AD A047103

(12)

ARI TECHNICAL REPORT
TR-77-A20

THE EFFECTIVENESS OF ALTERNATIVE MEDIA IN CONJUNCTION WITH TEC FOR IMPROVING PERFORMANCE IN MOS RELATED TASKS

by

W. G. Hoyt, F. D. Bennik, and A. K. Butler

System Development Corporation
2500 Colorado Avenue
Santa Monica, California 90406

DECEMBER 1977

Contract DAHC 19-76-C-0027

Prepared for

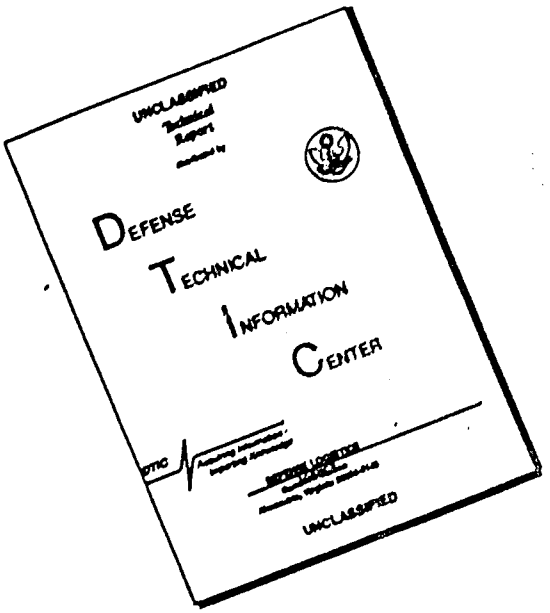
U.S. ARMY RESEARCH INSTITUTE
for the BEHAVIORAL and SOCIAL SCIENCES
5001 Eisenhower Avenue
Alexandria, Virginia 22333

AU NO. ____
DDC FILE COPY

DDC
RECEIVED
NOV 28 1977
B

Approved for public release; distribution unlimited.

DISCLAIMER NOTICE



THIS DOCUMENT IS BEST QUALITY AVAILABLE. THE COPY FURNISHED TO DTIC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

U. S. ARMY RESEARCH INSTITUTE
FOR THE BEHAVIORAL AND SOCIAL SCIENCES

A Field Operating Agency under the Jurisdiction of the Deputy Chief of Staff for Personnel

J. E. UHLANER
Technical Director

W. C. MAUS
COL, GS
Commander

Research accomplished under
contract to the Department of the Army

System Development Corporation

NOTICES

DISTRIBUTION: Primary distribution of this report has been made by ARI. Please address correspondence concerning distribution of reports to: U. S. Army Research Institute for the Behavioral and Social Sciences, ATTN: PERI-P, 5001 Eisenhower Avenue, Alexandria, Virginia 22333.

FINAL DISPOSITION: This report may be destroyed when it is no longer needed. Please do not return it to the U. S. Army Research Institute for the Behavioral and Social Sciences.

NOTE: The findings in this report are not to be construed as an official Department of the Army position, unless so designated by other authorized documents.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: ARI Technical Report TR-77-A20	2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER	
4. TITLE (and Subtitle): THE EFFECTIVENESS OF ALTERNATIVE MEDIA IN CONJUNCTION WITH TEC FOR IMPROVING PERFORMANCE IN MOS RELATED TASKS.	5. TYPE OF REPORT & PERIOD COVERED: Final rept.
6. PERFORMING ORG. REPORT NUMBER: SDC-TM-5841/000/01	
7. AUTHOR(s): W. G. Hoyt, F. D. Bennik[redacted] A. K. Butler	8. CONTRACT OR GRANT NUMBER(s): DAHC 19-76-C-0027
9. PERFORMING ORGANIZATION NAME AND ADDRESS: System Development Corporation, 2500 Colorado Avenue, Santa Monica, CA 90406	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: 2Q763743A771
11. CONTROLLING OFFICE NAME AND ADDRESS: US Army Field Artillery School, Ft Sill, OK 73503	12. REPORT DATE: Dec[redacted]77
	13. NUMBER OF PAGES: ~~110~~ 122p.
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office): US Army Research Institute for the Behavioral and Social Sciences, 5001 Eisenhower Ave[redacted], Alexandria, VA 22333	15. SECURITY CLASS. (of this report): Unclassified
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Project monitored technically by Arthur Marcus, Educational Technology and Training Simulation Technical Area (James D. Baker, Chief), Army Research Institute.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Computer Assisted Instruction
Computer Training
Instructional Systems

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This research report addresses two questions: Does CAI provide a suitable and acceptable media for delivering Training Extension Course (TEC) materials to field units? Can Army lesson developers feasibly be trained to convert self-paced, audio-visual materials into CAI format and easily update such materials?

The approach used was to convert TEC materials into CAI format. The job

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

339900

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

Item 20.

sequence for each task was followed and each new topic was introduced as needed. This provided a logically-structured, integrated, functional, product-oriented, learner-centered approach. Maximum use of job aids and procedures guides were used in carrying out the Instructional System Development (ISD) process.

At the US Army Field Artillery School a total of 490 hours were required for four course development personnel to learn to convert TEC audio visual lessons to computer assisted instruction (CAI) lessons with the same training objectives. Two Observed Fire TEC lessons were converted to PLANIT CAI following the Instructional System Development process (ISD). These lessons were reviewed by subject matter experts, and a preliminary evaluation on Army students was conducted. Additionally, four other TEC lessons were converted to CAI. Average cost of developing each of four CAI lessons with pre- and post tests was 128 man hours and $681 in hardware/software cost for each CAI lesson.

In addition to the six lessons converted, contractor project personnel developed the same six Observed Fire lessons in a Text Presentation (paper-and-pencil) format with the same objectives as the TEC and CAI lessons. Module pre-and post tests for on-line computer administration for the six lessons were also prepared. These efforts provide the Field Artillery School with three media for six Observed Fire lessons, audio visual, CAI, and paper-and-pencil combinations of these.

This report demonstrated capability to develop, execute, evaluate and validate CAI lessons.

The results of this report suggest that: CAI can be cost effective; development and evaluation lead time can be short; Army lesson developers can be trained in a relatively brief period. Hence, CAI has the potential for cost savings in course development, evaluation, and administration. The results also suggest potential training effectiveness as a result of individualized self-paced instruction inherent in the use of CAI, and evaluation capabilities useful in the management of the instructional process.

ACCESSION for
NTIS White Section
DDC Buff Section
UNANNOUNCED
JUSTIFICATION
BY
DISTRIBUTION/AVAILABILITY CODES
Dist. AVAIL. and/or SPECIAL
A 23

FOREWORD

This research was conducted by the System Development Corporation (SDC) for the U.S. Army Research Institute for the Behavioral and Social Sciencies (ARI) under contract number DAHC19-76-C-0027, The Effectiveness of Alternative Media in Conjunction with TEC for Improving Performance in MOS Related Tasks. Mr. Arthur Marcus, ARI, was the technical contract monitor.

The course materials on Observed Fire developed as a part of this project by the U.S. Army Field Artillery School and project personnel in the CAI and printed (Text) media are available from the U.S. Army Research Institute.

ACKNOWLEDGEMENTS

The System Development Corporation wishes to acknowledge the efforts made by the U.S. Army civilian and military personnel in the development of course materials and conduct of this project. Our sincere thanks to:

U.S. Army Research Institute

Mr. James Baker
Dr. Leon Nawrocki
Mr. Arthur Marcus
Mr. John Larson

U.S. Army Field Artillery School

B.G. John S. Crosby
Maj. John A. Evans
Mr. James W. Bowick
Mr. Douglas M. Converse
Mr. Robert G. Horn
Mr. Billy J. Hudson

Preceding Page BLANK - NOT FILMED

TABLE OF CONTENTS

Section		Page
1	EXECUTIVE SUMMARY	1-1
	A. Problem	1-1
	B. Methodology	1-1
	C. Results	1-2
	D. Implications for Army Training	1-3
2	INTRODUCTION	2-1
	A. Project Background	2-1
	B. Purpose of the Project	2-3
	C. Project Objectives	2-4
	D. Organization of this Final Report	2-4
3	PREPARATIONS FOR THE TECMEDIA CAI WORKSHOP AND CONVERSION COURSE	3-1
	A. Defining System Parameters	3-1
	B. TEC-CAI Conversion Requirements	3-3
	C. TEC-CAI Conversion Data Collection System	3-8
	D. TEC-to-CAI Conversion Workshop Plan	3-16
4	CONDUCT OF THE TECMEDIA CAI WORKSHOP AND CONVERSION COURSE	4-1
	A. Preliminary Activities	4-1
	B. Conduct of the TECMEDIA CAI Workshop	4-2
	1. Preparation of CAI Lessons	4-2
	2. Subject Matter Expert (SME) Reviews	4-7
	3. Student Tryouts-Lessons 0001 and 0002	4-9
	4. Problem Areas in the Workshop	4-13
	C. Conduct of the Six Week TEC-to-CAI Conversion	4-14
	1. Preparation of CAI Materials	4-14
	2. Subject Matter Expert (SME) Reviews	4-15
	3. Student Tryouts - Lessons 0003 to 0006	4-15

TABLE OF CONTENTS (Cont.)

Section		Page
5	RESULTS	5-1
	A. Preliminary Evaluation of the Suitability of CAI as One Means for Providing TEC Instruction.	5-1
	1. Test Scores	5-2
	2. Attitude of Students.	5-2
	3. Attitude of SMEs.	5-6
	B. TEC-to-CAI Conversion Costs	5-7
	1. Means Hours Required (Per Lesson - Based on Four Lessons).	5-8
	2. Computer Costs (Derived - Per Lesson)	5-8
	3. Telephone Costs (Derived)	5-8
	C. Workshop Training Time Required	5-10
	D. TEC-to-CAI Conversion Time and Types of Difficulties During Conversion Course	5-11
	1. Tec-to-CAI Conversion Time.	5-11
	2. Types of Difficulties Encountered	5-12
	E. Three Alternative Versions.	5-14
	1. CAI Stand-Alone	5-14
	2. CAI/Audio-Visual Combination.	5-15
	3. Text Presentation	5-15
	4. Observed Fire Modular Pre- and Post Tests	5-16
	F. Trained USAFAS Cadre.	5-16
6	TEXT PRESENTATION	6-1
	A. Introduction.	6-1
	B. Production of Text Lessons.	6-1
	C. Observed Fire Module Pre- and Post Tests.	6-3
7	CONCLUSIONS AND RECOMMENDATIONS	7-1
	A. Conclusions	7-1
	B. Recommendations	7-3

TABLE OF CONTENTS (Cont.)

Section		Page
Appendix A -	Scope of Project.	A-1
Appendix B -	Procedure Guides for Accessing and Operating the UNIVAC 1108/EXEC 8, Text Editor and Planit Systems. .	B-1
Appendix C -	TEC-to-CAI Conversion Workbook Examples	C-1
Appendix D -	Data Collection System.	D-1
Appendix E -	TEC-to-CAI Conversion Workshop Schedule	E-1

LIST OF FIGURES

Figure		Page
4-1	Workshop Area - Room 23, Snow Hall.	4-3
4-2	Team 1 Working on Scripts	4-5
4-3	Team 2 Working on Scripts	4-5
4-4	Inputting Lesson Frames into the Computer	4-6
4-5	Executing and Editing the Lesson.	4-6
4-6	Subject Matter Expert Review.	4-8
4-7	Student Tryout.	4-10
4-8	PLANIT Student Record-Tests	4-10
4-9	PLANIT Student Record-Lesson Execution.	4-11
B-1	Procedure Guide to Sign on to the UNIVAC System	B-3
B-2	Procedure Guide for Use of Text Editor - Input Mode . . .	B-4
B-3	Procedure Guide for Use of Text Editor - Edit Mode. . . .	B-5
B-4	Procedure Guide to Build a Lesson Using PLANIT.	B-6
B-5	Procedure Guide to Use of PLANIT Editing Commands to Modify (Replace) Material	B-7
B-6	Procedure Guide for Running (Executing) a PLANIT Lesson.	B-8
C-1	Final TEC Narration Script.	C-3
C-2	Step 1 - Review TEC Lesson with Script.	C-4
C-3	Step 2 - Modify Annotated Script.	C-5
C-4	Step 3 - Rewrite Script in Frame Order.	C-6
C-5	Step 4 - Encode Frames for CAI.	C-7
D-1	TEC/CAI Background Data Questionnaire	D-3
D-2	Daily Individual Activities Log	D-5
D-3	Monitor's Observation Log	D-6
D-4	Questionnaire (SME)	D-7
D-5	Guidelines for Subject Matter Review.	D-9
D-6	CAI Lesson Review	D-10
D-7	Questionnaire (S)	D-12
D-8	CAI Student Attitude Questionnaire.	D-13
D-9	Student Interaction Record.	D-19
D-10	PLANIT Student Record	D-20

TABLE OF CONTENTS (Cont.)

Figure		Page
E-1	Conversion Workshop Schedule Block 1 (Week 1): Prepare TEC Material for CAI Conversion.	E-3
E-2	Conversion Workshop Schedule Block 2 (Week 2): Prepare Material in PLANIT	E-5
E-3	Conversion Workshop Schedule Block 3 (Week 3): Evaluate and Revise Converted Materials.	E-7

LIST OF TABLES

Table		Page
3-1	TEC-to-CAI Conversion Tasks.	3-5
3-2	TEC-to-CAI Conversion Requirements	3-9
5-1	Student Pre- and Post Test Scores.	5-3
6-1	Text Lesson Objectives and Test Items.	6-4

Section 1. EXECUTIVE SUMMARY

A. PROBLEM

Certain instructional situations or settings may permit making alternative delivery systems available for assignment to or selection by trainees. However, there is little sense in considering alternative delivery systems for the same training objectives unless there is evidence of the feasibility and utility of their employment in Army training, and training development settings. Within this context, the following questions were posed: Does CAI provide a suitable and acceptable media for delivering TEC materials to field units? Can Army lesson developers feasibly be trained to convert self-paced, audio-visual materials into CAI format and easily update such materials?

