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ABSTRACT

The Air Force has been plagued with the rising cost of technical training and has increasingly turned to computer-assisted instruction (CAI) for better cost effectiveness. Toward this aim a trial of PLATO IV, a CAI system utilizing a graphic display and centered at the University of Illinois, was initiated at the Chanute and Sheppard training bases. At Chanute the trial is based on the development and use of materials for the Special Purpose Vehicle Maintenance Course. One lesson involves use of a battery hydrometer. A secondary program PIRL (PLATO Indicated Reading Level) is being used to determine the reading difficulty of developed materials. At Sheppard PLATO IV is being tested on a Physician Assistant program, initially on those aspects of the program dealing with respiratory problems. The PLATO IV program is expected to depart from the old course in its emphasis on a problem oriented curricula where the trainee repeatedly solves medical problems with the computer as a tutor. These trials of PLATO IV are still in progress, but it is hoped that these innovations will offer the potential for more cost effective technical training. (WH)

THE APPLICATION AND EVALUATION OF PLATO IV IN AF TECHNICAL TRAINING

Overview

The Air Force, in an attempt to keep pace with rising training costs, has closely monitored the development and implementation of futuristic educational systems. One of the more promising of these systems is the PLATO IV (Programmed Logic for Automated Teaching Operations) instructional system which has been under development at the University of Illinois for the past decade. PLATO IV is the most recent in a series of refinements of the computer-based system, and it is also the most successful. At the present time, it is being demonstrated and evaluated in elementary schools, community colleges, universities, and military technical training settings. Conceptually, the PLATO IV system can be viewed as a network of geographically dispersed sites, each of which is linked by low cost commercial communication lines to a central computer (CDC 6500) at the University of Illinois. If the computer can be viewed as the heart of the system, then the Computer-based Education Research Laboratory (CERL) can be considered the brain. CERL is a special unit of the graduate college of the University of Illinois (Urbana-Champaign campus),and since 1968, its primary function has been to implement and operate the PLATO system. CERL provides training in terminal maintenance and the computer authoring language (TUTOR), but its personnel also provide educational liaison, software programming support, and consultation in both instructional and evaluative strategies.

At the present time, the Air Force has two large scale service tests of the PLATO IV system underway at Chanute and Sheppard AFBs. Both of these efforts have been supported by the Advanced Research Projects Agency (ARPA) under a contract with the University of Illinois. Actually, the Air Force efforts are only one part of an overall ARPA sponsored effort which has been designed to investigate the potential applications of PLATO in military technical training settings. As the military has continued to implement the All-Volunteer force concept, it has also been faced with continually rising training costs. Therefore, a great deal of emphasis has been placed on computer-assisted instruction (CAI) as a possible means of reducing training time, and thereby costs, without incurring any performance decrements.

Some of the unique instructional advantages of the PLATO IV system can be attributed to its terminal design which allows for highly interactive, individualized instruction. The most interesting component of the terminal is the plasma panel (see Figure 1), which is itself a major technological innovation. The plasma panel consists of a layer of gas trapped between 2 plates of glass (8½in X 8½ in) which are criss-crossed by a matrix (512 x 512) of transparent wires. These wires combine to form over a quarter of a million intersections, each of which can be electrically excited by the computer, thereby causing the trapped gas to glow. The density of these intersections allows for visual displays with high resolution, thereby reducing visual fatigue. The student has the

