	Mark Laubach
	Occupation by Career Code	search7	Richard Sharf	Mark Laubach
	Exploring Careers	nxpl	Richard Sharf	Charles Collings Mark Laubach
Economics	Supply and Demand	nsupply	Charles Link	Phil Smith
	Income Determination without Government	nconsume	Charles Link	Phil Smith
	Review of Graphing	econgraph	Karna Mathre James O'Neill	Karna Mathre
Education	Big Story (Imitative reading)	readalong	Peter Pelosi	Jessica Weissman
	Factors in Reading Comprehension	readlab	Frank Murray	Judith Sandler

Department	Title	Filename	Developer	Programmer(s)
Education (Continued)	Fast Accurate Symbol Transcription for Evaluation of Elementary Reading	squiggles	John Pikulski	Deborah Braendle
	Sight Word Teaching Method Simulations	sightword	Peter Pelosi	Jessica Weissman
	Sight Word Attack Team	swat	Rosalie Bianco Peter Pelosi Jessical Weissman Bonnie Seiler	Jessica Weissman
	Make a Spy	makespy	Jessica Weissman	Jessica Weissman
	Spot the Spy	spotspy	Jessica Weissman	Jessica Weissman
	SWAT Promotion Test	swattest	Jessica Weissman Peter Pelosi	Jessica Weissman
	Word Zoo	wordzoo	Steve Hansell	Jessica Weissman
	Hang-a-Spy (hangman with spies)	hangspy	Jessica Weissman	Jessica Weissman
	Hang-a-Spy Word List Maker	hangsetup	Jessica Weissman Bonnie Seiler	Jessica Weissman
	Spy Concentration	newtwo	Jessica Weissman	Jessica Weissman
	Spy Concentration Word List Maker	consetup	Jessica Weissman	Jessica Weissman Carol Leefelt
	Spy Meeting	spymeet	Jessica Weissman Bonnie Seiler	Jessica Weissman
	Metric Estimation Game	skunkwar	Bonnie Seiler James Wilson	James Wilson Bonnie Seiler
English	Diagnostic Test of Classroom English	dtest	Louis Arena Marcia Peoples	Everett Langhans
	IS and ARE, the Missing Links	cdelete	Louis Arena	Jessica Weissman
	Learning TO BE	behabit	Louis Arena Marcia Peoples	Jessica Weissman Jean P. Maia
	The Power of Negative Thinking	negativl	Louis Arena Sophia Homsey	Jessica Weissman Rae D. Stabosz

Department	Title	Filename	Developer	Programmer(s)
English (Continued)	An S at the End	threepv	Louis Arena Phyllis Townsend	Jean P. Maia
	The Animal Game	animal	Louis Arena Sophia Homsey	Jessica Weissman
	Jotto	udjotto	Sophia Homsey	Sophia Homsey
	Spell Bound	thoughts	Sophia Homsey	Sophia Homsey
	Computer Poems	udpoems	Peg Phelan	Rae D. Stabosz
Health Education	Contraception	contra	Anne Lomax	Ivo Dominguez
	Sex Education Resource Network	refer	Anne Lomax	Mark Laubach David Anderer Scott Pearl
Human Resources	Metric Practice	seemet	Dorothy Elias Frances Mayhew Frances Smith	David Anderer Dorothy Elias
	Alteration Laboratory	alterlab	Dorothy Elias Frances Mayhew Frances Smith	David Anderer Dorothy Elias James Wilson
	Pattern Measurement	patterns	Dorothy Elias Frances Mayhew Bonnie Seiler Frances Smith	David Anderer Kathleen Bergey Dorothy Elias James Wilson
	Ease Requirements	ease	Dorothy Elias Frances Mayhew Frances Smith	David Anderer Dorothy Elias
	Body Measurement	bigbody	Dorothy Elias Frances Mayhew Bonnie Seiler Frances Smith	David Anderer Kathleen Bergey Dorothy Elias
	Determining Pattern Alterations	med	Dorothy Elias Frances Mayhew	David Anderer Dorothy Elias
	Consumer in the Marketplace Series -- Topic #1: Consumption	coneconl	James Morrison Deborah Mellor	Deborah Mellor Kathleen Bergey
	Consumer in the Marketplace Series -- Topic #2: Information	conecon2	James Morrison Deborah Mellor	Deborah Mellor Kathleen Bergey