B. METHODOLOGY

A three-week training workshop was conducted to train Army lesson developers in the process of developing, executing, and evaluating CAI courseware materials. TEC lessons were converted in this process.

The workshop was followed by a six-week conversion course in which lesson developers converted additional TEC materials into CAI format, executing and evaluating the course materials.

The approach used in the workshop and conversion course was to follow the job sequence for the task and introduce each new topic as it was needed and applied in this process. This provided a logically structured, integrated, functional, product oriented, learner centered approach to the workshop and the conversion course. Maximum use of job aids and procedures guides were used in carrying out the Instructional System Development process.

C. RESULTS

Four Directorate of Course Development personnel at the U.S. Army Field Artillery School each averaged 123 hours of workshop training, a total of 490 hours, to become proficient in converting TEC audio visual lessons to computer assisted instruction (CAI) lessons with the same training objectives. During the workshop the four course developers, in teams of two, following the Instructional System Development (ISD) process, converted two Observed Fire TEC lessons to PLANIT CAI, had them reviewed by subject matter experts, and conducted a preliminary evaluation on Army students.

During the six-week conversion course, each of the four personnel converted an additional TEC lesson on Observed Fire, completing the series of six lessons to CAI. These were also reviewed by subject matter experts for technical accuracy and current tactical doctrine and a preliminary evaluation conducted using Army students. Average cost of developing each of the four CAI lessons with pre- and post tests, approximately 1¼ hours, through preliminary evaluation (small group tryout) is as follows:

Course Developer	- 111 hours
Subject Matter Expert (2 @ 1½ hours)	- 3 hours
Students (tryout - 7 @ 2 hrs.)	- 14 hours
Computer Costs	- $381
Telephone Costs	- $300

The above totals to 128 man hours and $681 for each CAI lesson.

The course developers prepared their own off-line course exhibits. Course listings, test scoring, student records, and other course development administration was done by the computer and included in the above costs. Calendar time for development of a lesson through preliminary evaluation is 30 working days.

Subject matter expert and student reaction to the six Observed Fire CAI lessons was excellent.

In addition, project personnel have developed the same six Observed Fire lessons in a Text Presentation (paper-and-pencil) format with the same objectives as the TEC and CAI lessons. Module pre- and post tests for on-line computer administration for the six lessons have also been prepared. This provides the Field Artillery school with three media for the six Observed Fire lessons, audio visual, CAI, and paper-and-pencil and combinations of these.

The U.S. Army Field Artillery School personnel involved are capable of developing their own CAI lessons, executing them, evaluating and validating them via computer. The school is currently in process of conducting a large group validation of the Observed Fire CAI lessons and will be updating changes in tactical doctrine for 40 hours of PLANIT courseware which exists in the USAFAS TACFIRE Department. Other areas for CAI courseware development are being considered.

D. IMPLICATIONS FOR ARMY TRAINING

The results show that CAI development costs are low, the development and evaluation lead time is short, and Army lesson developers can be trained in a short time period. The CAI system provides cost savings in computerizing the course development, evaluation, and administration process. Lessons are listed, changes (editing) are made, lessons are executed, tests are scored, and prescriptives generated by computer action. At the same time, CAI fully incorporates a more truly individualized self-paced mode of course presentation with computerized control of the learning process. CAI has a further benefit that early in the ISD process, course material is in the format as the student sees it. This facilitates the subject matter expert review and course execution process.

CAI materials are quickly, easily, and inexpensively updated as changes in tactical doctrine occur.

Further, the requirement in CAI that the student gets feedback and advances only after committing to a substantive response suggests that the CAI process requires closer adherence to the ISD process in that the student either meets the objectives or does not. Data backing the ISD process, e.g., course listings, student lesson interaction, and lesson and module tests, are easily and automatically produced and scored by the computer. These records now provide the evaluation and validation data, including attitudinal data, which ensures that the ISD process and standards have been met. CAI has the benefit of clarifying and simplifying the ISD process to course developers, in that use of the CAI authoring language forces a structured, highly procedural task centered approach.

Section 2: INTRODUCTION

A. PROJECT BACKGROUND

In the current TEC Media research effort, sponsored by the U.S. Army Field Artillery School (USAFAS), the U.S. Army Research Institute (ARI) addresses several interrelated, continuing needs: (1) To be able to rapidly up-date field manuals and other training materials, and (2) To make these materials available to men in units who must maintain or improve their Military Occupational Speciality (MOS) proficiency, and (3) Above all, to ensure that training be conducted with maximum efficiency, effectiveness, and economy.

Traditional methods of instruction have not been entirely successful in fulfilling these needs, even though substantial time, energy, and money have been expended in preparing field manuals and other training materials. Not only is such training literature frequently unavailable to men in units, but often what is available is out of date with respect to changes in doctrine and/or weaponry.

In 1971, by direction of the Chief of Staff, U.S. Army, the Board for Dynamic Training was established and tasked with recommending ways "To make training in units more exciting and meaningful." Among their key recommendations was a suggestion to: "Provide MOS-related unit training extension courses (UTEC) employing multi-media materials applicable for both individual and small group study."

Pursuant to this suggestion, the U.S. Army Combat Training Board (which was established as a follow-up to the Board for Dynamic Training) established a program to develop training extension course (TEC) material. Briefly, TEC materials consist of self-paced visual, audio, or audio-visual instructional packages dealing with subjects which are common to the four combat arms branches of the Army (Infantry, Armor, Field Artillery, and Air Defense). TEC

lessons for various military occupational specialties (MOS) have been developed and are currently undergoing field testing, evaluation, and revision.

These new materials are expected to constitute an improvement over traditional instruction, particularly from the point of view of effectiveness and efficiency. Nevertheless, what problems will be encountered with respect to rapid updating remain, as yet, undetermined. It is, in part, this demand for rapid update capability which provides a major impetus for exploring alternative delivery systems. Since one advantage of computers is their facilitative effect on authoring, editing, and updating of course content, CAI was the vehicle chosen for the first phase of the present study, with the possibility of additional media to be considered in later research.

Although many CAI efforts have relied upon dedicated systems, all indications suggest that time-shared, mini, and tactical computers may also be deployed effectively. Indeed, the Army, which has already successfully developed and fielded several tactical data systems, has begun to look into this question. Because it is likely that the conduct of peace-time tactical operations will not fully utilize the data processing capability of these computers, studies have been undertaken to determine the expedience of supporting unit and individual training requirements with these systems when they are not engaged in tactical operations. The Army Research Institute (ARI) demonstrated the feasibility of this concept in the Development Tactical Operations Systems (DEVTOS) located at the Modern Army Selected Systems Test Evaluation and Review (MASSTER) facility at Fort Hood, Texas.

As part of this continuing research effort, ARI has compared the estimated cost data of TEC training with conventional Army classroom instruction and has also compared the effectiveness of TEC training with that of conventional Army

classroom instruction. The results of this research have been published in the following ARI research reports.

> Research Problem Review 75-3, A Cost Assessment of Army Training Alternatives, August 1973
>
> Research Report 1188, Training Individuals in Army Units: Comparative Effectiveness of Selected TEC Lessons and Conventional Methods, December 1975

B. PURPOSE OF THE PROJECT

While the overall purpose of the TEC Media research program was to determine the efficiency and effectiveness of alternatives for providing TEC materials to units in the field, the present effort addresses one sophisticated alternative delivery system for TEC; namely, Computer Assisted Instruction. This study examined the potential advantages in implementing CAI in training extension courses. The major thrust was not to pit CAI directly against other training media. Implicit in such a treatment would be the assumption that alternative delivery systems are competitive rather than complementary. As a planning concept, TEC is not wedded to any particular device, medium, or technique. Indeed, there has been consistent Army-wide support (throughout both the training and research establishments) for exploring a full range of alternative delivery systems for TEC. A study of the TEC to CAI conversion process, as operable within an Army setting, represents the initial phase of this type of research. The current study investigated the requirements, associated procedures, resources, materials, and costs necessary to convert TEC lessons to CAI lessons which teach to the same training objectives.

The immediate goal was to ascertain the feasibility of having Army (in this case, Field Artillery School) lesson developers convert self-paced, audio-visual materials into CAI format.

C. PROJECT OBJECTIVES

The objectives of this effort were to:

1. Provide a formative (preliminary) evaluation of the suitability of CAI as one means for providing TEC instruction.
2. Determine the amount of time involved and the types of difficulty encountered in having Field Artillery School lesson writers convert audio-visual TEC material to appropriate CAI format.
3. Provide documentation of CAI-to-TEC conversion costs and procedures for conducting a more formalized training effectiveness evaluation.
4. Determine the training time required to provide Army lesson developers with the capability to produce CAI versions of TEC.
5. Make available three alternative versions of six selected TEC lessons (i.e., CAI stand-alone, CAI/Audio-visual Combination, Text Presentation).
6. Provide the USAFAS with a course development cadre trained in the practical steps of converting self-paced TEC audio visual lessons to CAI, and in the use of the computer system to input, check, edit, and update CAI materials.

The scope of the project in conformance with the above objectives are shown in Appendix A.

D. ORGANIZATION OF THIS FINAL REPORT

Information in this final report follows the sequence in which the tasks were accomplished as follows:

- Section 1 - Executive Summary
- Section 2 - provides the background, purpose, objectives, and scope of the project.

- Section 4 - explains how the workshop and conversion course were conducted
- Section 5 - provides the results obtained.
- Section 6 - explains the development of text and the modular pre- and post tests used with the three alternative versions of the six lessons on Observed Fire (TEC, CAI, TEXT).
- Section 7 - states the conclusions and recommendations stemming from the project.

The Appendix contains many of the procedures guides, job aids, experience questionnaires, student records, lesson listings, and attitude questionnaires developed and used in this project. Use of these materials is explained in the text for the appropriate section.

Section 3. PREPARATIONS FOR THE TECMEDIA CAI WORKSHOP AND CONVERSION COURSE

The workshop preparations involved four major areas as follows:

A. Defining System Parameters
B. TEC-CAI Conversion Requirements
C. TEC-CAI Conversion Data Collection System
D. TEC-to-CAI Conversion Workshop Plan

The procedures, products, requirements, and assumptions for each of these are covered in the paragraphs which follow.

A. DEFINING SYSTEM PARAMETERS

One of the first activities in this type of project is to define what systems are being used and the parameters and limitations of each. These in turn determine the preparations required to train individuals in the operation and effective use of the systems. In this project, the following systems came into use:

- UNIVAC 1108 computer and EXEC 8 operating system
- ADDS Consul, with telephone modem, and slave printer
- UNIVAC Data Base Management System and Text Editor
- PLANIT CAI Language and System

Three instructional techniques were employed to describe the operation and use of these systems.

- Classroom instruction incorporating "chalk talk" explanations.
- Reference and use of a specially prepared procedures guide containing detailed procedural steps, results of action, and comments (stimulus, action, response).

- "Hands-on" familiarization and use of each system via the ADDS 880 consul.

Instruction in accessing the UNIVAC 1108/EXEC 8 Operating System included steps to "power up" the peripheral equipment, establish data phone communication with the computer located at Edgewood Arsenal, and for entering the job statements correctly and in the proper sequence at the ADDS terminal to initiate interaction with the desired program or operation (e.g., Text Editor or PLANIT). (See Appendix B, Figure B-1.)

Course participants use of the Text Editor system was a means of building a card image file that would subsequently serve as an input to the CAI PLANIT system.

Course participants were given appropriate instruction in how to access the Text Editor and the capabilities and differences between the two basic operating modes--input (Appendix B, Figure B-2) and edit (Appendix B, Figure B-3). A subset of editing commands by which students could modify the card image input file was included in the procedures guide for student use. Appropriate instruction and on-line practice were provided. The procedures guide reference document was consulted as required as an aid to instruction and use of the Text Editor.

Before using the PLANIT system, the course participants received intensive off-line instruction as to the system's general capabilities and requirements. Language syntax and conventions that dictated the format in which TEC-to-CAI converted material was to be developed were presented and reviewed in detail. On-line instructions (Appendix B, Figure B-4) included procedures to "prestore" and "build" the lesson material from the card input files that were created using the Text Editor, how to execute and checkout the lesson material, and use of the editing features of PLANIT to make modifications

(Appendix B, Figure B-5) prior to validating the lesson material using Army personnel. "Prestore" and "Build" are PLANIT commands to enter lessons from card image format into the PLANIT System for execution. Course participants also received instruction on PLANIT record keeping capabilities and how to access and retrieve student performance records. As a final step, instruction and procedures were given on how to make the developed lessons "permanent" by transferring these lessons from the PLANIT system to permanent storage using the Data Base Management System within the UNIVAC 1108. The procedures guide reference document again served as an adjunct instructional aid to the on-line and off-line instruction concerning the use of the PLANIT system.

B. TEC-CAI CONVERSION REQUIREMENTS

The TEC-to-CAI conversion requirements specify the procedures, resources, and materials which are required to convert TEC lessons to CAI lessons which teach to the same training objectives, yet which enhance the reinforcement, test, and critical capabilities unique to the CAI training mode.

The conversion requirements served to:

- provide performance-oriented objectives and sequence for the three-week TECMEDIA CAI Workshop.
- specify the tasks for which time and difficulties data were collected during the preparation of CAI/TEC materials by Army personnel.
- specify the procedure which determined the design and operation of the TEC/CAI conversion data collection system.
- provide a procedure for converting TEC audio visual materials to CAI materials which is operable within an Army setting.
- provide a procedure which is independent of lesson content or type of test.