PLATO IV STUDENT TERMINAL

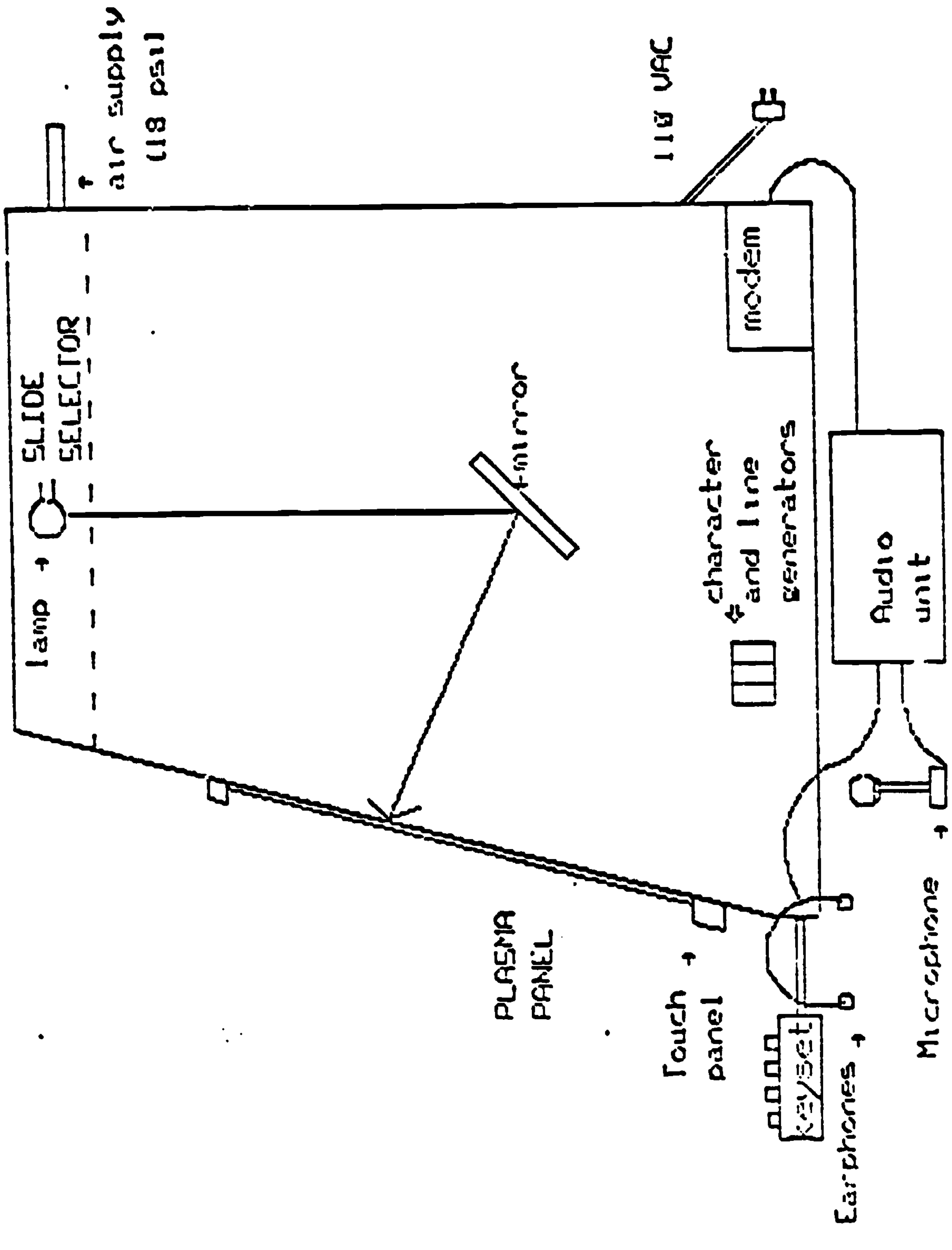
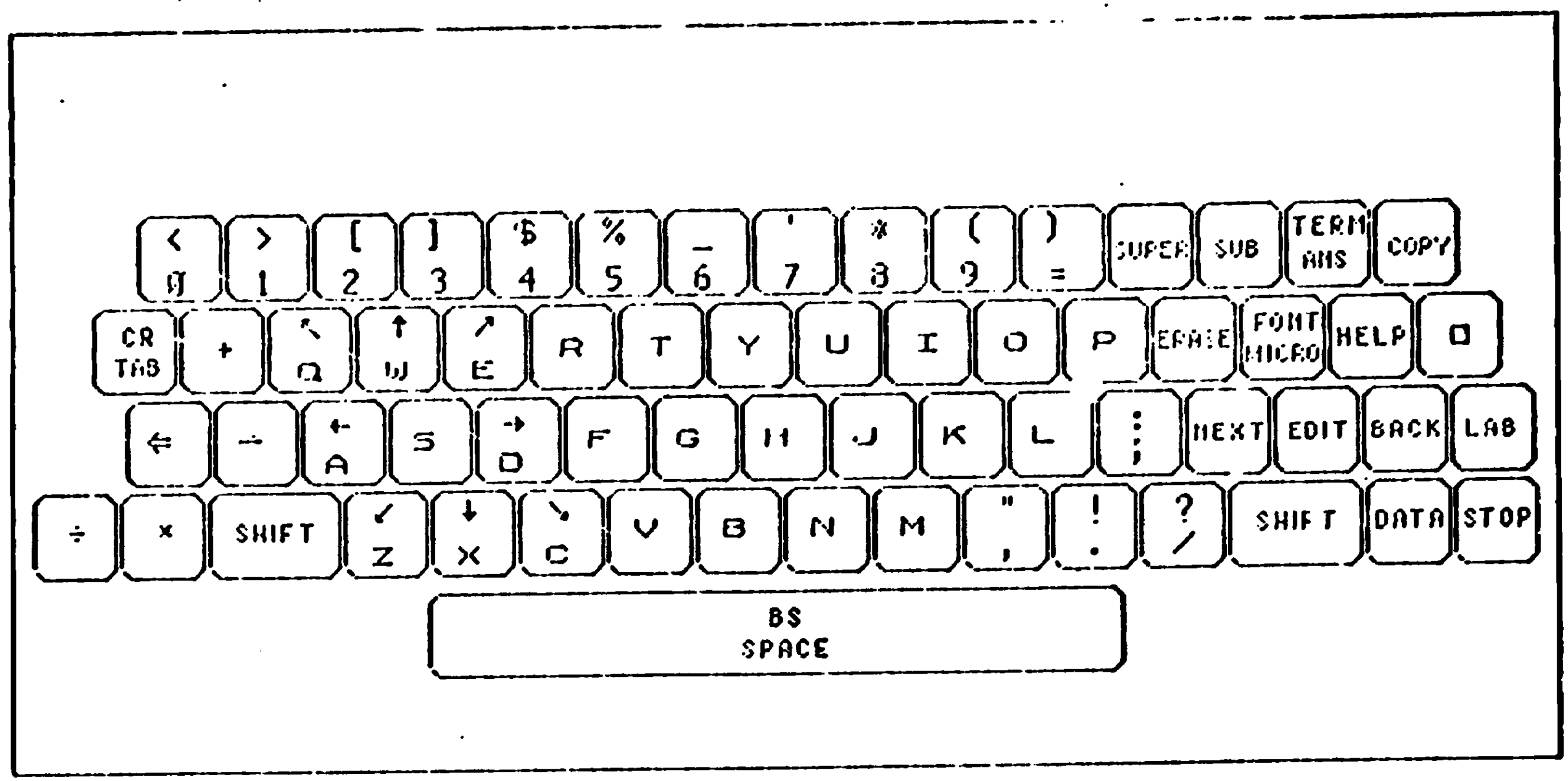


Fig. 1



Does this look familiar? If not, I'm sure it will become so. Look at the keyset below this screen

Fig. 2

Press any key!

option of responding to such visual displays either through the use of the keyboard (Figure 2), which is similar to a standard typewriter keyboard, or, in certain situations, by simply touching the plasma panel which is surrounded by a matrix of infra-red light sources and detectors. Other features of the terminal include a random access audio device, a rear-projection microfiche system which allows images to be superimposed over any writing on the plasma panel, and an on-line authoring capability using a computer language (TUTOR) which was designed specifically for instructional purposes. The combination of these preceding features with an educational philosophy which emphasizes sensitivity to individual differences offers vast potential for significantly improving Air Force technical training. For this reason, the Air Force has chosen to implement and evaluate the PLATO IV system in diverse technical training settings at Chanute and Sheppard AFBs.