Department	Title	Filename	Developer	Programmer(s)
Human Resources (Continued)	Consumer Education Resource Network	consume	Hester Stewart	Mark Laubach Deborah Mellor Kathleen Bergey Daniel Tripp David Anderer
Institutional Research	Graph Generating Program	gredit gruse	Brand Fortner Aart Olsen	Brand Fortner Aart Olsen
Language	The Verb Factory	Øfactory1,2	Gerald Culley	Gerald Culley
	Cursus Honorum: A Latin Verb Game	Øcursus	Gerald Culley	Gerald Culley
	Mare Nostrum: A Game with Latin Nouns and Adjectives	mare	Gerald Culley	Gerald Culley
	Artifex Verborum	artifex	Gerald Culley	Gerald Culley
	Translate: Exercises in Translating Latin Sentences	translat	Gerald Culley	Gerald Culley
	Touche: A French Word Order Touch Lesson	touche	George Mulford	Dan Williams
	Ringers: A Grammar Recognition Lesson	ringers	George Mulford	George Mulford
	Substitution Drill and Editor	subdrill submaker	Dan Williams	Dan Williams
	Review of English Grammar	udgrammar	Gerald Culley	Gerald Culley
	Hidden Word Game and Generator	subpuz	Christine Brooks	Christine Brooks
	German Adjective Endings	pgerm	Anne Howard	Anne Howard
	Language Lab Tape Preparer	tapemaker	George Mulford	James Wilson
Mathematics	Vector Field Plotter	vplotter	Morris Brooks	Morris Brooks
	Calculus Basic Skills	calcprac	Morris Brooks	Morris Brooks

Department	Title	Filename	Developer	Programmer(s)
Mathematics (Continued)	Power Series Plotter	psplotter	Morris Brooks	Morris Brooks
	Parametric Curve Plotter	pplotter	Morris Brooks	Morris Brooks
	Sigma Notation Quiz	sigma	Morris Brooks	Morris Brooks
	Sequence Plotter	sequence	Morris Brooks	Morris Brooks
	Interval Notation Quiz	interval	Morris Brooks	Morris Brooks
	Calculus Basic Skills I	calcprc1	Morris Brooks	Morris Brooks
	Calculus Basic Skills II	calcprc2	Morris Brooks	Morris Brooks
	Polar Coordinate Game	polarco	Alan Stickney	Alan Stickney
	Rectangular Coordinates	carteco	Alan Stickney	Alan Stickney
	Derivative, Difference Quotients, and Increments	deriv4	Alan Stickney	Alan Stickney
	Differentiation Formulas	deriv5	Alan Stickney	Alan Stickney
	Integration Using Areas	integ1	Alan Stickney	Alan Stickney
	Properties of Integrals	integ2	Alan Stickney	Alan Stickney
	Two Variable Function Plotter	plot2	Alan Stickney	Alan Stickney
	Surface Plotter	plotsh	Alan Stickney	Alan Stickney
	Rootfinder and Function Plotter	rootfind	Alan Stickney	Alan Stickney
	Simulation of TI-58 Calculator	ticalc	Alan Stickney	Alan Stickney
	Math Practice Problem Driver	mpracind	Ronald Wenger Keith Slaughter	Keith Slaughter Jay Green Richard Payne
	Math Diagnostic Test	matest	Ronald Wenger Keith Slaughter	Keith Slaughter

Department	Title	Filename	Developer	Programmer(s)
Military Science	Solving Problems Statistically	yellow	Thomas Reinhardt	Michael Houghton Thomas Noyes
Music	GUIDO Ear-Training System:			
	Intervals	interunits	Fred Hofstetter	William Lynch
	Melodies	meldset	Fred Hofstetter	William Lynch
	Harmonies	harØldset	Fred Hofstetter	William Lynch
	Rhythms	rhydset	Fred Hofstetter	William Lynch
	Competency-Based Chord Quality Drill	udchord	Fred Hofstetter	William Lynch
	Competency-Based Harmonic Dictation Drill	udharmon	Fred Hofstetter	William Lynch
	Interval Hall of Fame	intervals	Fred Hofstetter	William Lynch
	Competency-Based Interval Dictation Drill	musicdrill	Fred Hofstetter	William Lynch
	Competency-Based Melodic Dictation Drill	udmelody	Fred Hofstetter	William Lynch
	Competency-Based Rhythmic Dictation Drill	udrhythm	Fred Hofstetter	William Lynch
	Fundamentals of Ear-Training	udthomas	Robert Hogenson	Richard Thomas
	Note Reading Hall of Fame	notegame	Peter McCarthy	Deborah Braendle
	Set Names (after Forte)	setnames	Fred Hofstetter	James Trueblood
	Intervals	bintrain	Michael Arenson	Richard Thomas
	Pitch Identification Test	cmimus	Michael Arenson	William Lynch
	Musical Terms Glossary	cmimusterm	Michael Arenson	William Lynch
	Aural Recognition of Scales and Modes	modes	Michael Arenson	Russell Kozerski William Lynch
	Seven Basic Rhythms	rrhythm	Michael Arenson	Rachel Preiss William Lynch
	Clef Transposition Test	cmimus2	Michael Arenson	Russell Kozerski