The four conversion steps for preparing TEC materials for CAI are:

1. Review TEC Lesson with TEC Script
2. Modify Annotated TEC Script
3. Rewrite Script in Frame Presentation Order
4. Encode Frame Sequence for CAI (PLANIT)

The workbook "TEC-to-CAI Examples" was prepared as a procedures guide showing the inputs and procedures, with two completely worked examples using the LAW TEC lesson training objectives. The workbook provided a working reference for each course designer during the workshop and conversion course. The approach used was to have easily managed, clearly defined, easily learned step-by-step procedures which introduced new material at the time it was needed and could be applied. Sample pages of the workbook showing the four steps are contained in Appendix C. These steps were incorporated into the five major conversion tasks, shown in Table 3-1.

A brief synopsis of each of these tasks is as follows:

Task-1. Review a CAI Lesson. The purpose of this task is to provide an overview of the CAI end product, i.e., the organization, frame formats, and execution order of a representative CAI lesson (e.g., a LAW lesson). The Army training specialist reviews a CAI lesson listing and student handouts, while executing the lesson at a terminal, noting how the frame constructions in the listing control displays, response-matching, feedback, and lesson execution order. He obtains portions of the execution record at the terminal printer to verify how lesson decision frames operate to provide conditional feedback and branching according to performance standards for the lesson pre-test, lesson segment, or end of lesson test. In the training workshop, this task also serves as a vehicle for teaching points on the capabilities, strengths, and restrictions of the particular CAI training mode.

Table 3-1. TEC-to-CAI Conversion Tasks

		Method
1.0	**Review a CAI Lesson**	
1.1	Obtain a CAI Lesson Listing	Available or use of PLANIT commands.
1.2	Execute CAI Lesson & Tests	PLANIT commands.
1.3	Compare CAI Lesson with Listing	Visual inspection.
1.4	Review Execution Records	PLANIT commands.
2.0	**Review TEC Lesson & Materials**	
2.1	Execute TEC Lesson to be Converted	Operate Beseler Cue-See.
2.2	Identify Areas of Change for Conversion	Annotate TEC script.
2.3	Gather & Review Related Content Materials	Available Army material.
3.0	**Prepare TEC for CAI Conversion**	
3.1	Modify & Sequence Existing Display Frames	Edit script & visuals.
3.2	Modify & Sequence Existing Question Frames	Change for CAI.
3.3	Prepare & Sequence New Question Frames	Write for CAI.
3.4	Specify Branching for Correct/Incorrect Responses	Update frames.
3.5	Prepare End of Lesson Test &Specify Decisions	Add new frames.
3.6	Organize Lesson Pretest & Specify Decisions	Add new frames.
4.0	**Prepare Material in PLANIT**	
4.1	Review PLANIT Conventions & Constraints	Checklist & references.
4.2	Encode Lesson & Test Frames in PLANIT	Notebook deskwork.
4.3	Input Lesson & Tests at Console	PLANIT entries.
4.4	Check PLANIT Listings & Student Handouts	PLANIT & inspection.
4.5	Checkout & Edit Materials at Console	PLANIT, student handout & job-aid
5.0	**Evaluate & Revise Materials**	
5.1	Obtain Listings & Student Handouts	PLANIT & reproduction.
5.2	SME Review of Materials	Inspect listings & handouts.
5.3	Edit Materials Based on SME Review	PLANIT/graphic arts.
5.4	Conduct Student Tryouts	PLANIT, records & interview.
5.5	Edit Materials Based on Tryouts	PLANIT/graphic arts.
5.6	Reproduce Student Materials	Reproduction.

Task-2. Review TEC Lesson and Materials. In this task the Army training specialist reviews the objectives, lesson pretest, lesson test items, the structure and content of the TEC lesson to be converted to CAI. As he takes the lesson on the Beseler Cue-See, he identifies and marks in the TEC audio script (containing visual cues) those areas of the TEC lesson that need expansion or change for CAI--for example: TEC questions that must be supplemented with anticipated correct-incorrect responses and associated feedback; portions of the script where additional questions are needed; existing TEC pretest items that require alternative forms for the CAI lesson post test; and, visuals that can be used directly or with modifications in the CAI student handouts. He also determines the need for, gathers, and familiarizes himself with the content of related FMs, TMs, and other Army materials. This work provides a basis for the next major task.

Task-3. Prepare TEC for CAI Conversion. The purpose of this first-stage conversion task is to modify, supplement, and organize frames of the existing TEC lesson so as to be directly convertible to the PLANIT CAI language and adjunct visual handouts. An existing TEC frame sequence consists of audio-visual information, instruction, questions, and comparison material for student self-check of answers. Much of the information, instructions, and questions will be transferable to on-line CRT displays. What is not, is transferred to off-line printed visuals either directly or with minor changes. Constructed response questions in TEC will, for CAI, require that correct and incorrect responses be anticipated and listed, while all types of questions will require appropriate feedback statements for correct, incorrect, and unanticipated student responses. TEC sequences may need additional questions to ensure mastery of component objectives of multiple-part criterion test items. New questions written for the CAI mode incorporate appropriate anticipated answers and answer feedback, including extra (remedial) frames for incorrect answers. Performance standards and conditional feedback or lesson control is specified at pretest, lesson segment, and lesson test checkpoints

for the CAI mode. The outcome of this task is a numeric sequence of "frames" and draft visuals compatible with the original TEC lesson but modified and supplemented for direct conversion to CAI. This material is organized and numbered in the training specialist's conversion notebook.

Task-4. Prepare Material in PLANIT. The training specialist modifies material in his lesson notebook from Task-3 in accordance with conventions of the PLANIT CAI language. He then inputs his lesson directly to the computer from the terminal keyboard using either the Text Editor system or the author mode of PLANIT. Entry of textual presentation, questions, and feedback statements is straightforward. Special language features are used to specify answer-matching, decision criteria, recordkeeping, and control requirements of the CAI lesson. Upon entering his lesson frames, the author obtains a lesson listing at the terminal printer and then self-administers the lesson frames in the student mode of PLANIT to check that they execute as intended and without error halts. Where errors are found, he uses PLANIT commands to edit the lesson in accordance with guidance provided by the PLANIT errors checklist. His on-line check includes the draft copies of the printed student adjunct materials so as to ensure compatibility of the CAI lesson with off-line visuals and clarity of usage instructions.

Task-5. Evaluate and Revise Materials. This final task assures that the converted CAI materials are suitable for initial student use. Army subject matter experts review the CAI lesson listings and draft visuals for appropriateness of technical-procedural content and tactical doctrine, noting changes in the lesson listing and providing clarification to the training specialist. The specialist then edits his CAI lesson and visuals in accordance with the SME's findings, and sufficient copies of the visuals are made for testing the lesson with a small number of students. This tryout with Army students naive to the subject matter and representative of the ability range of the target student group serves three purposes: (1) to improve

language-level, clarity, and adequacy of remedial material in the lessons in accordance with needs expressed by students while taking each lesson; (2) to ensure that the CAI instructions and procedures are appropriate; and (3) provide a small-sample verification that students meet lesson test standards after CAI training. Revisions to materials are made in accordance with findings of the tryout. Final lesson listings and off-line exhibits are then produced for the field studies.

The five conversion tasks given above are further detailed in Table 3-2, "TEC-to-CAI Conversion Requirements." This table shows the Input (support) Requirements, the Activity, and the Output/Product (task outcomes). These procedures follow the TRADOC ISD model as applied to TEC materials, given that the training objectives and tasks have already been specified.

C. TEC-CAI CONVERSION DATA COLLECTION SYSTEM

The TEC-to-CAI Conversion requirements provided the basis for the data collection system. This system was designed to obtain data on time and difficulties and other factors relevant to the purpose and conduct of the workshop and conversion course. The forms and logs developed and their purpose are as follows: Copies of the forms are included in Appendix D.

1. TEC-CAI Background Data Questionnaire - used to provide experience data of the course participants. Completed on the first day.
2. Daily Individual Activities Log - provides a daily self-report of the activities of each of the course participants. Collected daily during the workshop and conversion course.
3. Monitor's Observation Log - used by SDC personnel to provide a daily observational audit of task time, difficulties, and corrective actions occurring each day during the workshop and conversion course.

Table 3-2. TEC-to-CAI Conversion Requirements

Input Requirements	Task/Step	Activity	Output/Product
	1.0	REVIEW A CAI LESSON	
CAI lesson listing	1.1	Obtain a CAI Lesson Listing (e.g., LAW)	Lesson listing (if not already available)
On-line CAI lesson & student exhibits	1.2	Execute CAI Lesson & Tests	Familiarity with CAI lesson components & format
PLANIT	1.2.1	Execute lesson pretest.	Interaction hardcopy
Lesson structure exhibit	1.2.2	Execute lesson with correct & incorrect answers.	↓
ADDS Consul 880 terminal & terminal printer	1.2.3	Execute lesson post-test.	
	1.3	Compare CAI Materials & Listing During Execution	Annotated lesson listing
	1.4	Review Execution Records	Annotated lesson listing & execution record
	1.4.1	Attach & display record at CRT.	
	1.4.2	Obtain hardcopy if desired.	
	2.0	REVIEW TEC LESSON & MATERIALS	
Beseler Cue-See TEC filmstrip cartridge TEC audio cassette TEC objectives list	2.1	Execute TEC Lesson to be Converted	
	2.1.1	Give correct & incorrect answers.	Familiarity with lesson objectives, components & structure
	2.1.2	Identify frames which test listed objectives.	

Table 3-2. TEC-to-CAI Conversion Requirements (Cont.)

Input Requirements	Task/Step	Activity	Output/Product
	2.1.3	Identify pretest, preview, lesson, review and lesson test segments.	
Lesson Admin. Instructions	2.1.4	Identify pretest & lesson test standards.	
TEC audio script & visuals ↓	2.2	Identify Areas of Change for Conversion	Annotations on script and notepad ↓
	2.2.1	Confusing or misleading audiovisual material.	
	2.2.2	Portions of script requiring added questions.	
	2.2.3	Questions requiring anticipated answers and student feedback.	
	2.2.4	Instructions for students requiring clarification.	
	2.2.5	Visuals suitable-unsuitable for printed exhibits.	
Army files & SMEs	2.3	Gather & Review Related Content Materials	
	2.3.1	Determine if need exists.	
	2.3.2	Obtain & review if necessary.	Content references
	3.0	PREPARE TEC FOR CAI CONVERSION	
TEC audio script with visual cues from 2.2 ↓	3.1	Modify & Sequence Existing Display Frames	
	3.1.1	Identify material directly transferable to CRT.	Annotated script ↓
	3.1.2	Identify material transferable to CRT with editing.	
Working copies of TEC visuals & content references ↓	3.1.3	Identify visuals directly transferable to exhibits.	
	3.1.4	Identify visuals transferable to exhibits with editing.	
	3.1.5	Prepare textual frame changes.	Edited script
	3.1.6	Draft changes to copies of visuals.	Draft changes or spec.
Notebook	3.1.7	Sequence changed presentations.	Lesson Notebook

Table 3-2. TEC-to-CAI Conversion Requirements (Cont.)

Input Requirements	Task/Step	Activity	Output/Product
TEC audio script	3.2	Modify & Sequence Existing Question Frames	
TEC visuals & references	3.2.1	Identify TEC questions needing multiple-choice distractors.	Annotated script
Examples	3.2.2	Prepare multiple-choice distractors.	Multiple-choice questions
	3.2.3	Prepare multiple-choice feedback messages.	Feedback for distractors
	3.2.4	Identify TEC constructed response questions needing anticipated correct-incorrect answers.	Annotated script
Examples	3.2.5	Prepare correct-incorrect constructed response answer lists.	Anticipated answers
	3.2.6	Prepare constructed correct-answer feedback.	Correct answer feedback
	3.2.7	Prepare constructed incorrect-answer feedback.	Incorrect answer feedback
	3.2.8	Prepare constructed unanticipated answer feedback.	Default feedback
	3.3	Prepare & Sequence New Question Frames	
	3.3.1	Identify what & where questions are needed.	Annotated script
	3.3.2	Write multiple-choice or constructed response questions.	New questions
	3.3.3	Repeat steps 3.2.2-3.2.8 as appropriate.	Answer lists & feedback
Notebook	3.3.4	Sequence revised & new question frames.	
	3.3.5	Sequentially number frame components.	Updated Lesson Notebook
Numbered material in Lesson Notebook (3.3.5)	3.4	Specify Branching for Question Responses	
Examples & guidelines	3.4.1	No branching (continue in sequence).	
	3.4.2	Within-frame (prompt and try again).	
	3.4.3	To another frame & return (help & try again).	
	3.4.4	To another frame sequence (help & continue).	Branching specifications
	3.4.5	Write any new frames required.	New frames
	3.4.6	Organize new frames for branching.	Updated Lesson Notebook
TEC pretest and lesson test items	3.5	Prepare End-of-Lesson Test & Specify Decisions	
	3.5.1	Identify, modify & prepare questions.	
	3.5.2	Write test instructions.	Instructions & questions

Table 3-2. TEC-to-CAI Conversion Requirements (Cont.)