The Chanute PLATO IV Service Test

Chanute Technical Training Center is located in Rantoul, a small village approximately 15 miles north of the central PLATO IV computer center at the University of Illinois. The mission of Chanute is typical of Air Training Command's five Technical Training Centers: Chanute, Sheppard, Lackland, Lowry, and Keesler. These five centers share the burden of providing almost all basic and advanced technical training required to maintain the Air Force's defense systems. The training mission of Chanute is concerned primarily with large aircraft and missile maintenance, the maintenance of associated weapon support equipment, and weather.

Of the many military sites operating PLATO terminals under the ARPA project, Chanute is the nearest to CERL. As a result it has often been the first of the sites to experience the growing pains of the new system. The first training of military authors was conducted for Chanute; the first ARPA terminals were delivered to Chanute; and here many of the hardships involved in pioneering PLATO IV training were first experienced.

Preparations for the PLATO effort at Chanute began early in 1972 with selection of a test course and identification of eight instructors to become PLATO authors. The training content selected as the test bed for the new system was vehicle maintenance. The reason for this selection lies in the manipulative skills component of that type of training. In the past almost all attempts to apply CAI have dealt with subject areas of primarily theoretical content, such as electronic principles. In this effort, however, an attempt is being made to apply CAI to a curriculum oriented toward manual skills.

The eight instructors, four military and four civil service were selected directly from teaching positions in two vehicle maintenance courses. None of them had prior experience in curriculum development or computer programming. They were chosen on the basis of a CERL intent to construct the TUTOR language such that a lay instructor could design and program his own CAI material without the assistance of a specialized computer programmer. Indirectly, then, these individuals are testing the soundness of that idea.

For the first year of the service test many pitfalls were encountered in the still developing system. The language was under constant improvement and revision and sub-contracts for hardware had run into lengthy delays. Consequently the initial development of lesson material did not progress smoothly. By the end of the second year, however, most of the bugs had been exterminated, all but two of the twenty-five terminals had been delivered, and PLATO lesson production was in high gear. The only major hardware systems left to be delivered were the touch panels and the microwave communications link.

The microwave link allows operation of all 25 terminals over a single phone line (with a second phone line for back-up if a problem develops in the primary). Through this link signals coming from the computer are broadcast by a microwave transmitter at CERL to a receiving antenna at Chanute. Signals from the remote terminals are then returned to the computer over the telephone line.

The principal advantage of the microwave link is the savings in cost. Voice grade telephone communications over land lines between CERL and Chanute cost approximately $75.00 per month per line. The cost to operate 25 terminals at Chanute would therefore be around $1875 per month. The microwave system, on the other hand, utilizes only one telephone line and can accommodate all 25 terminals. This then reduces the cost of telephone service to $75.00 per month or $3.00 per terminal. Of course, the initial cost of installing the microwave system is quite high, but since every PLATO site within a thirty mile radius of CERL will be linked by it, this cost will be amortized in a short time.

Training Applications

The PLATO IV service test at Chanute is being conducted in the Special Purpose Vehicle Maintenance Course. This course instructs Air Force enlisted men in the fundamentals of maintaining all motor vehicles designed for specific jobs. These include fire trucks, graders, cranes, snow plows, tow trucks, etc. Because of the diversity of equipment, four different training courses each treating a different category of vehicles are necessary. In every course, however, the first eight weeks of instruction cover the same basic automotive subjects. It is within this common 8 week area of training that the PLATO system is being applied.

The instruction to be presented through PLATO deals with basic automotive principles ranging from engines and related fuel and ignition systems, through electrical systems, to vehicle chassis systems, brakes, and suspension. To be sure that the effectiveness of instruction presented through the PLATO system is not obscured by improper utilization, these eight weeks of training are undergoing instructional systems development (ISD) (c.f. Air Force Pamphlet 50-58, January 1974). By means of the ISD process PLATO instruction will be integrated into the curriculum such that it will be utilized in an environment of flexibility and individualization which will not obstruct its potential.

Lessons developed to date have dealt primarily with teaching basic facts and information concerning various automotive subsystems. All of these lessons attempt in different ways to capitalize on the unique capabilities of PLATO. One such lesson is on the Battery Hydrometer.

In this lesson, the student is presented a program of instruction explaining the relationship between specific gravity of battery acid and the state of charge of the battery. The lesson also covers how specific gravity is measured with a battery hydrometer and how low temperature of the fluid affects that measure. At the end of the lesson, the student is presented a display similar to that in Fig. 3. The level of the fluid in the simulated hydrometer is determined by a random number generator within the computer. The level of mercury in the simulated thermometer is set the same way. The student's task is then to read the level of the fluid in the hydrometer and to enter that value at the arrow. He next completes a similar exercise for the thermometer. His final task is then to add or subtract a correction factor (four points on the hydrometer for each ten degrees above or below 80 degrees respectively) to determine the correct specific gravity of the fluid. When he has successfully completed this operation, he is presented with a new problem, the levels of the hydrometer and thermometer are generated as before from a set of random numbers. The student must complete five correct repetitions of the drill before he is allowed to progress to the next lesson.