Department	Title	Filename	Developer	Programmer(s)
Music (Continued)	Grand Staff Test	cmimus3	Michael Arenson	Russell Kozerski
	Scale and Mode Test	cmimus4	Michael Arenson	Patricia Bayalis
	Key Signature Test	cmimus5	Michael Arenson	Patricia Bayalis
	Four Voice Triad Test	cmimus6	Michael Arenson	Patricia Bayalis
	Beat Unit and Division Test	cmimus7	Michael Arenson	Patricia Bayalis William Lynch
	Meter and Time Signature Test	cmimus8	Michael Arenson	Patricia Bayalis William Lynch
	Rhythm Notation Test	cmimus9	Michael Arenson	Patricia Bayalis William Lynch
	Half Steps-Whole Steps	cmimus11	Michael Arenson	Gary A. Feurer
	Triad Identification and Construction	cmimus12	Michael Arenson	Gary A. Feurer
	Transposition	cmimus13	Michael Arenson	Gary A. Feurer
Nursing	Human Heart Valves (adapted from Illinois vet med lesson)	heartv2	Mary Anne Early	Charlotte Criste David Graper
	The Nursing Process (adapted from University of Pittsburgh)	soapie	S. Cudney	Charles Wickham James Trueblood
	Simulated Treatment of Diseases	simexec	Mary Anne Early	Monica Fortner James Trueblood
	Nursing Sample Challenge Test Driver	nursesampl	Mary Carroll Mary Anne Early Monica Fortner C. Freid Keith Slaughter	Monica Fortner Keith Slaughter
	Nurse 301: Challenge Exam Driver	chalques	Mary Carroll Mary Ann Early Monica Fortner C. Freid Keith Slaughter	Monica Fortner Keith Slaughter
	Nurse 406: Challenge Exam Driver	chalques	Mary Anne Early Monica Fortner C. Freid Keith Slaughter	Keith Slaughter

Department	Title	Filename	Developer	Programmer(s)
Nursing (Continued)	Nursing Inventory Operations	notps	Mark Laubach D. Mackay Al Start	Mark Laubach
	An Introduction to Pharmacological Nursing	pharm1	Sylvia Alderson Elaine Boettcher	Monica Fortner Kim Buckman
	The Use of the Nursing Process in Psychopharmacological Nursing	pharm2	Sylvia Alderson Elaine Boettcher	Monica Fortner Kim Buckman
	Abdominal Perineal Resection: A Patient Care Simulation	peri	Mary Anne Early	Monica Fortner
Physical Education	Basic Racquetball Strategies for Doubles Play	raquet	James Kent	Patricia Bayalis
	Biomechanics Application Problems: The Laws of Signed Numbers	lawsign	David Barlow	Patricia Bayalis
	Balancing Equations	balance	David Barlow	Patricia Bayalis
	Formula Transformation	formula	David Barlow	Patricia Bayalis
	Proportion	proport	David Barlow	Patricia Bayalis
	Calories, Exercise Nutrition	calorie	Barbara Kelly	Patricia Bayalis
	Cartesian Coordinate System	cartesian	J. Richards	J. Richards Stuart Markham
	Digitizer	digitizer	David Barlow	Stuart Markham
	Du Pont Study	projbit	David Barlow M. Provost	Stuart Markham
	Film Motion Analysis	analysis	David Barlow	Stuart Markham
	Film Motion Analysis	analproj	David Barlow	Stuart Markham
	Film Motion Analysis	analbit	David Barlow	Stuart Markham
	Muscle Identification	muslide	Keith Handling	Patricia Bayalis
	Muscle Physiology	muscle	Robert Neeves	Stuart Markham