Input Requirements	Task/Step	Activity	Output/Product
TEC Scoring key Decision formats & examples	3.5.3	Determine decision conditions based upon cut-off score and key questions; e.g., -- Pass (to next lesson) -- Fail (retake all or parts of lesson) -- Review (to review element before re-test)	Post-test decision standards & actions
	3.5.4	Write summary feedback for each condition.	Performance feedback
	3.5.5	Specify branching for each condition.	Branching specifications
Lesson Notebook	3.5.6	Insert or modify review element.	Review frames
	3.5.7	Organize question, decision & review components.	Updated Lesson Notebook
End of lesson test (3.5)	3.6	Organize Lesson Pretest & Specify Decisions	
TEC pretest & scoring key	3.6.1	Review & prepare alternative question forms.	Instructions & questions
Decision formats & examples	3.6.2	Determine decision conditions based upon cut-off score and key questions; e.g., -- Pass (bypass lesson) -- Fail score and key questions (take lesson) -- Fail key question (to starting topic)	Pretest decision standards & actions
	3.6.3	Specify summary feedback & branching.	Feedback & branching
Lesson Notebook	3.6.4	Organize test question & decision components.	Completed Lesson Notebook
	4.0	PREPARE MATERIAL IN PLANIT	
PLANIT reference data & summaries	4.1	Review PLANIT Conventions & Constraints	Ground rules & refresher
	4.1.1	Capacities, display size, character set.	
	4.1.2	Frame & statement formats & legalities.	
	4.1.3	Specify recording requirements.	Item names & controls.
Frame legalities	4.2	Encode Lesson & Test Frames in PLANIT	Updated Lesson Notebook
	4.2.1	(M)ultiple-choice, (Q)uestion, (D)ecision formats.	
	4.2.2	Add header data to frames.	
Terminal connect to PLANIT & terminal printer.	4.3	Input Lesson & Tests at Console	CRT/hardcopy displays

Table 3-2. TEC-to-CAI Conversion Requirements (Cont.)

Input Requirements	Task/Step	Activity	Output/Product
PLANIT reference data	4.3.1	Enter author mode.	CRT/hardcopy displays
	4.3.2	Select frame types.	↓
	4.3.3	Respond to PLANIT prompts & messages.	
Lesson Notebook	4.3.4	Make PLANIT & local-edit keyboard entries.	
	4.3.5	Name lesson material & specify protection.	On-line CAI lesson
	4.4	Check PLANIT Listings & Student Handouts	
PLANIT & printer	4.4.1	Obtain lesson listing.	Lesson listing
Lesson Notebook	4.4.2	Obtain student exhibit drafts.	
Listings/visuals	4.4.3	Check materials & mark corrections.	Annotated listing & visuals
	4.5	Checkout & Edit Materials at Console	
CAI lesson file	4.5.1	Retrieve CAI lesson.	CRT/hardcopy lesson displays & error messages
Lesson listing	4.5.2	Make edit changes from deskcheck (4.4.3).	↓
PLANIT commands	4.5.3	Execute lesson in student mode.	
	4.5.4	Check displays, answer-matching, control.	
Visual exhibits	4.5.5	Check compatibility of lesson & exhibits.	
Reference list	4.5.6	Interpret execution error messages.	
PLANIT commands	4.5.7	Edit lesson as required.	
Graphic arts	4.5.8	Edit student exhibit visual masters.	Updated lesson & visuals
	5.0	EVALUATE & REVISE MATERIALS	
PLANIT & printer	5.1	Obtain Listings & Student Handouts	
PLANIT commands	5.1.1	Retrieve & list CAI lesson.	Updated lesson listing
Reproduction	5.1.2	Obtain copy of student exhibits.	Student handout
Army SME	5.2	SME Review of Materials	
Guidelines	5.2.1	Check technical-procedural content.	
Lesson listing & exhibits	5.2.2	Check tactical doctrine.	
	5.2.3	Check performance test compatibility.	

Table 3-2. TEC-to-CAI Conversion Requirements (Cont.)

Input Requirements	Task/Step	Activity	Output/Product
	5.2.4	Mark changes.	Annotated materials
	5.3	Edit Materials Based on SME Review	
PLANIT & printer	5.3.1	Edit CAI lesson & obtain listing.	Updated lesson listing
Graphic arts	5.3.2	Edit student exhibit visual masters.	Updated visuals
Reproduction	5.3.3	Reproduce & bind exhibits for tryout.	Updated student handout
	5.4	Conduct Student Tryouts	
Terminal & deskspace	5.4.1	Configure terminal & monitor positions.	
Army coordinator	5.4.2	Obtain & schedule appropriate students.	Student tryout schedule
Cue-card & handouts	5.4.3	Post student instructions & exhibits.	
Monitor's outline	5.4.4	Brief students on purpose & focus.	
PLANIT, lesson materials & lesson listing	5.4.5	Execute CAI lessons in student mode.	
	5.4.6	Record student suggestions & attitudes.	Monitor's log & lesson listing
	5.4.7	Record time & procedural observations.	Monitor's log
PLANIT & printer	5.4.8	Record & obtain performance data.	PLANIT records & hardcopy
	5.4.9	Determine item performance & specify revisions.	Item revisions
Lesson revisions, PLANIT & printer	5.5	Edit Materials Based on Tryouts	
	5.5.1	Edit CAI lesson & check revisions.	Updated CAI lesson
Graphic arts	5.5.2	Edit student exhibit masters & check.	Updated student visuals
Computer & printer	5.5.3	Produce lesson listings & backup files.	Updated listings & CAI files
Reproduction	5.6	Reproduce Student Materials	Exhibits for field study

4. Questionnaire (SME) - provides experience data on the Subject Matter Expert (SME). Each SME completes the form once.

5. CAI Lesson Review - provides data on the technical accuracy of each lesson and whether the objectives of the CAI and TEC lessons are the same. Completed by the SME after review of the lesson.

6. Questionnaire (S) - provides data on students taking the lesson, particularly in terms of whether the prerequisites for the course (land navigation and map reading) have been met. Completed by the student prior to taking the CAI lessons.

7. CAI Student Attitude Questionnaire - provides data on student acceptance and reaction to lesson content and media. Completed by the student following the on-line session.

8. Student interaction record - printout of lesson and test execution by the student (frame presentation and responses). Obtained by turning on the printer attached to the console prior to executing the lessons and tests.

9. PLANIT Student Record - computer printout of student performance data for each lesson and test. Automatically recorded, scored, and stored during execution. Obtained after students have completed lessons and tests.

The above records, forms, and logs provide a data collection system which permits accurate records to be kept with respect to length of time spent, difficulties encountered, and acceptability of the product. The system is applicable to any TEC/CAI subject matter conversion. Much of the system can also be used in developing any course materials using the Instructional System Development (ISD) process.

D. TEC-TO-CAI CONVERSION WORKSHOP PLAN

The approach used in developing the model for the workshop was to follow the developed job sequence for the conversion tasks, and to introduce each new topic as it was needed and applied in this process. Further, only those elements of a topic that would be used would be presented at that particular time, but, by the time the workshop was over, all required elements and topics would have been applied.

This provided a logically structured, integrated, functional, product oriented, learner centered approach to the workshop and the conversion course.

The TEC-to-CAI Conversion Workshop Schedule is given in Appendix E. The workshop model is organized into three training blocks in accordance with the primary product outcomes of each conversion activity. These are:

Conversion Activity	Converted Product
Prepare TEC Material for CAI	Lesson Conversion Notebook
Prepare Material in PLANIT	Lesson Executable on PLANIT
Evaluate and Revise Lesson	Lesson Effective and Acceptable

This particular plan assumes that two CAI lessons were to be converted during the three-week workshop by the four Army course development personnel assigned to the workshop. It assumes also that four more TEC lessons were to be converted during the subsequent six-week conversion period.

After the initial setup and first workshop day, the emphasis is increasingly on performing conversion tasks with only that on-the-job training needed to move from task-to-task and step-to-step.

A brief synopsis of each training block follows:

Block 1 - Prepare TEC Materials for CAI Conversion

Product Objective. Army lesson writers prepare Lesson Conversion Workbook, ready for encoding in PLANIT, from TEC materials selected, modified, and supplemented in accordance with CAI design requirements.

Training Topic	Conversion Task
Workshop Preview	
Beseler Cue-See Familiarity	
Team Exercise on Cue-See	
Use of TEC Materials and Lesson Conversion Notebook	
Overview of CAI and PLANIT	
Use of CAI Console (Exercise)	
Overview of a Typical CAI Module	Review a CAI Lesson
TEC-to-CAI Design Requirements	
Frame-Thinking, Part I: Presenting Information and Questions	Review TEC Lesson and Materials
Review Example Conversion Notebook	Prepare TEC for Conversion
Frame-Thinking, Part II: Writing Decisions. Decision-Writing Practice	
CAI Considerations	
TEC/CAI Testing Requirements	
	Deskcheck Conversion Notebook

Block 2 - Prepare Lesson Materials in PLANIT

Product Objective. Army lesson writers encode material in their Lesson Conversion Notebook in PLANIT, enter it into the computer, and determine that the lesson operates without errors.

Product Standards. This checkpoint is to ensure that all lesson material has been entered into the computer and that it executes in the student mode of PLANIT without halt, as intended:

- All lesson frames entered into the computer.
- Lesson executes without error messages or halts.
- Lesson executes as intended by the lesson-writer.

Training Topic	Conversion Task
PLANIT Conventions and Legalities, Parts I and II, M & Q Frames	Encode (M)ultiple-choice and (Q)uestion frames
PLANIT Conventions and Legalities, Part III, D-Frames	Encode (D)ecision frames
Entering Frames to the Computer	Enter frames at console (Team 1 and Team 2)
	Deskcheck materials
Executing, Checking, and Editing with PLANIT	On-line Check and Editing of converted lesson (Team 1 and Team 2)

Block 3 - Evaluate and Revise Converted Materials

Product Objective. Update lesson to include changes from Subject Matter Expert (SME) review and lesson tryouts with naive students to indicate performance, time, and acceptance standards are met.

Product Standards. This final checkpoint is to ensure lesson effectiveness and acceptance:

- SME review comments incorporated.
- Students perform to standard on post-test.
- Student acceptance medium-to-high.

Training Topic	Conversion Task
SME Review Procedure	Prepare for SME Review
	Conduct SME Review (Team 1 and Team 2)
	Edit Materials Based on SME Review (Teams 1 and 2 stagger schedule)
Block-3 Progress Check	
Preparing for Student Tryouts	Conduct Student Tryouts (Teams 1 and 2 stagger schedule)
Determining Revisions Required	Compile Data and Determine Revisions (Team 1 and Team 2)
Block-3 Progress Check	
	Make Final Revisions (Teams 1 and 2, as required)

A special feature of the workshop plan and preparations was the development of outlines, summaries, guidelines, and other job aids and procedures guides for carrying out the conversion process. *This minimized* any extensive note-taking on the part of the Field Artillery School lesson developers assigned to the workshop. It further changed and simplified the nature of the tasks involved from "learning or memorizing a procedure" to "learning to follow the steps in the procedural guide or job aid to carry out the procedure." This was further simplified to show the stimulus (cue or display) for each procedural step, the action taken, and the feedback which results from the action. This is illustrated in Appendix B, Figure B-6, which shows the procedures guide to run (execute) a CAI lesson under the course developer (author) control.

Section 4. CONDUCT OF THE TECMEDIA CAI WORKSHOP AND CONVERSION COURSE

A. PRELIMINARY ACTIVITIES

Prior to the start of the workshop and conversion course (1 February 1977), the requirements were defined as follows:

1. Dedicated classroom and working facilities at Fort Sill.
2. ADDS Consul 880 CRT/keyboard and slave printer (and paper) with remote phone tie to UNIVAC 1108 computer at Edgewood Arsenal, Maryland.
3. Assignment of four U.S. Army Field Artillery School personnel for the 9-week period.
4. PLANIT CAI system on-line on the UNIVAC 1108 computer.
5. Previously prepared CAI materials on-line on the UNIVAC 1108, i.e., Lessons INTRO and PLANIT, and the CAI LAW lessons with lesson listings.
6. Two Beseler Cue-See devices.
7. TEC filmstrips and audio cartridges available for the materials to be converted, including Lesson Administrative Instructions, Lesson Pretest, and Scoring Key.
8. TEC Final Narration scripts and other production backup materials available at USAFAS.
9. A graphic arts and reproduction capability for the several off-line exhibits.

The TEC materials were available prior to the start date. Copies of these materials (scripts, tests, etc.) were reproduced for use during the workshop and conversion course. Materials and guidelines on course development for subject matter expert review, student runs, and the job aids and procedures

guides for on-computer use were finalized and reproduced in the quantities required for the 9-week workshop and conversion course.

Preparations were completed by 28 January 1977.

The workshop area, Figure 4-1, was set up and on-line checkout of PLANIT, Text Editor, and the computer system were made on 31 January 1977. Preparations for the workshop were completed on schedule and ready for the start of the workshop on the next day.

B. CONDUCT OF THE TECMEDIA CAI WORKSHOP

1. Preparation of CAI Lessons

The TECMEDIA CAI Workshop was conducted in Room 23, Snow Hall, USAFAS, Fort Sill, Oklahoma. The four USAFAS course participants from the Directorate of Course Development were as follows:

Mr. Robert G. Horn (Team 1)
Mr. James W. Bowick (Team 1)
Mr. Billy J. Hudson (Team 2)
Mr. Douglas M. Converse (Team 2)

Mr. Horn was designated project coordinator by Major John A. Evans, USAFAS Project Officer. Conducting the workshop and course were Dr. William G. Hoyt, Mr. Alfred K. Butler, and Mr. Fred D. Bennik.

The workshop was performance oriented and product centered. The 3-week schedule shown in Appendix E was closely but not rigidly followed. On Day 1 and Day 2, the participants received hands-on experience with TEC and CAI (LAW); reviewed the TEC materials, Beseler Cue-See operation, and lesson scripts; and became familiar with the organization and execution of CAI lessons.