In another lesson representative of the work being done at Chanute, the student is taught the nature of the battery ignition system. An example of this lesson is presented in Fig. 4. Here the student must apply his knowledge of the ignition system, learned earlier in the lesson, to connect the components in their proper sequence. In a related lesson on the ignition system, a game playing strategy was adopted from a program designed and developed at the Army Signal Center and School, Fort Monmouth, New Jersey. The basic game was modified by a Chanute author to lend some interest to learning the sequence of components in the ignition system. The game is based upon the popular number puzzle in which the object is to arrange 15 numbered squares in their proper numerical sequence. In the modified game the numbers have been replaced with electronic symbols (Fig. 5). By using the keyboard the student can move the squares about until they are in the correct order. Each time the game is entered, a different random order of symbols are presented. The time it takes to complete the game is kept by the computer. When finished, the student can compare his time to other students who have played the game. Past players have taken from 45 seconds to ten minutes to finish a game.

A somewhat novel application of the PLATO system to automotive training problems is presented in a diagnostic drill for the starter system. In this lesson, the student is presented with a list of ten fictional

You wanted a test. Here it is... Good luck!

If you cannot do the test, you can press -Back- at any time to go through the lesson.

What is the Hyd reading.

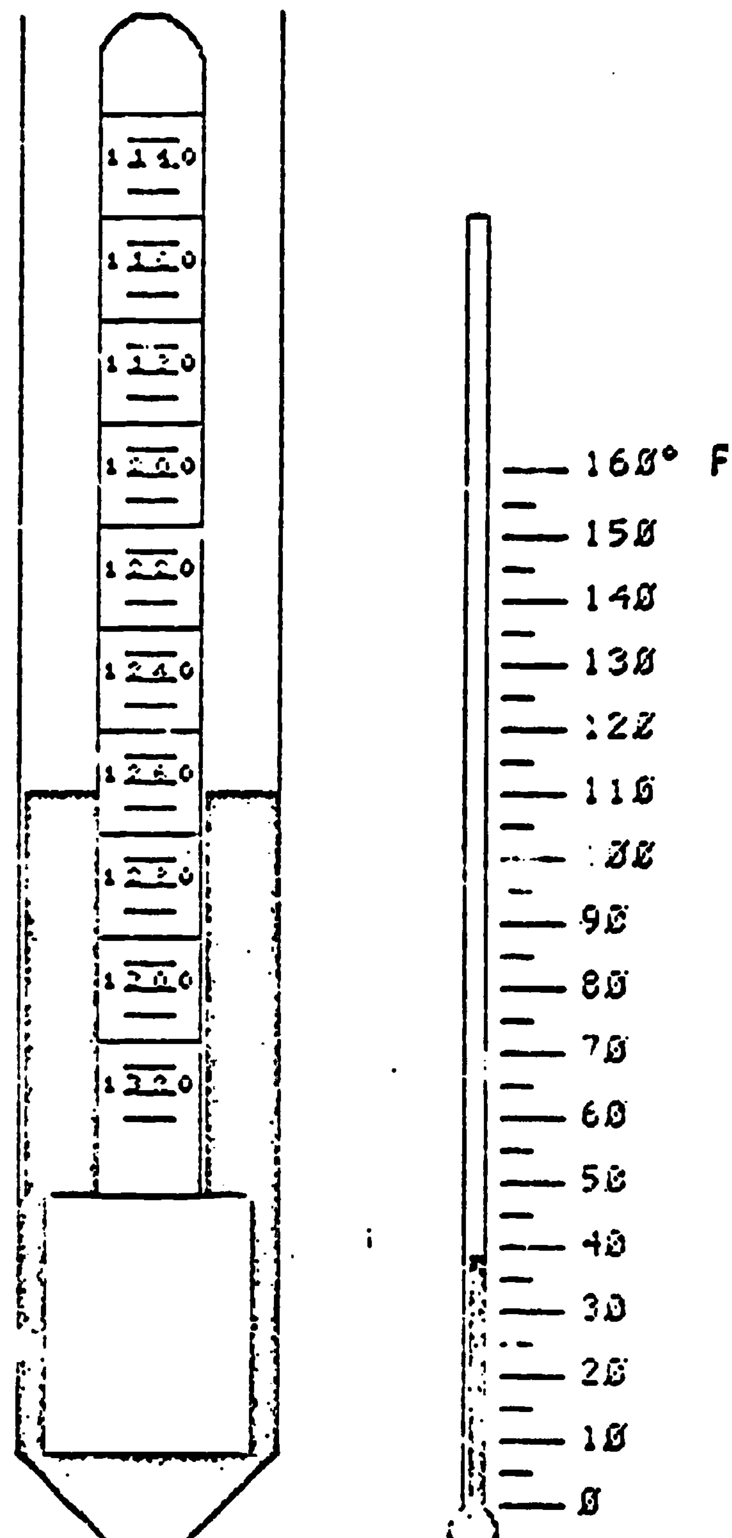
1262 ok

What is the Temp?

38 ok

What is the corrected hydrometer reading?