Department	Title	Filename	Developer	Programmer(s)
Physical Education (Continued)	No Frills Gait Analysis	gait	David Barlow	Stuart Markham
	Projectile	projectile	David Barlow	Stuart Markham
	Social Dancing	dancer	Janet Pholeric	Patricia Bayalis
	Volleyball Strategies (4-2) (2-1-3)	volleyball	Barbara Viera	Stuart Markham
	Volleyball Strategies (6-2) (2-4)	vbal	Barbara Viera	Stuart Markham
	Volleyball Situations	vbaldrill	Barbara Viera	Stuart Markham
Physics	A Problem in Angular Velocity	udfou	Cheng-M. Fou	Charles Wickham
Political Science	Environmental Policy Simulation	enconint enconsim	Richard T. Sylves	Stuart Markham
PLATO	How to Use PLATO	udhelp	Jessica Weissman	Jessica Weissman
	How to Use PLATO (short version)	udhlp	Jessica Weissman	Jessica Weissman
	System Messages -- Who Sent It and Why	messages	Jessica Weissman	Jessica Weissman
	Programming for the Touch Panel	touchhelp	Jessica Weissman	Jessica Weissman
	HELP -- on the Page and Off	nhelpkey	James Trueblood	James Trueblood
	Delaware PLATO System Hardware Configuration	udhard	Brand Fortner	Brand Fortner
Psychology	Anagrams	anagrams	G. Berg-Cross John McLaughlin	Judith Sandler
	Mental Imagery	wrmaps	John McLaughlin Rae D. Stabosz Clare Berrang	Rae D. Stabosz Clare Berrang
	Direct Scaling	dscale	James Hoffman	Jessica Weissman
	Reaction Time	reactime	James Hoffman	Cheinan Marks
	Geometrical Optical Illusions	illusion	James Hoffman	Jessica Weissman

Department	Title	Filename	Developer	Programmer(s)
Psychology (Continued)	The Poggendorf Illusion	pogexp	James Hoffman	Jessica Weissman
	Iconic Memory	rletters	James Hoffman	Jessica Weissman
	Visible Light	eyel	James Hoffman	Jessica Weissman
	SIMON	simonc	James Wilson	James Wilson
Security	Ticketing Professionalism	secure secprof	Steven Swain John Schimmel	Raymond Schwartz Raymond Schwartz
	Motor Vehicle and Bicycle Regulations (PCMI module)	sectrain	Steven Swain	Raymond Schwartz
	Criminal Code (PCMI module)	crimcode	Steven Swain	Raymond Schwartz Robert Krejci
	Phonetic Alphabet Code for Law Enforcement	alphdrill	Raymond Schwartz	Raymond Schwartz
	Public Safety 10 Code	tencode	Steven Swain	Robert Krejci
Statistics	Statistics Worksheet Lesson	statone	Victor Martuza Aart Olsen James Trueblood Joseph P. Maia Keith Slaughter	Aart Olsen
Theatre	Interactive Timeline	timeline	Brian Hansen	Michael Larkin Jeffery Davis James Wilson

Research Programs

Department	Title	Filename	Developer	Programmer(s)
Art	Statistical Package for Letter Spacing	artstats	Raymond Nichols	Charles Wickham
Educational Foundations	Effect of Orthographic Structure on Letter Search	scan	A. Tobin Richard Venezky	David Anderer
	String Rating	ratedriver	Jane Hart Richard Venezky	David Anderer
	Graph Reading	graphs	Victor Martuza	James Trueblood

Department	Title	Filename	Developer	Programmer(s)
Educational Foundations (Continued)	Visual Perception	vper	Richard Venezky	David Anderer
	Reading Experiment	reading	D. Birkmire	David Anderer
	Moving Window	window	Richard Venezky	David Anderer
	Recall Pattern Among Autistic and Retarded Learners	recall	Clifford Meisel G. A. Smith	Dawn Mosby
Psychology Instruction	Memory Experiment	remember	John McLaughlin	Judith Sandler
Psychology Research	Orientation Experiments	visual	James Hoffman	Michael Frank
	Consistent Mapping Experiments	visualcm viscmx viscmb	James Hoffman	Michael Frank
	Varied Mapping Experiment	visual7n	James Hoffman	Michael Frank
	Statistics Packages	vstatscm vstatso vstatson vstatcmo vstat7n	James Hoffman	Michael Frank
	Subject Group Editor	visgroup	James Hoffman	Michael Frank
	Subject Router	visra	James Hoffman	Michael Frank

Utilities

Department	Title	Filename	Developer	Programmer(s)
UD PLATO	Comprehensive Accounting Analysis Package	caap	Charles Wickham	Charles Wickham
	Classroom Scheduler Package	scheduse	Bonnie Seiler Joseph P. Maia	Joseph P. Maia
	Equipment Inventory Programs	mopts	Mark Laubach	Mark Laubach
	Group Statistics Printer	groupstats	Charles Wickham	Charles Wickham