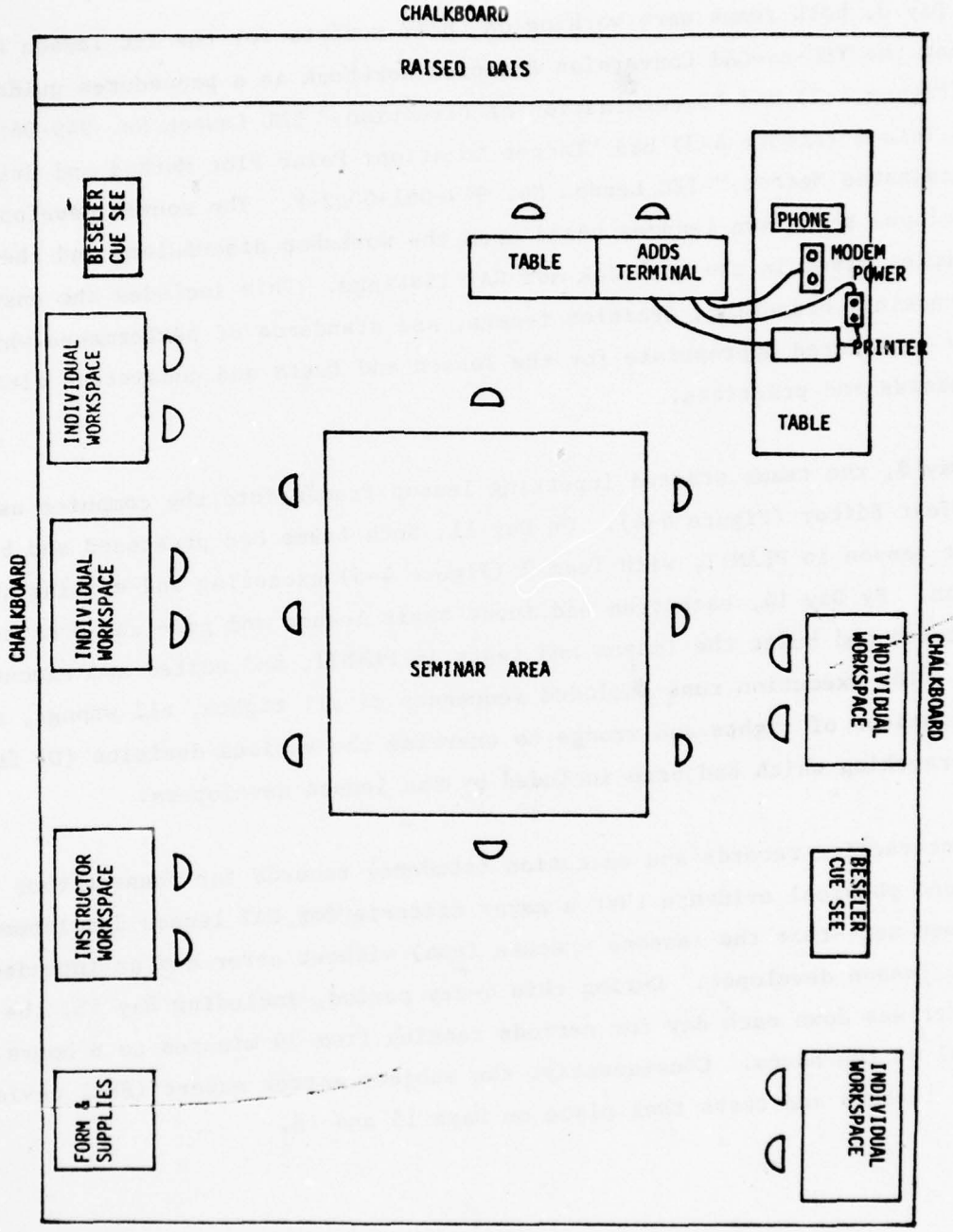


Figure 4-1. Workshop Area - Room 23, Snow Hall

By Day 3, both teams were working on their scripts for the TEC lesson assigned. using the TEC-to-CAI Conversion Examples Workbook as a procedures guide. Team 1 (Figure 4-2) had "Determination of Direction," TEC Lesson No. 949-061-0001-F; and Team 2 (Figure 4-3) had "Target Location: Polar Plot Method and Grid Coordinates Method," TEC Lesson No. 949-061-0002-F. The course developers developed their own lessons based upon the workshop discussions and the examples given in the workbook and CAI listings. This included the answer processing, branching, decision frames, and standards of performance which they considered appropriate for the lesson and tests and consistent with USAFAS standards and practices.

On Day 8, the teams started inputting lesson frames into the computer using the Text Editor (Figure 4-4). On Day 11, both teams had prestored and built their lesson in PLANIT, with Team 2 (Figure 4-5) executing and editing their lesson. By Day 14, each team had input their lesson and pre- and post test, prestored and built the lesson and tests in PLANIT, and edited and executed them. The execution runs included sequences of all rights, all wrongs, and combinations of rights and wrongs to exercise the various decision (D) frames and branching which had been included by the lesson developers.

The interaction records and execution (student) records for these author runs provided physical evidence that a major criteria for CAI lesson development had been met--that the lessons execute (run) without error and as intended by the lesson developer. During this 4-day period, including Day 15, the computer was down each day for periods ranging from 30 minutes to 6 hours for a total of 10½ hours. Consequently, the subject matter expert (SME) review of the lessons and tests took place on Days 15 and 16.

Figure 4-2. Team 1 Working on Scripts

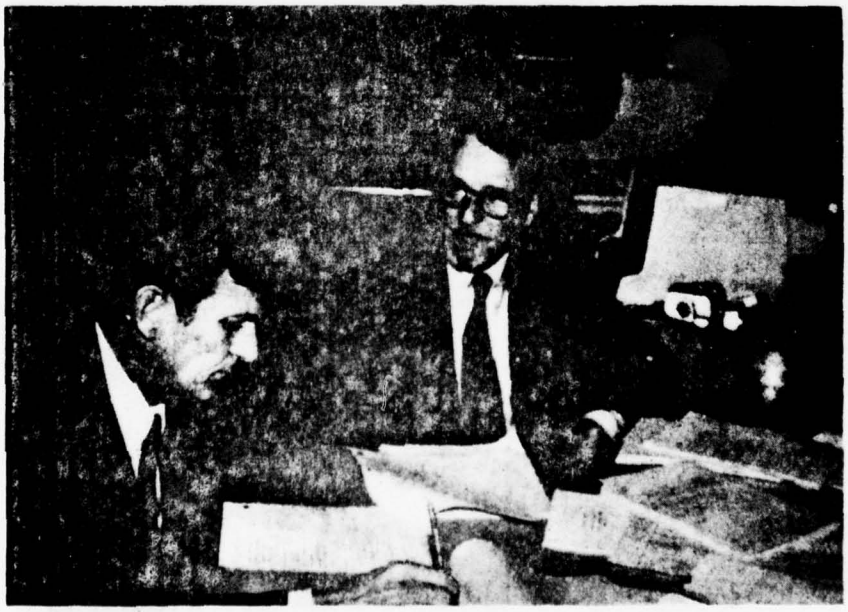


Figure 4-3. Team 2 Working on Scripts

Figure 4-4. Inputting Lesson Frames Into the Computer

Figure 4-5. Executing and Editing the Lesson

2. Subject Matter Expert (SME) Reviews

The purpose of the SME review is to determine whether the lessons and tests are technically accurate and complete, and are consistent with current or upcoming Army tactical doctrine and employment.

A second purpose is to further verify whether the objectives of each CAI lesson are the same as those for the comparable TEC lessons.

Three SME documents were produced by SDC for conducting the reviews during the workshop and conversion course. These are: 1. Questionnaire (SME); 2. Guidelines for Subject Matter Review; and 3. CAI Lesson Review. These are listed in Appendix B, Items 4, 5, and 6.

The "Questionnaire (SME)" establishes the credibility of the Subject Matter Expert. Basically, it asks those questions relative to his experience and background which verify that he is proficient in the subject matter area being reviewed. The "Guidelines for Subject Matter Review" give direction and structure to the SME for his review. The "CAI Lesson Review" asks those questions necessary to verify technical content, Army doctrine, lesson structure, and comparison with TEC.

Upon arrival, the SME was briefed by the team members, including a review of the objectives of the TEC lesson. The SME filled out the questionnaire, was given the guidelines to use, took the INTRO lesson to familiarize himself with the CAI console operation, and reviewed the lesson and tests on-line with the team members (Figure 4-6). Comments, changes, and corrections were noted on the lesson listings. After the lesson, the SME filled out the "CAI Lesson Review" which formed the basis for further discussion and clarification. The review process was repeated by Team 2 on Lesson 0002. The second SME (at least two for each lesson) went through the same procedure.

Figure 4-6. Subject Matter Expert Review

The recorded comments of the SMEs on the lesson listings and the CAI Lesson Review provided physical evidence that the lessons and tests were technically accurate, reflected current tactical doctrine, and covered the same objectives as the comparable TEC lesson.

Each team edited and executed their lesson and tests and exhibits based upon the SME reviews. Changes to the lessons (and tests) were made on-line, and the updated lessons were immediately ready and available for lesson execution. The 2-day SME reviews took place on Days 15 and 16 with editing on Day 16. The lessons were ready for student tryout on Day 17.

3. Student Tryouts - Lessons 0001 and 0002

The purpose of the student tryout is to determine whether learning occurs as a result of taking the lesson as measured by the pre- and post tests. A second purpose is to "shake down" the lessons by exposing the lesson and test situations to typical students to determine if they can go through the learning process (take the lesson and tests) easily and effectively. If not, then identify and analyze the problem areas and update the materials. A third purpose is to determine student attitudes toward the CAI materials.

Two documents were produced by SDC for use during student tryouts. These are: (1) "Questionnaire (S)," and (2) "CAI Student Attitude Questionnaire." These are listed in Appendix B, Items 7 and 8.

The Questionnaire (S) is used primarily to verify that the prerequisites for taking the Observed Fire lessons had been met, i.e., the student had already had land navigation and could read a military map. The CAI Student Attitude Questionnaire taps the student's like and dislikes, problem areas in taking the CAI lessons, and level of confidence in being able to carry out the tasks learned.

Student runs started on Day 17. Upon arrival the student was briefed by the team members and filled out the Questionnaire (S). The student took the INTRO lesson to familiarize himself with the CAI console operation. He then took the pretest for the first lesson. If he failed the pretest, he took the lesson (Figure 4-7) and the post test. If he passed, he took the pretest for the next lesson. Team members monitored the test and lesson runs by means of the printer which provided a complete interaction record of student progress through the lesson. When the post test was completed, the student filled out the CAI Student Attitude Questionnaire. PLANIT student records of the pre- and post test (Figure 4-8) and lesson execution (Figure 4-9) were obtained on-line by the team members.

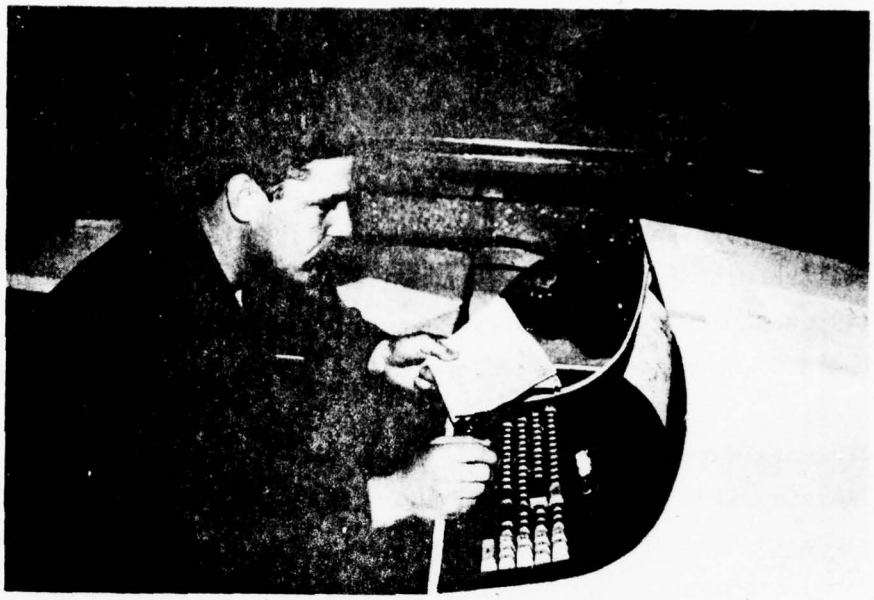


Figure 4-7. Student Tryout

```
DATE    0/0/1                                                STUDENT HISTORY
LESSON NAME  CFFTB;  STUDENT NAME
  FRAME    TYPE    TIME     NEUTRAL    ANSWER    LABEL
                   MIN/     RIGHT+       TAG
                   SEC      WRONG-
START                                                 0/0/1      0.00
   1.00      Q     63.63       0          A        CFFPOST
   2.00      Q     63.60       0          A        SIT
   3.00      Q     63.63       -          -        E1
   4.00      Q     63.63       +          A        E2
   5.00      Q     63.63       +          A        E3
   6.00      Q     63.58       +          A        E4
   7.00      Q     63.60       +          B
   8.00      Q     63.61       +          B
START                                                 0/0/1      0.00
NUMBER RIGHT    5
NUMBER WRONG    1
NUMBER ENTRIES    8
NUMBER TIME-OUTS    0
TOTAL TIME    512.11
```

Figure 4-8. PLANIT Student Record-Tests

```
]1
DATE   0/0/1                                                    STUDENT HISTORY
LESSON NAME  OFF,  STUDENT NAME
  FRAME    TYPE     TIME      NEUTRAL     ANSWER     LABEL
                    MIN/      RIGHT+       TAG
                    SEC       WRONG-
START                                                    0/0/1      0.00
   1.00      Q      63.58        0          A
   2.00      Q      63.58        0          A
   3.00      Q      63.58        0          A
   4.00      Q      63.63        0          A
   5.00      Q      63.58        -          -
   4.00      Q      63.63        0          A
   5.00      Q      63.58        +          A
   6.00      Q      63.59        0          A
   7.00      M      63.62        +          B
   8.00      Q      63.60        0          A
   9.00      Q      63.63        +          +
  10.00      Q      63.63        +          A
  11.00      Q      63.59        0          A
  12.00      M      63.62        +          C
  13.00      Q      63.58        0          A        E1
  14.00      Q      63.63        +          +
  15.00      Q      63.59        +          A
  16.00      Q      63.61        0          A
  17.00      Q      63.61        +          A
  18.00      M      63.59        +          C
  19.00      Q      63.59        -          -
  20.00      Q      63.60        0          A
  21.00      M      63.63        +          C
  22.00      Q      63.60        0          A
  23.00      Q      63.63        0          A
  24.00      Q      63.61        +          A
  25.00      Q      63.59        0          A
  26.00      Q      63.60        0          A
  27.00      M      63.63        +          C
  28.00      Q      63.59        0          A
  29.00      M      63.60        +          B
  30.00      Q      63.61        0          A
  31.00      Q      63.62        0          A
  32.00      M      63.63        +          B
  33.00      M      63.59        +          A
  34.00      M      63.58        +          C
  35.00      D      63.63        0
  36.00      Q      63.58        0          A
  37.00      M      63.62        -          B
  37.00      M      63.62        +          C
  38.00      Q      63.63        +          A
  39.00      M      63.63        +          B
  40.00      M      63.60        +          C
  41.00      M      63.59        +          D
  42.00      M      63.60        +          A
  43.00      Q      63.60        0          A
  44.00      Q      63.62        0          A
  45.00      Q      63.60        0          A
  46.00      Q      63.59        0          A
NUMBER RIGHT    22
NUMBER WRONG    3
NUMBER ENTRIES    49
NUMBER TIME-OUTS    0
TOTAL TIME    3136.27
```

Figure 4-9. PLANIT Student Record-Lesson Execution

The above data furnished the basis for team members to discuss the lesson run with the student. Among areas covered were lesson content and understanding, student answers to questions, off-line exhibits, lesson execution, and attitudes of student.