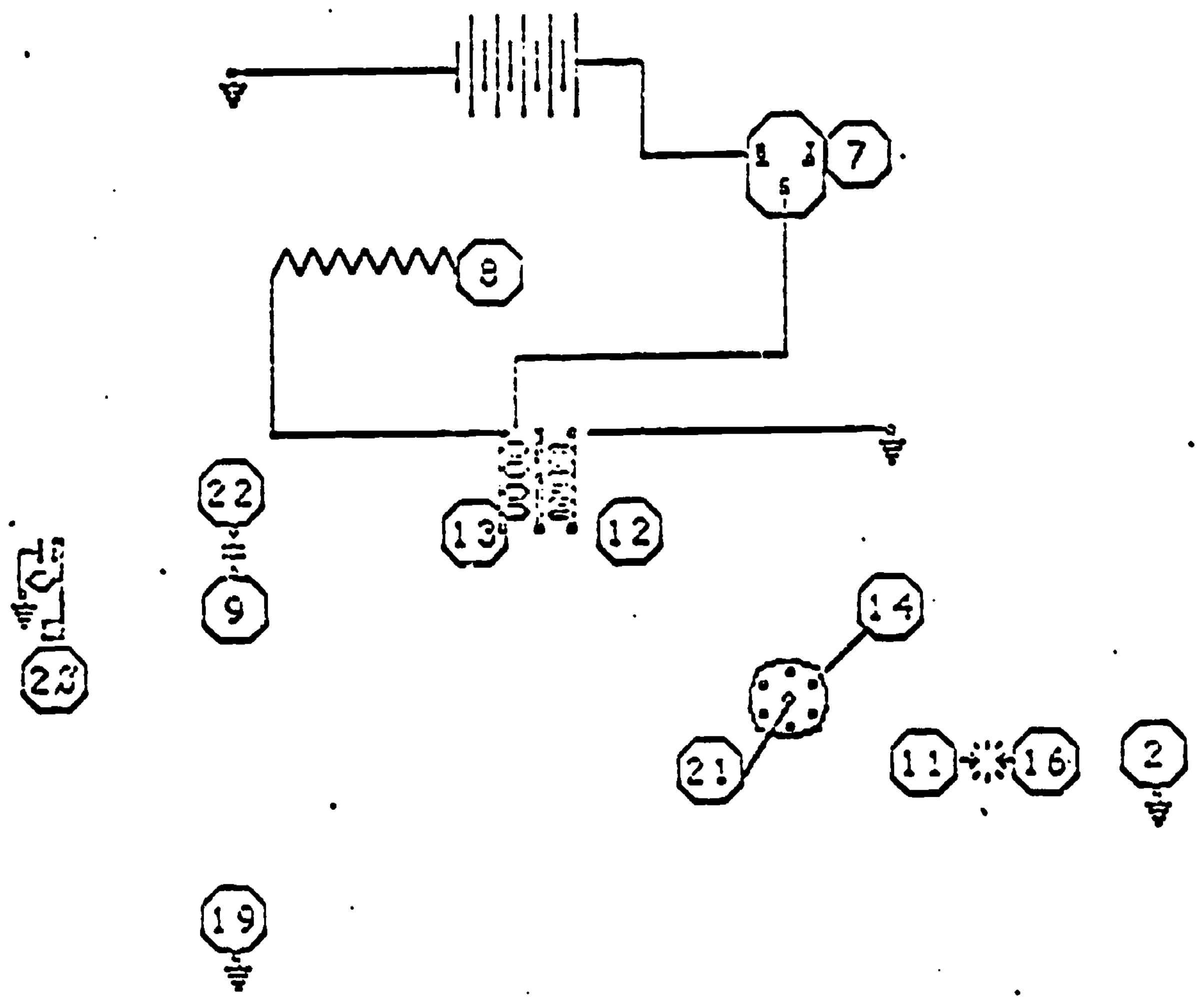
»



-Next-

* The arrow indicates a student response is required.

Fig 3 Battery Hydrometer Test



Write end when you've finished.

>

* The arrow indicates a student response is required.

Fig. 4 Schematic Drill for the Battery Ignition System

In this game there are 15 tiles and one blank space in a square. You use the directional arrows (←, ↑, →, ↓) to slide the adjacent tile into the blank space.

The objective for this game is to align the ignition components to show the proper order, from batteryground to the firing order of a 6 cylinder 1973 chevy engine.

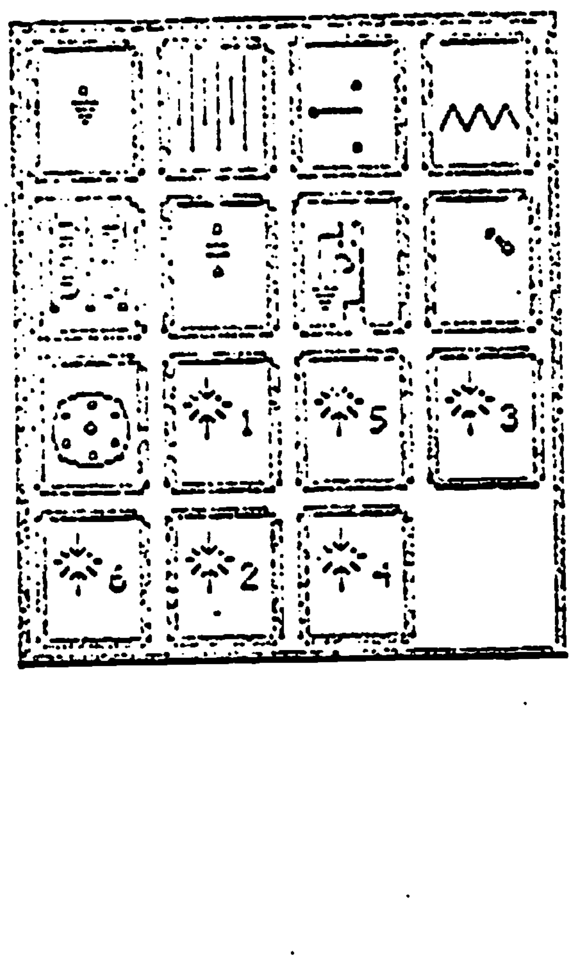


Fig. 5 Battery Ignition System Game

Mr. Smithson asks "Please can You help me?"