Department	Title	Filename	Developer	Programmer(s)
UD PLATO (Continued)	PLATO Users Survey Package	question	Daniel Tripp	Daniel Tripp
	Ud Lesson Catalog Package	catalog	David Anderer	David Anderer
	User Directory	udpeople	Mark Laubach Bonnie Seiler James Wilson	Mark Laubach
	Time Management Utility	tmu2	Mark Laubach	Mark Laubach Robert Stradling
	Minder -- A Schedule Minder Utility	minduse	Mark Laubach Joseph P. Maia	Mark Laubach Joseph P. Maia
	Information System for Small Documents	infosys	Mark Laubach Daniel Tripp	Mark Laubach
	Equipment Usage Statistics Package	mstats	Mark Laubach James Wilson	Mark Laubach
	Multi-Dimensional Scaling Survey Package	scaled scalex scaledd	Victor Martuza Joseph P. Maia	Joseph P. Maia
	Full-Lesson Search Utility	lsearch	James Trueblood	James Trueblood
	Lesson Code Comparer	comparator	James Trueblood	James Trueblood
	Lesson List Manager	leslists	James Trueblood	James Trueblood
	Multi-Plot	mplotter	James Hoffman	Michael Frank
	University of Delaware PLATO Network	udnet	James Wilson Carl Gill Larry Carson	Carl Gill Larry Carson James Wilson
	Memo Editor	udmemo	James Wilson	Stuart Markham
	Character Set Checker	charchek	Aart Olsen	Aart Olsen
	Simulation Driver/Editor	simedit	Monica Fortner	Monica Fortner Michael Frank
	Test Driver	multitest	Monica Fortner	Monica Fortner Keith Slaughter

Department	Title	Filename	Developer	Programmer(s)
UD PLATO (Continued)	Index System	mindex	Michael Frank	Michael Frank
	Site Usage	skedsum	Michael Frank	Michael Frank
	Usage Check	skedchek	Michael Frank	Michael Frank
	Group Copy Utility	gcopy	David Anderer	David Anderer
	Terminal Memory Test Routine	ppt	David Ander	David Ander
	Lesson Access Controller	laseditor	Mark Laubach	Mark Laubach
	Time Report Form Maker	trf	Charlotte Coletta Daniel Tripp	Daniel Tripp David Tweed
	PLATO Staff Schedules	mysched	Bonnie Seiler Rae D. Stabosz	Rae D. Stabosz
	Basic Skills Data Converter	bslsconv	Charles Wickham	Charles Wickham

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 desire 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 which 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 University of Delaware Computing Center did an excellent job in preparing for the installation of the machine. A large area in the newly constructed Computing Center was designated for the PLATO system. Power generators were installed, a chilled water system was engineered, and the necessary electrical lines and pipes were put into place for the machine. 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 the latest line of computer hardware offered by the Control Data Corporation. Based on a Cyber 173 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.

During the 1978-79 academic year, the number of PLATO terminals on the Delaware campus was increased from 50 to 75, 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 4 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 4 peripheral processors was added to the central system in order to handle increasing input-output needs.

The Delaware PLATO system is linked to a worldwide PLATO network which allows Delaware authors to exchange materials and ideas with other users on systems in Minnesota, Illinois, Quebec, Brussels, Alberta, and California. Figure 1 shows the hardware configuration of the Delaware PLATO system.

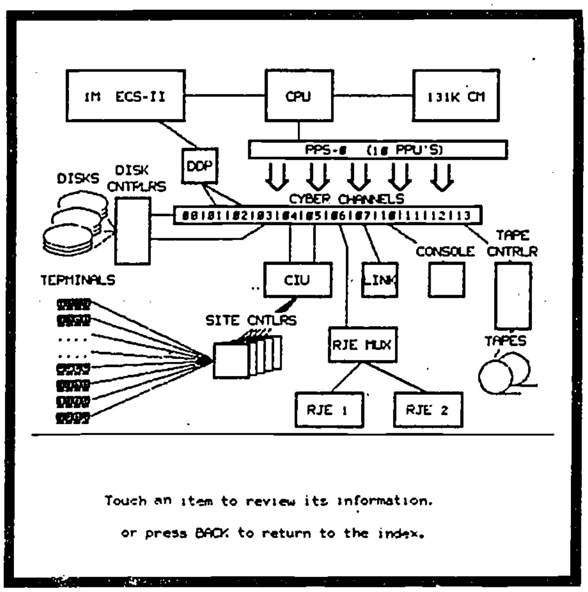


Figure 1. Hardware Configuration of the Delaware PLATO System, by Brand Fortner. Copyright © 1978 by the University of Delaware PLATO Project.