The student runs were continued until the desired number of students (four) had been run for each lesson, i.e., failed the pretest, taken the lesson, and passed the post test. Students who passed the pretest were not included in this number.

Changes to the lessons and tests were effected immediately by on-line editing. These changes resulted from team observation of the student's performance on-line, discussions with the student on problem areas, and analysis of PLANIT student records as to constant or random errors made by the students.

The lesson and test listings, interaction records, and PLANIT student records were used to identify and record the changes to be made. After they had completed their update, the team members obtained new listings on-line. Full advantage was taken of the computerized capability to automate the Instructional System Development (ISD) process. Student runs which started on Day 17 were completed on Day 29.

The student runs for the workshop overlapped three weeks and a day into the 6-week conversion period. The student runs and computer input of new lessons were highly dependent on the one CRT console (ADDS terminal) available. Priority in console use was given by the course participants to student runs. The two activities, students' runs and conversion of new lessons, continued in parallel until the student runs were completed on Day 29 (14 March). Activities connected with student runs, e.g., analysis of student records, continued into the conversion period.

4. Problem Areas in the Workshop

a. Student Selection. A particular problem which surfaced at this time was student selection. Eleven students were processed in order to obtain data on the desired four "usable" students. This is more than normally expected if student selection criteria are specifically defined and the selection process adequately carried out by the providing organization. One of the prerequisites was that the student will have received training in map reading which was conducted during Basic Combat Training (BCT). It turns out that map reading is no longer covered in BCT but is included in most of the Advanced Individual Training (AIT) courses. Two of the students did not meet the prerequisites but took the lessons and did not pass. Other factors also were evident. Three other students were able to pass the pretest for the second lesson. Another student could not return to take the second lesson. Students were also not available every day. This problem, like others which came up in the 9 weeks, provided the course participants with practical experience and insight into the Instructional System Development process. As the problems came up they were discussed, the alternatives based upon past experience were presented along with the probable effects. The course participants then made their own decisions. This was an integral part of the overall learning process and structure of the course.

b. Computer Down Time. Computer down time (10½ hours over 4 days) was not considered excessive but was inconvenient. It occurred primarily during the SME and student on-line executions and extended the schedule and time required.

c. One CRT Console. The one CRT console (ADDS terminal) was somewhat of a bottleneck as the course participants queued to get on-line to input their lessons and to run students. This also limited the number of SMEs and students to one at any one time. This was alleviated by both morning and afternoon on-line sessions.

d. Reference Materials. A minor problem occurred in regard to the references cited. This is a general problem in the ISD process and not specific to TEC. The references are too broad. The entire FM or TC is cited rather than the specific pages and paragraphs applicable to the particular task or topic. The course developer (and the TEC user) has to research the document to locate the material. If this were specified to begin with, time would be saved and there would be no errors in determining and locating what was applicable.

The reason sometimes given for not being specific is that changes are made to the documents which make the reference obsolete. This, however, would appear to be a valid reason for being specific.

C. CONDUCT OF THE SIX WEEK TEC-TO-CAI CONVERSION

1. Preparation of CAI Materials

In the workshop, the four course participants worked in two man teams on lessons 0001 and 0002. They continued to work in two man teams conducting student runs on lessons 0001 and 0002 until these were completed on Day 29 (14 March 1977).

In the conversion period, Day 15 through 43, each course participant worked alone and was solely responsible for converting his own lesson. Assignments were made and work began on Day 15 (25 February) as follows:

Individual	TEC Lesson
Mr. Horn	Locate a Target by Shift from a Known Point, #949-061-0003-F
Mr. Bowick	The Call for Fire, #949-061-0004-F
Mr. Hudson	The Adjustment of Field Artillery Fire by the Bracketing and Creeping Methods, Part I, #949-061-0005-F
Mr. Converse	The Adjustment of Field Artillery Fire by the Bracketing and Creeping Methods, Part II, #949-061-0006-F

On Day 20 (1 March), five work days after start of the conversion period, the first lesson frames for lesson 0006 were input using the Text Editor. By Day 33 (18 March) all four lessons and eight pre- and post tests for lessons 0003 to 0006 had been developed and input into the computer. By Day 35, 20 days after start, all lessons had been prestored, built, edited, and executed in PLANIT. During this same 20 day period, 11 of the days had included SME and student runs on Lessons 0001 and 0002. The procedures, procedures guides, and job aids used during the conversion period were the same as those used and learned in the workshop.

2. Subject Matter Expert (SME) Reviews

The SME reviews of the four lessons and eight pre- and post tests (12 PLANIT lessons) took place on-line on Days 36 through 38 (23-25 March).

Each course participant conducted the SME review of his own lesson and tests using the procedures, questionnaires, and lesson listings as described earlier for Lessons 0001 and 0002. A total of three SMEs were used for Lessons 0003 to 0006 with each lesson being reviewed independently by two SMEs. Lessons and tests were edited, based upon the SME reviews, in preparation for the student tryouts which started the next day, Day 39.

3. Student Tryouts - Lessons 0003 to 0006

Student tryouts of the four lessons and eight pre- and post tests began on Day 39 (28 March).

Each course participant conducted the student tryouts for his own lesson and tests using the procedures, questionnaires, and lesson listings as described earlier for the workshop Lessons 0001 and 0002. Changes to the lessons and tests were effected immediately by on-line editing. These changes resulted from observation of the student's performance on-line, discussions with the

student on problem areas, and analysis of PLANIT student records as to constant or random errors made by the students.

The lesson and test listings, interaction records, and PLANIT student records were used to identify and record the changes to be made. After the up-date was completed, new listings were obtained on-line. Full advantage was taken of the computerized capability to automate the Instructional System Development (ISD) process. Student runs started on Day 39 (28 March 1977). The conversion period officially closed 1 April with five students having been run. The course participants continued to run students after 1 April to obtain the desired number (four) for each lesson, i.e., failed the pretest, taken the lesson, and passed the post test. Students who passed the pretest were not included in this number.

Section 5. RESULTS

The objectives of this project were to:

A. Provide a formative evaluation (preliminary validation) of the suitability of CAI as one means for providing TEC instruction.

B. Provide documentation of CAI to TEC conversion costs and procedures for conducting a more formalized training effectiveness evaluation.

C. Determine the training time required to provide Field Artillery School lesson developers with the capability to produce CAI versions of TEC.

D. Determine the amount of time involved and types of difficulty encountered in having Army lesson writers convert audio visual TEC material to appropriate CAI format.

E. Provide three alternative versions of six selected TEC lessons (i.e., CAI stand-alone, CAI/Audio-visual combination, Text Presentation).

F. Provide USAFAS with a course developer cadre trained in the practical steps of converting self-paced TEC audio visual lessons, and in use of the computer system to input, check, edit, and update CAI materials. Convert six TEC audio-visual lessons into appropriate CAI format and incorporate all identified changes in doctrine, employment, etc., pertinent to the selected TEC lessons.

The results obtained in regard to the above objectives are contained in the paragraphs which follow.

A. PRELIMINARY EVALUATION OF THE SUITABILITY OF CAI AS ONE MEANS FOR PROVIDING TEC INSTRUCTION

The preliminary evaluation covered three basic areas: (1) Do the lessons execute (run), (2) Is the content technically accurate, and (3) Do students learn as evidenced by their test scores. The results were positive as

described in paragraph 1. which follows. Also of consideration was: Are the lessons acceptable, i.e., what is the attitude of those concerned, SMEs, and students. Again, the results were positive as detailed in paragraphs 2. and 3. which follow.

1. Test Scores

Each of the six CAI lessons on Observed Fire were reviewed by Subject Matter Experts (SMEs) for technical content and for verification of current tactical doctrine.

Each of the lessons were also tried out (run) on a small sample of students. Student and SME runs were monitored by the applicable course developer (teams on Lessons 0001 and 0002, individuals on Lessons 0003 to 0006).

Test scores for the first 18 students (S1 through S18) on which the lessons were tried out are shown in Table 5-1. The school is in process of completing the preliminary evaluation and finalizing the lessons. This will be followed by a full-scale validation of 30 students on all six lessons (versus the six to eight for each lesson in Table 5-1).

The test scores show that learning takes place as a result of the CAI lessons.

2. Attitude of Students

When the student finished his lesson and tests, he completed the "CAI Student Questionnaire" (Appendix D, Item 8).

The results show that students like this method of instruction, found the lessons easy to understand, and thought the method of instruction was effective. Most of them did not express any problems or difficulties in interacting with

Table 5-1. Student Pre- and Post Test Scores

Student No.	Lesson Number																							
	0001				0002				0003				0004				0005				0006			
	Pre		Post		Pre		Post		Pre		Post		Pre		Post		Pre		Post		Pre		Post	
	R	W	R	W	R	W	R	W	R	W	R	W	R	W	R	W	R	W	R	W	R	W	R	W
S1	1	5	6	2	6	0	*																	
S2	2	4	7	1	4	2	5	1																
S3	1	5	7	1																				
S4***	(1	7	1	7	3	3	4	2)																
S5***	(1	7	3	5	0	6	4	2)																
S6	4	4	7	1	5	1	*																	
S7	3	5	5	3	3	3	4	2																
S8					2	4	6	0																
S9	R = Right				6	0	*																	
S10	W = Wrong				3	3	5	1																
S11					3	3	5	1																
S12									4	5	3	0	3	3	2	4	3	3	4	2	4	1	5	0
S13									4	5	3	0	4	2	5	1	3	3	4	2	5	0	*	
S14									5	4	3	0	1	5	5	1	1	5	5	1	5	0	*	
S15									1	8**	1	2**	2	4	3	3	2	4	6	0	4	1	4	1
S16																	2	4	6	0	3	2	5	0
S17									6	3	3	0	3	3	6	0	1	5	6	0	5	0	*	
S18									3	6	3	0	3	3	6	0	1	6	4	2	5	0	*	
No. of Test Items	8 2)		8		6		6		9		3		6		6		6		6		5		5	
Passing Score	5 1)		5 1)		5		5		7 1)		3		5 1)		5 1)		5		5		5		5	

*Passed pretest so did not take lesson or post test.
**Did not have glasses.
***Prerequisites not met.
1)Passing score includes passing of all critical items in the test.
2)Pretest increased from 6 to 8 items.

the computer. The comments of four who said they did have problems are as follows:

- At first I was disoriented and didn't take enough time.
- Doing before thinking.
- I was misreading problem only other than that it was okay. Some words mean something different.
- The only problems was pushing the key button with wrong answer and not being able to stop it.

These comments do indicate that the lessons required them to take time and to think and learn about what they were doing.

Other comments are as follows:

- There seems to be a one-to-one relationship with the computer. You go back over the question. The computer will tell you if you were incorrect. You don't have to hold up a class or the class doesn't hold you up.
- Instructors can be boring and hard to listen to. You can do this at your own pace.
- The student can receive the lessons almost like from an actual instructor anytime he wants to or has time to.
- Because it holds my attention well.
- You can move at your own pace.
- It is much more interesting than other types.
- This type of training allows a man to work at his own speed and holds your attention better.

- If I understood something I could go on; if not, I could go over it until ready to go on.
- I believed I learned a lot today of the course.
- I thought they were very informative and can save a great deal of time in learning. More work with a computer of this type will aid a student in proficiency and comprehension.
- With the right programming there seems to be no limit to the different subjects you could learn.
- It keeps you interested and it allows you to advance at your own pace.
- It explains it more easier.
- You can spend time to think and figure out problems without rushing yourself.
- It's alright.
- I enjoyed taking the lesson.
- I think it might be faster than the classroom. It can be seen easier, you can move at your own speed.
- If you get the wrong answer you can go over it right away.
- Because it is very easy to understand and the facts brought forth were straight out, very fine learning process.
- Using the computer method I think holds your attention to the subject being presented, and knowing your wrong it gives you a chance to go back and study again.
- I learned a new area of my MOS.
- I like this type of lesson very much and would like to see (it) put into use.

Even though they liked CAI and had no problems, two of the students expressed preferences in regard to a specific lesson as follows:

- It is really great but I prefer an instructor.
- I feel that it would be an aid to instruction but don't feel it could replace the instructor.