Now, as the expert, what would you like
to know about this system? (Ask PLATO questions)

> how are the brushes

The brushes are new.

Press -HELP- for suggestions on possible questions
Press -LAB- when you feel you know the correction
and/or check that is needed.

Fig. 6 Sample Frame From The Starter Motor Diagnosis Lesson

What must be done to fix this automobile?

.. fill the gas tank
2. recharge or replace battery
3. clean cable clamp and terminal; tighten clamp
4. bench test the cranking motor
5. free pinion
6. check commutator, brushes, and connections
7. repair solenoid and tighten connections
8. car in A1 condition (even an engine in perfect conditio will crank slowly if its too cold.)
9. Check fuel pump, line, choke and carburetor
10. replace solenoid
11. install new shift-lever return spring
12. check engine to find trouble
13. get a new car

>

After making your choice, Press -NEX

Fig. 7 Possible Alternatives In The Starter Diagnosis Lesson people, each of whom have a different problem with starting their car. The student then must ask questions which will enable him to diagnose the malfunction. An example of a student's question and the computer response is shown in Fig. 6. After the student has asked enough questions and feels he knows the problem, he presses the -LAB- key and is presented a list of 13 alternative actions (Fig. 7). If he is wrong he is returned to the problem and allowed to ask more questions or to press the -HELP- key for some suggestions. When he has successfully resolved the problem, he may either leave the lesson or attempt another problem.

In the area of training management, the PLATO system is being applied to test analysis and student record keeping. One program has been prepared to gather data on how students respond to multiple choice examinations. In this case, all of the major tests will have been programmed into the system. Thus, when the students take each test their responses will be stored in the system for scrutiny at a later time. A display of some sample data which demonstrates the capability of this program is shown in Fig. 8. This program shows for any specified test (in this example it is #111) the number of times each of the four possible responses were marked by each student (represented by the three letter initials to the right of the response frequencies), and the total number of times each response was selected.

An example display of information on how students as a group responded to each item in a test is shown in Fig. 9. Here (again for test #111) the responses to each question are displayed for all students. If a specific question has an inordinate number of right or wrong responses, that item can be called up and displayed on the screen without leaving the analysis program. In this way, each item, in any sequence, can be examined to determine what it is that may make them too difficult or too easy.

A third feature of this program is the capability to examine the individual student performance. By entering the student's name, his performance on each of the tests can be monitored along with his overall percentage for all tests. The capability is illustrated in Fig. 10 for student "ccd". Each test in which this student failed to meet the criterion of 60% correct is marked to assist the instructor to identify the tests with which the student had difficulty.

Further Applications

In addition to the development of instructional lessons and management capabilities, various authoring aids have also been implemented on PLATO. One such aid, PIRL (PLATO Indicated Reading Level), has nothing whatever to do with the TUTOR programming language; instead, it is a lesson designed to assist an author in determining if his materials are written at a proper difficulty level for the intended users. Simply, PIRL only requires that the author or a secretary type into the computer the narrative material to be analyzed. In turn, the computer will present

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TEST #: 111_   # QUES: 18_

# CORR:	%	a	b	c	d	NAME:
16	89	16	Ø	2	Ø	ccd
16	89	16	Ø	1	1	rwb
16	89	16	Ø	2	Ø	ccd
2	11	2	5	5	6	ccd
18	1ØØ	18	Ø	Ø	Ø	ccc
18	1ØØ	18	Ø	Ø	Ø	sss
18	1ØØ	18	Ø	Ø	Ø	qqq
14	78	14	Ø	Ø	Ø	ssss
15	83	15	1	Ø	1	willia
1	6	1	Ø	Ø	17	trial
Ø	Ø	Ø	Ø	Ø	18	ccd
5	28	5	5	4	4	ccd
3	17	3	3	2	2	ccd
4	22	4	8	5	1	joe
18	1ØØ	18	Ø	Ø	Ø	ccd
7	39	7	3	3	5	dennis
12	67	12	2	2	2	dennis
183	51	183	27	26	57	

Fig. 8 Sample Test Analysis Display

TEST# 111 QUES.#	RESPONSES: a	b	c	d	CORR [illegible]P:	
1	10	2	2	3	A	less than 60% correct!
2	10	2	1	3	a	less than 60% correct!
3	8	1	3	1	a	less than 60% correct!
4	7	1		7	a	less than 60% correct!
5	10	3	1	2	a	less than 60% correct!
6	13	1		3	a	
7	11		1	5	a	less than 60% correct!
8	11	1	1	4	a	less than 60% correct!
9	9	2	2	4	a	less than 60% correct!
10	10	4	1	2	a	less than 60% correct!
11	9	4	1	2	a	less than 60% correct!
12	11	2		3	a	less than 60% correct!
13	11	1	1	3	a	less than 60% correct!
14	9		4	3	a	less than 60% correct!
15	11	1	3	1	a	less than 60% correct!
16	10	1	2	3	a	less than 60% correct!
17	12		2	2	a	
18	11	1	1	3	a	less than 60% correct!
TOTALS=	183	27	26	57		

To look at individual questions, type question number and press -NEXT-.