In summary, the response to the questionnaires showed a positive and enthusiastic acceptance of this method of instruction.

3. Attitude of SMEs

The SMEs were favorably impressed both with the lessons and CAI as a media. The SME reviews for the four lessons took parts of three days, about 10 to 12 hours. The review was done "on-line" with comments noted on the course materials. After the review, each SME filled out the "CAI Lesson Review." (Appendix D, Item 6.) Typical comments on the review were:

- It was thorough and easy to understand.
- Standard "FO" procedures were followed very well.
- The CAI is a good system, much better for teaching and maintaining student interest. It won't let you quit--you can quit the TEC anytime.
- The lesson was accurate and thorough, yet maintained a level of learning ability for the average soldier.
- I don't really see a problem with the low level reader. The lesson was simple and easy to understand without insulting a man's intelligence.
- Well organized lesson. The content was good, precise, and presented in a simple easy to learn format.

- This lesson accurately and completely covered the same material that the TEC lesson covered.
- As for completeness and accuracy, both the TEC lesson and the CAI lesson were excellent, but the CAI lesson was a helluva lot more interesting.
- It moves along well and is clearly presented. The student is kept busy throughout the program.
- It keeps the student well occupied and thinking.
- Is definitely not boring.

B. TEC-TO-CAI CONVERSION COSTS

Daily logs were maintained by each of the four course participants during the workshop and the conversion. A daily monitor's log was also maintained. Also retained were costs of various computer runs. In addition, a monthly summary of the UNIVAC 1108 operating expenses was obtained for the months of February and March 1977. The costs are based largely upon the four lessons (0003 to 0006) converted during the six-week conversion period. The average (or mean) is used because the lessons varied in length (frame size), use of off-line exhibits, and execution times. The averages used are considered representative of typical TEC to CAI conversion costs for a given lesson.

The mean costs derived for one TEC lesson converted to CAI including preliminary validation with four usable students is as follows:

1. Mean Hours Required (Per Lesson - Based on Four Lessons)

Course Developer	-	111 hours total
SME Review (2 @ 1½ hrs.)	-	3 hours
Students (7 required to obtain usable sample of 4, 2 hours each student including questionnaires, pre- and post tests and lesson).	-	14 hours

2. Computer Costs (Derived - Per Lesson)

Student (11 hours) and SME (3 hours) runs - 14 hours @ $7.50	-	$ 105
Inputting lessons in Text Editor - 16 hours @ $1	-	16
Checkout and editing in PLANIT, lesson listings, prestore, build, restore - 16 hours @ $9.50	-	152
Other computer costs	-	108
	Total	$ 381

The other computer costs of $108 include facilities usage, catalogued storage usage, permanitizing PLANIT lessons, and other computer uses accociated with the project.

3. Telephone Costs (Derived)

Telephone cost for the local Baltimore line at Fort Sill, Oklahoma, is a flat rate of $963 a month. The cost of the line is based upon the distance from the local exchange. For the two months of the project, telephone costs were $1926. Assuming $1800 of this amount was due to the six lessons (the remaining $126 for training) this would prorate the telephone costs for each lesson to approximately $300.

The telephone line is available 24 hours a day, seven days a week, at the same cost of $963 a month.

The computer costs and telephone costs ($681) shown in 2. and 3. above are based upon the use of the UNIVAC 1108 at Edgewood Arsenal, Maryland. Should Army tactical computers be used for this purpose, these costs would not be incurred. There would, however, be time associated with the already in place Army computer operator being used to turn the system on (and then off) when it is used for CAI.

The above costs do not include secretarial costs as there are few associated with the development of CAI courses. The course developer inputs the lesson into the computer from his handwritten script, and from then on lesson listings, scoring, student records, etc., are printed by the computer. When off-line course exhibits are included (Lessons 0003 and 0004 had exhibits, Lessons 0005 and 0006 did not), then there are costs associated with these. The lesson developers produced their own exhibits for use during the lesson development and preliminary evaluation.

Calendar time (lead time) to produce course-ware should also be considered, as well as the time required to update lesson materials. The calendar time to produce the four lessons is approximately 30 working days. The time required to update (edit) a lesson when a change is indicated, e.g., a change in tactical doctrine, is a few minutes to an hour or so, depending on the number and variety of changes (editing) to be made. The cost savings in terms of lead time in meeting training needs is a factor to be considered. An early lead time also increases the useful life of the course materials.

There are costs also associated with the management of course development. If lessons are produced more quickly, with less preparation of paper work, then management and peripheral costs should be less.

The TEC to CAI conversion started with the tasks, training objectives, and TEC lessons and scripts available. A reasonable estimate for course development,

starting from the task and training analysis at the beginning of the ISD process would be a 50% or 60% increase in the lesson preparation stage. In the case of CAI, this would require an additional 20 to 30 hours to be added to the 111 hours of course developer time. The remainder of the ISD process would be the same.

C. WORKSHOP TRAINING TIME REQUIRED

The TECMEDIA CAI Workshop and Conversion Course was set up in two parts. The first was the workshop, Days 1 through 14, in which initial training took place. As an integral part of the initial training, two TEC lessons were converted, one by each team of two participants. The workshop day was originally set at five hours (0730 to 1330, with a 1130 to 1230 break for lunch). The student runs for the workshop overlapped and ran intermittently parallel with the conversion course until Day 29. Each team was responsible for the complete ISD process, starting with the tasks and objectives (TEC) having been defined. This included scripting, updating tactical doctrine, computer input, execution, editing, SME reviews, student runs, student records, analysis, and finalizing of course materials.

The workshop training time, including the development and preliminary validation (student runs through Day 29) for Lessons 0001 and 0002, was as follows:

	Total Hours	Mean Time per Team Member
Team 1 (Lesson 0001)	232	116
Team 2 (Lesson 0002)	258	129
Total	490	122.5

Of the 490 preceding hours, approximately 20% was on consul (on computer) time as follows:

	Total Hours	Mean Hours per Team Member
Team 1 (Lesson 0001)	57	29
Team 2 (Lesson 0002)	42	21
Total	99	25

Of the 490 hours, approximately 75% was involved directly in doing (hands on) the conversion tasks as follows:

	Total Hours	Mean Hours per Team Member
Team 1 (Lesson 0001)	184	92
Team 2 (Lesson 0002)	212	106
Total	396	99

D. TEC-TO-CAI CONVERSION TIME AND TYPES OF DIFFICULTIES DURING CONVERSION COURSE

1. TEC-to-CAI Conversion Time

In the six-week conversion course, the initial training received in the workshop was reinforced. Each course participant was responsible for and carried out the complete process (i.e., scripting, doctrine update, SME and student runs, etc.) on his own lesson. The six-week conversion course officially closed on 1 April based upon agreement by the ARI COTR, course instructors, course participants, and USAFAS project officer that the course participants were indeed fully capable and confident to carry out the remaining student runs. As of 1 April, five students had been run on Lessons 0003 to 0006. Student runs were continued by the course participants, and by 7 April seven students had been run.

On 7 April, four students had gone through the pretest, lesson, and passed the post test for Lessons 0003, 0004, and 0005. Two had done so for Lesson 0006. It is assumed that no more than four additional students will be required to complete the preliminary evaluation for Lesson 0006, the remaining lesson. A maximum of two hours per student run, eight hours, is estimated

for this effort. The TEC to CAI conversion times for Lessons 0003 to 0006, actuals through 1 April and estimated for 7 April and completion, are as follows:

Lesson No.	Total Hours to 1 April	Estimated Total Hours to 7 April	Estimated Total Hours to Completion
0003	84	87	87
0004	110	114	114
0005	129	133	133
0006	97	101	109
Total	420	435	443
Mean	105	109	111

The mean time to effect the TEC to CAI conversion process during the course for a given lesson from initial TEC review through SME and preliminary validation is 111 hours.

A breakdown of the 111 hours within the following categories used is: (estimate only, as category boundaries may overlap)

	Hours	Percent
Lesson Preparation	36	32%
Initial computer input and lesson execution	32	29%
SME review, student tryouts, and editing	43	39%
Total	111	100%

2. Types of Difficulties Encountered

In spite of the number and complexity of systems involved (Text Editor, PLANIT, UNIVAC Executive, and Instructional System Development (ISD)), the task oriented, learner centered step-by-step approach led to few problems associated with the TEC to CAI conversion process. The procedures guides and job aids were a necessary and integral part of this process. These were annotated by the course

participants as necessary to integrate them into the process. The process was also simplified in that once the lesson was input into the computer, the computer took care of most of the paperwork which is an integral part of course development, i.e., lesson listings, interaction records, student records.

The problems that did occur fell into two areas, computer down time and student selection for the student runs. Computer down time was approximately 21 hours over the nine weeks. Problems with this early version of PLANIT ARI (Version 1.1) which resulted in having to restore the system accounted for approximately 15 hours of downtime. These times are to some extent maintenance requirements for this version of PLANIT and not considered excessive. They were somewhat inconvenient, occurring during SME review and student runs. They did, however, provide opportunities for the course participants to exercise their skills to initiate the UNIVAC system and restore PLANIT; both of which they carried out with confidence.

The second problem was student selection. This problem is not peculiar to CAI but is one of the problems in carrying out the validation (preliminary in this case) of courseware. For example, a total of 11 students for Lessons 0001 and 0002 were required to obtain four usable students with pretest scores low enough to require taking the lesson and who met the prerequisites for the lessons.

During this period, the student selection process was reexamined. It was determined, for example, that land navigation and map reading were no longer given in Basic Combat Training (BCT). Discussions with school personnel responsible for TEC resulted in clarification of TEC prerequisites for these TEC lessons to include BCT and AIT (map reading is covered in most AIT courses). The student selection process was modified accordingly.

E. THREE ALTERNATIVE VERSIONS

Three alternative versions of the six selected Observed Fire TEC lessons were produced along with the modular pre- and post test. These are identified in the following paragraphs.

1. CAI Stand-alone

The six CAI stand-alone lessons, with their pre- and post tests, were produced by the four course participants during the workshop and conversion course. These lessons are currently available on computer as follows:

PLANIT Lesson Name	Title
DOD1	Determination of Direction
DODTA	Pretest
DODTB	Post test
TL2	Target Location: Polar Plot Method and Grid Coordinates Method
TLTA	Pretest
TLTB	Post test
TL3	Locate a Target by Shift from a Known Point
TATL3	Pretest
TBTL3	Post test
CFF	The Call for Fire
CFFTA	Pretest
CFTTB	Post test
BCA	Area Fire Mission (Bracketing and Creeping Methods) Part I
BCATA	Pretest
BCATB	Posttest
BCB	Area Fire Mission (Bracketing and Creeping Methods) Part II
BCBTA	Pretest
BCBTB	Post test

2. CAI/Audio-Visual Combination

The six CAI lessons given in 1 above along with the following TEC audio-visual lessons provide the CAI/Audio-Visual Combination.

	TEC Lesson No.	Title
1.	#949-061-0001-F	Determination of Direction
2.	#949-061-0002-F	Target Location: Polar Plot Method and Grid Coordinates Method
3.	#949-061-0003-F	Locate a Target by Shift from a Known Point
4.	#949-061-0004-F	The Call for Fire
5.	#949-061-0005-F	The Adjustment of Field Artillery Fire by the Bracketing and Creeping Methods, Part I
6.	#949-061-0006-F	The Adjustment of Field Artillery Fire by the Bracketing and Creeping Methods, Part II

The TEC lessons will be updated by the U.S. Army Field Artillery School to reflect current tactical doctrine and usage. This update is part of their TEC review and update cycle.

3. Text Presentation

The six Text Presentation lessons (produced by project personnel) are as follows:

Lesson 1. Determination of Direction

Lesson 2. Target Location - Polar Plot Method and Grid Coordinates Method

Lesson 3. Locate Target by Shift from a Known Point

Lesson 4. Call for Fire

Lesson 5. Area Fire Missions: Adjustment of Field Artillery Fire by the Bracketing and Creeping Methods, Part I

Lesson 6. Area Fire Missions: Adjustment of Field Artillery Fire by the Bracketing and Creeping Methods, Part II

4. Observed Fire Modular Pre- and Post Tests

Project personnel also developed modular pre- and post tests for on-computer use with the three alternative versions. These tests are currently available on computer, as follows:

PLANIT Lesson Name	Title
OFTA	Observed Fire Pretest
OFTB	Observed Fire Post test

F. TRAINED USAFAS CADRE

The four TECMEDIA CAI Workshop and Conversion Course graduates are fully trained and provide the U.S. Army Field Artillery School with a trained cadre of personnel. They have demonstrated and continue to demonstrate their capability to convert TEC audio visual lessons to CAI. The six TEC lessons on Observed Fire that have been converted to CAI attest to this capability. The six CAI lessons are current, incorporating the latest tactical doctrine.

The four course graduates have demonstrated and continue to demonstrate their ability to use the computer system to input, check, edit, and update CAI materials. During the latter stages of the conversion course, they were operating and interacting with the computer system on their own. Since 1 April, the end date of the course, they have continued to operate the system; run students; and input, check, edit and update their CAI materials. This includes all aspects of the Instructional System Development process involved in TEC to CAI conversion including data collection, data compilation, and data analysis.

Section 6. TEXT PRESENTATION

A. INTRODUCTION

One of the project objectives (Section 2, C, 5) was to have three alternative versions of each of the six selected TEC Observed Fire lessons made available for use by the U.S. Army Field Artillery School. Three versions were (1) CAI stand-alone, (2) CAI/Audio-visual combination (TEC), and (3) Text Presentation. These alternatives provide USAFAS with a number of different media and combinations of media for the six Observed Fire lessons to meet individual needs or preferences of students.