>

Fig. 9 Sample Test Question Analysis Display

Student Name > ccd ok

TEST #	# QUEST.	# CORR.	%	
111	18	16	89	
111	18	16	89	
111	18	2	11	did not make criterion
121	8	2	25	did not make criterion
222	18	17	94	
333	18	1	6	did not make criterion
111	18	Ø	Ø	did not make criterion
111	18	5	28	did not make criterion
111	18	3	17	did not make criterion
433	2Ø	6	3Ø	did not make criterion
111	18	18	1ØØ	
655	18	5	28	did not make criterion
			43	composite percentage

That's all for ccd!!

Fig. 10 Sample Student Performance Analysis Display a print-out which lists (1) an estimate of the reading grade level difficulty, (2) the number of words in the sample, (3) the number of sentences, and (4) the total time it took to type the sample. (Fig. 11). An additional print-out (Fig. 12) also presents a frequency count, by word length, of the words in the sample.

Although numerous readability formulas exist, for the most part, they are monotonous and boring to use. Therefore, PIRL was designed specifically as a quick and simple method for analyzing one's writing. It requires no variations from normal typing behavior, and although it is not capable of prescribing stylistic or syntactic changes, it nevertheless provides an author with data about his writing which hopefully will result in more effective material.

The PIRL estimate of reading grade level difficulty is based on factors commonly found in traditional readability formulas. Specifically, PIRL utilizes estimates of sentence difficulty (number of words per sentence) and word difficulty (number of letters per word) to arrive at an overall estimate of difficulty. To determine the accuracy of PIRL relative to more commonly used readability formulas a small study was conducted at Chanute in which 400 word narrative samples from five technical areas were analyzed by four different groups of individuals. The first group of 27 technicians/authors were assigned to the technical areas and they analyzed the samples (except for the sample from their area) using the FOG count (AFP 10-1). A second group of six clerk-typists and a third group of seven PLATO authors merely typed the samples into the computer to obtain a PIRL estimate of difficulty; whereas, the last group of nine education and training specialists performed a Flesch count on the five samples. Table 1 summarizes these results, and on the basis of this limited sample, it can be seen that the difficulty estimates are quite similar.

Average Estimated Reading Difficulty Level of 5 Technical Samples

Table 1

Sample	FOG Count	PIRL (6)	PIRL (7)	FLESCH
1	13.2	13.5	13.9	13.7
2	9.4	9.5	9.4	9.4
3	15.5	14.8	14.9	13.9
4	9.8	10.9	10.8	11.0
5	14.6	14.5	14.8	13.9

As with most indexes of reading difficulty, PIRL does have certain drawbacks. For one thing, it is only a measure of reading difficulty and, therefore, it cannot be used as a guide to better writing. However, an author can review his writing characteristics and attempt to make certain

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- TYPE MATERIAL AT THE ARROW: Press -NEXT- when finished.
-HELP-

> Another such area is one that involves the worldwide dissemination of weather data. As you probably know, Air Force Communications Service (AFCS) is responsible for maintaining and operating the communications networks over which meteorological data are disseminated.

12 12 8 7

Reading level...14.0
Number of sentences.....2 Total number of words...37
-SHIFT NEXT- for new sample, -DATA- to store this data
Time... 1.8 minutes

Fig. 11

You have room for 10 more samples before
the data collection file is filled.

	(123)	(456)	(789)	(10+)	#words	#sen	PIRL
(1)	12	10	8	7	37	2	14.0
(2)	2	8	2	1	13	2	4.67
(3)	1	3	2	5	11	2	5.50
(4)	0	2	7	6	15	1	16.3
(5)	11	19	6	4	40	2	13.8
	26	42	25	23	116	9	...TOTAL
	5	8	5	4	23	1	...MEAN

Mean PIRL of 5 samples... 10.9

-NEXT- to store more data
-SHIFT DATA- to delete this
data and start a NEW sample

Fig. 12

adjustments in his future writing, such as using simpler words or shorter sentences. It is important to emphasize, however, that material which has just been analyzed should be totally rewritten if it is found to be unacceptable. Artificially deflating the PIRL index by breaking up sentences and inserting shorter words could seriously interrupt the "flow" of the writing and result in even poorer materials. Readability formulas provide only a gross estimate of readability, in general, their accuracy increases with larger samples, but unfortunately, they are incapable of assessing writer style, organization, syntactic structure, content difficulty, etc. As such, they should be used with care and only as one indicator of the acceptability of written materials.

Summary

In addition to those lessons previously described, an operational service test of PLATO lessons covering approximately 50 training objectives in the Special Vehicle Maintenance curriculum will begin in January, 1975. This phase will run six months during which detailed records of the effectiveness and management of PLATO based training at Chanute will be kept. In September of that year a comprehensive technical report will be published which presents the results of that service test.

Sheppard PLATO IV Service Test

As previously mentioned, the Air Force has usually demonstrated training innovations in highly cognitive areas, such as, electronics, electrical systems repair, etc. In its evaluation of the PLATO IV system, however, a more representative sampling of technical training was desired, therefore, the Special Purpose Vehicle Maintenance Course was chosen at Chanute AFB and the Physician Assistant Course (3ALR91730) was selected at Sheppard Technical Training Center. Together, these course areas cover a spectrum of perceptual-motor and cognitive skills which should provide a unique testbed for a valid evaluation of PLATO.

The Physician Assistant (PA) program at Sheppard is a relatively new course (two years old) which was initiated as a means of maintaining quality health care services in the Air Force. The Air Force and the other military services as well, are presently faced with a physician shortage which has worsened with the implementation of the all-volunteer force. The PA program, which is analogous to paramedic training in civilian universities, is designed to deal with this shortage by graduating highly trained and dedicated individuals who are able to deal with common and minor ailments (colds, bone breaks, muscle injuries,etc.) which normally consume a significant portion of a physician's time. A physician, therefore, with the assistance of a PA, is free to devote more of his time to serious ailments and diseases which require the expertise of a practicing doctor.

In its present configuration, the PA course is two years in duration and is accredited by the University of Nebraska. The first year consists of 1430 hours of primarily didactic material; whereas, the second year the PA trainee actually works in a hospital environment under the close supervision of a physician. Current plans call for the utilization of 200 hours of PLATO-directed material in the first year of the course, however, the exact relationship of the PLATO material to the existing course instruction has not yet been determined. Approximately 200 students a year (Air Force and Navy) are expected to graduate from the course on an annual basis.

The PA course was selected for a demonstration of the PLATO system because it was felt that a restructuring of the PA curriculum via PLATO could result in significantly improved training. To clarify this point, it is first necessary to gain a better understanding of a traditional medical curriculum. The current PA curriculum parallels the traditional curriculum in that the instruction is segmented into essentially three levels. The first, and most general level, can best be described as a "core of knowledges" which consists primarily of a background in basic sciences. Once this level has been mastered, the student advances to the second level, or, "core of skills"; specifically, those clinical skills unique to the medical profession, such as, physical assessment, history taking, diagnosis, therapy, etc. Finally, the third level encompasses a "core of behaviors" which, on a general level, refers to those interpersonal behaviors required of a doctor in his patient interactions.

Although the preceding levels cover all the necessary components of a medical education, a physician or PA is not deemed competent unless he is able to integrate the knowledges and skills in these levels and apply them towards the resolution of a medical problem. Unfortunately, due to the disjointed nature of a traditional medical curriculum, this must occur more or less spontaneously at some point in the student's educational cycle. Medical educators have, therefore, suggested major changes in the medical curriculum to make it more problem-oriented, and accordingly more relevant to the student's needs. Ideally under the problem-oriented curriculum (POC) approach, a student would be faced with a set of clinical problems, the resolution of which would lead him through the instructional material in an instructionally valid sequence. Thus, a student faced with certain patient symptoms would gain experience in problem-solving as well as receive instruction in basic science material and clinical material relevant to the immediate problem. The end result of such an instructional sequence is hopefully a student who has better mastered the necessary background material, as well as refined his problem-solving skills in differential diagnosis and the prescription of therapy. Actually, the educational process being described is one which would exist if each student was able to have his own physician-tutor. Obviously, such a relationship is not possible with the existing doctor shortage, nor could it be termed cost-effective. It may be feasible, however, to establish a "model" tutor using the capabilities of a computer which could easily store all the components of a medical curriculum and provide easy accessibility to them in resolving medical problems. The extent to which this can be accomplished utilizing the PLATO IV system is one of the more important questions being addressed in this service test.

At this point, a more detailed explanation of the problem-oriented curriculum (POC) is necessary in order to understand how it can be merged with PLATO into an effective instructional system. Loosely defined, the POC uses clinical problems, as both a point of departure and reference, for teaching in an integrated manner the areas of anatomy, neuroscience, physiology, pathology/pathophysiology and clinical medicine, pharmacology/therapeutics, and laboratory techniques. Initially, in the PLATO version of the PA course, only those patient complaints or symptoms concerned with the respiratory system will be dealt with, since this area can be restricted to a fairly well defined body of knowledge, and associated medical problems are common to the Air Force population with whom the PA will be working. It is expected that individual lessons within the POC that deal with simulated patient encounters and the clinical sciences will be integrated, but potentially free standing. That is as a student attempts to diagnose and test a given problem, he can access appropriate basic and clinical science material from any point within a lesson sequence. Essentially, therefore, in addition to the mastery of necessary cognitive material, the student will also receive practice in differential diagnosis and prescribing therapy, an exercise which requires a thorough integration of all components of the medical curriculum.

It is important to emphasize that the problem-oriented curriculum is a significant undertaking which hopefully will utilize the full capabilities of the PLATO system. At this point in the service test, the difficult transition from a conceptual system to an operational instructional system is taking place, that is, a set of clinical problems (respiratory system) have been defined and lessons are being developed and integrated to complete the instructional sequence. A team approach is being used in lesson development which essentially consists of individual subject matter experts working on a lesson segment supportive of a major clinical problem(s). In addition, a technical support team exists in the service test which will assist authors in pro gramming lessons, setting up testing routines, or establishing overall management functions. At the present time, the Sheppard service test has been in existence for approximately seven months. A significant portion of that time has been devoted to author training and to planning for the problem-oriented curriculum. The overall effort is supported by an interdisciplinary team of approximately 15 individuals: computer programmers, instructional technologists, physicians, PAs, basic scientists, and psychologists. In addition, a close working relationship exists with CERL at the University of Illinois and the Technical Training Division of the Air Force Human Resources Laboratory at Lowry AFB, CO.

Conclusions

As stated previously, the Air Force has closely monitored the development of instructional innovations which offer the potential for more cost-effective technical training. At the present time, the implementation and evaluation of the PLATO IV system is one of the most important projects, simply because PLATO offers unique instructional advantages not found in typical CAI systems. There are, however, many questions to be answered before PLATO can be considered a viable medium in technical training. For example, what types of technical training materials are effective on PLATO? What are the instructional advantages and disadvantages of the PLATO system? What administrative and organizational changes are required to implement a computer-based educational system into the Air Force? What are instructor and student attitudes towards CAI? And finally, what are the costs associated with a computer-based system? The preceding questions are only a sampling of the questions which the Chanute and Sheppard service tests hope to address, but they are questions which must be answered if rational decisions concerning computer-based instruction in Air Force technical training are to be made.