The CAI stand-alone version was produced by the USAFAS course participants during the TECMEDIA CAI Workshop and Conversion Course. These CAI lessons in conjunction with the current (and/or to be updated) TEC lessons on Observed Fire provided the CAI/Audio visual combination. The third alternative, Text Presentation, was produced by SDC project personnel after the workshop and conversion course was completed.

Development of the Text Presentation materials is covered in Section 6.B., which follows. Development of the modular pre- and post tests, also part of the alternative version requirements, is covered in Section 6.C.

B. PRODUCTION OF TEXT LESSONS

Text lessons are printed material developed to serve as an alternative form of self-paced individualized instruction. Text lessons contain the tasks (objectives), referenced Army publications, supplemental material, test items, and a method of evaluating performance. The requirements specified in the six Observed Fire TEC lessons (#949-061-0001-F through 0006-F) were incorporated into six text lessons on a one-for-one basis. For each of these text lessons the appropriate reference material (FM, TC, etc.) was assembled and reviewed,

applicable pages from each publication to meet the objectives stated in the TEC lessons were reproduced, and test items to assess student mastery were developed.

Supplemental material from the TEC-to-CAI converted lessons were also incorporated into the text lessons to cover objectives stated in the TEC lessons that were either not covered or incompletely presented in the Army reference material. The use of supplemental material thus brought the instructional content of the text lessons in concert with the instructional level achieved in the TEC and CAI lessons. The material in the text lessons was organized as follows:

Introduction	Purpose and organization of the lesson and the objectives the lesson covers.
References	Army reference material and listing of all applicable pages that were reproduced and included in the lesson. Army source documentation included: FM 20-6 Map Reading FM 6-40 Field Artillery Cannon Gunnery FM 6-40-5 Modern Battlefield Cannon Gunnery TC 6-40-4 Fire for Effect
Procedures	Instruction on how to proceed through the lesson.
Topics (Objectives and References)	Reproduces all applicable pages from the Army publications indicated in the reference section. The reference pages from all source material for each objective are gathered together. This is followed by supplemental material extracted from the applicable CAI lesson. Extracted CAI material is reworded as appropriate from an on-line interactive form of presentation to conform to a more conventional non-conversational printed text format.

Performance Quiz	Presents the performance test. The test items are performance oriented set in a situational context. Instructions on how to answer the test items are included in the stem. Multiple-choice questions, when used, usually contain four alternative answer-choices.
Scoring Key	Provides a scoring key for self scoring the test, indicating the number of possible points for each item or sub item.
Self Evaluation	Specifies the criteria for successfully meeting the objectives of the lesson. Instructions are provided to guide the student on to his next step--proceed or enter a review cycle.

The objectives, number of performance test items, possible points and passing score developed for each text lesson are summarized in Table 6-1.

C. OBSERVED FIRE MODULE PRE- AND POST TESTS

The Observed Fire Module Pre- and Post Tests (OFTA and OFTB - separate PLANIT lessons) were developed by project personnel to assess student performance as part of Task 4, Three Alternative Versions (Section 2, C, 5). The module pre- and post tests are given on-line (on computer) and are automatically scored. Decision frames have been included which determine for the student which of the six Observed Fire Lessons, if any, he has passed or needs to take. The module pre- and post tests were developed by providing alternate forms of the pre- and post test items (one for one) that had been generated in the workshop and conversion course to assess student performance for the six CAI lessons. These lesson assessment test items were based in turn on test items developed for the individual TEC lessons. The alternate forms of the test items were then chained together to form separate pre- (OFTA) and post module (OFTB) tests.

Table 6-1. Text Lesson Objectives and Test Items

Lesson	Title	Objectives	Test Items	Possible Score	Passing Score
1	Determination of Direction	Determine direction to a target with a compass, with a map and from a point of known direction. Determine direction using field expedient methods.	12	15	12
2	Target Location - Polar Plot Method and Grid Coordinates Method	Locate a target using: Polar Plot Method Grid Coordinates Method	10	16	13
3	Locate Target by Shift from a Known Point	Define a known point. Locate a target by shift from a known point.	7	7	6
4	Call for Fire	Identify the six elements in the call for fire. Call for indirect fire support.	12	22	18
5	Area Fire Missions: Adjustment of Field Artillery Fire by the Bracketing and Creeping Method, Part I	Determine O-T factor Spot range and deviation Determine the deviation correction	10	10	8
6	Area Fire Missions: Adjustment of Field Artillery Fire by the Bracketing and Creeping Method, Part II	Send corrections to adjust artillery rounds in an area fire mission using bracketing and creeping techniques.	10	10	8

Items selected from the CAI lesson tests were treated as follows:

- The content (values, names, etc.) of items was changed whenever possible for each test.
- Items requiring constructed responses that did not lend themselves to alteration were inserted at different points within each test.
- The order was scrambled for alternatives in multiple-choice items that could not be changed.

The number of items in OFTA and OFTB and the PLANIT CAI lessons from which they were derived are shown below. The number of items are the same as in the CAI lessons prepared by the course participants, e.g. the DOD pretest, DOTA, has 8 items.

LESSON	PRETEST (OFTA)	POST TEST (OFTB)
DOD1	8	8
TL2	6	6
TL3	9	3
CFF	6	6
BCA	6	6
BCB	5	5
Total Items	40	34

Adjunct materials (off-line exhibits) were developed in conjunction with the construction of each module test. Test items that required an accompanying exhibit that could not be accomplished on-line were flagged as needing off-line materials. Development of these materials was accomplished either by securing copies of pictures and diagrams that were contained in TEC source documentation and modifying them as required, or by preparing original material. Completed materials for each module test were bound separately as handouts for student use.

The strategy of each module test is to exploit the diagnostic capabilities of the CAI language PLANIT followed by outputting prescriptive information to the student concerning the performance. This is accomplished as follows: The student takes the module test (pre- or post) and proceeds through the test item-by-item. At the completion of the test, the students' performance is evaluated and based upon pre-determined decision criteria, prescriptive information is displayed to the student. Lessons for which the student has met criteria are indicated as "passed" and need not be taken (pretest) or repeated (post test). When the student fails to meet criteria for individual lessons he is informed which lesson(s) he must take (pretest) or repeat (post test). Lessons flagged to be taken are available to the student in three different media--TEC, CAI or as Text materials, or combinations of these.

Section 7. CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are based on the results of conducting the TECMEDIA CAI Workshop and Conversion Course.

A. CONCLUSIONS

1. A preliminary evaluation of the six Observed Fire CAI lessons was conducted. Results show students learn and like the CAI lessons.

2. The CAI to TEC conversion costs are summarized as follows. The costs include subject matter expert (SME) review and preliminary evaluation (small group tryout) based on four usable students being obtained. The costs are based upon an average lesson of approximately 1¼ hours, including pretest and post test.

   a. Total Man-Hours (per lesson)

Course Developer	- 111 hours
SME Review (2 @ 1½ hrs. each)	- 3 hours
Student hours for preliminary evaluation (7 students @ 2 hrs. each)	- 14 hours

   b. Computer Costs (per lesson)

Student (11 hours) and SME (3 hours) runs, 14 hours @ $7.50	- $ 105
Inputting lessons in Text Editor - 16 hours @ $1	- 16
Checkout and Editing in PLANIT, lesson listings, prestore, build, restore, 16 hours @ $9.50	- 152
Other computer costs	- 108
Total	$ 381

   The other computer costs of $108 include facilities usage, catalogue storage usage, permanitizing PLANIT lessons, and other computer uses associated with the project.

c. Telephone Costs (Local Baltimore line at Fort Sill, flat rate)

Telephone costs for the local Baltimore line at Fort Sill for the two months of the project were $1926 (flat rate of $963 per month). Assuming $1800 of this amount was due to the six lessons (the remaining $126 for training), this would prorate the telephone costs for each lesson to approximately $300.

3. The training time required to provide each of the four Field Artillery School lesson developers with the capability to produce PLANIT CAI versions of TEC (or new CAI materials) is 123 hours (total 490 hours). As part of the 490 hours, two TEC lessons were converted to CAI, reviewed by subject matter experts, and a preliminary evaluation conducted using Army subjects. Full use was made of job aids and procedures guides developed for the conversion course.

4. Using CAI, USAFAS course developers can produce and evaluate lessons in approximately 111 course developer hours per lesson. Difficulties encountered were minor and in two areas peripherally related to the project; computer down time, and selection of tryout students. Better selection procedures and coordination have alleviated the latter.

5. As a result of this project, the USAFAS has the six "Observed Fire" lessons in three alternative versions, CAI stand-alone, audio visual (TEC), and Text Presentation (printed format), and combinations of these. In addition, module pre- and post tests for on-line computer administration have been developed for the six lessons.

6. The U.S. Army Field Artillery School (USAFAS), as a result of this project, has a cadre of trained personnel who have demonstrated and continue to demonstrate their capability to convert TEC lessons into CAI and to use the UNIVAC computer system and PLANIT CAI system to develop, execute, edit, update, and validate CAI lesson materials.

B. RECOMMENDATIONS

The recommendations which follow are those applicable in the evaluation of CAI as a delivery system for TEC Army-wide (including USAFAS) and those which have a specific potential for USAFAS applications. Recommendations 1 through 3 are in regard to the CAI application Army-wide and 4 through 7 are more specific to USAFAS applications.

1. The TECMEDIA Workshop and Conversion Course has demonstrated that USAFAS Course Development personnel have quickly developed a capability to produce CAI course materials. In producing the six Observed Fire CAI lessons, they have followed the ISD model from the point where the tasks and training analysis has been completed and scripts produced. The scripts were revised and new material added as a result of changes in tactical doctrine, organization, and language. As part of this process, they have learned and experienced the strengths and weaknesses of CAI as compared with other systems and have concluded that CAI will become an important factor for Army training. They are also capable, as a result of their experience, to evaluate how and where CAI should be used and the factors to consider in implementing CAI systems. This is a capability which other Army schools should have.

   It is recommended the TECMEDIA CAI Workshop and Conversion Course be given at other Army schools for course development, evaluation, and training management personnel to develop the same capability, produce CAI courseware in their subject areas of responsibility, and provide experience to evaluate the usefulness of CAI as a training media. The result would be a common pool of lessons prepared by course development personnel (i.e., the responsible branch school) which would be readily available to other branch schools, operational units, reserves, and national guard.

2. A clearly demonstrated advantage of CAI is the speed and ease in carrying out the Instructional System Development (ISD) process. Much of this can be attributed to the computerization of myriad paper work usually involved. In CAI, the lesson developer inputs his lessons into the computer from his handwritten scripts. From then on, listings, SME reviews, student records, scoring, etc., are automated. Update of lesson materials based upon the ISD process is done on computer, with the lessons immediately ready for the next step. The manual preparation of course materials is no longer required, the exception being off-line course exhibits when these are needed for the lesson.

   It is recommended that the costs and times associated with the development of CAI materials be compared with the costs and times associated with preparation of other materials. The comparison to include low density and high density expected use of lessons to determine cross-over points in regard to cost effectiveness. Low development costs and high usage costs are cost effective when the student use (density) is low (one curve) as compared with high development costs and low usage costs when the student use (density) is high (second curve). At some point the two curves can be expected to cross. Computer costs include storage and distribution. Lead times for course materials and paper work costs for lesson development should be part of the comparison.

3. The Observed Fire series of lessons provide USAFAS with a three track capability--CAI, audio visual (when TEC is updated), and printed material (Text). It is also clear that students vary in their preferences for the different type of media.

   It is recommended that the three tracks be made available for student use and research conducted to establish the relationships between student characteristics, media, and learning effectiveness as it relates to the student/media (aptitude x treatment) interactions.

4. The U.S. Army Field Artillery School has developed the series of six Observed Fire CAI lessons. Observed Fire is a requirement for all combat arms personnel.

   It is recommended that the USAFAS complete the ISD process by conducting the large group tryouts to validate the Observed Fire lessons and that they be made available to all the combat arms. Validation could be conducted directly through the computerized configuration presently being used, but remoted to other users, e.g., at Fort Hood. Further, the lessons could be adapted to the parameters required by the TACFIRE computer and then presented on tactical data systems should such a policy decision be made by the Army.

5. The U.S. Army Field Artillery School has converted the six Observed Fire TEC lessons to CAI and has the capability to convert other TEC lessons or to develop new CAI lesson materials. The process for converting current TEC materials or developing new materials is the same, except that in the case of new materials, the front end of the ISD process, task and training analysis, needs to be conducted. The front end analysis is part of the ISD process and is independent of the media used.

   It is recommended that the U.S. Army Field Artillery School initially develop additional CAI lessons in low density student areas that have problems in terms of complexity of material, potential shortage of instructors, high failure rate or a high need for remedial training. Suggested areas are FADAC maintenance and operation, Fire Support Team Operation, Pershing repair, SR-56 operation, and survey.

6. The current CAI system configuration utilizes a single student terminal coupled to an earlier version (ARI Version 1.1) of PLANIT. This configuration restricts the CAI system to single student usage at one time and requires additional maintenance steps (and time) to increase the smoothness of operation by eliminating spurious PLANIT errors. This limitation places an additional burden on the USAFAS CAI trained cadre to provide an error free system during course development and subsequent student system use.

   It is recommended that a more recent ARI version of PLANIT (not previously available) be coupled with the existing USAFAS CAI system to enable the practicality of the system to be increased by permitting an increase in the number of student terminals. The latter CAI system expansion would permit a greater number of students to be run while decreasing the calendar time period required.

7. The USAFAS has 40 hours of CAI TACFIRE courseware covering the operation of the Fire Direction Center Artillery Control Console (ACC). This courseware was produced several years ago, and changes in tactical doctrine and employment have occurred. The course materials need to be updated.

   It is recommended that the USAFAS Course Development personnel update the existing 40 hours of TACFIRE CAI courseware.

APPENDIX A

SCOPE OF PROJECT

The scope of this project was as follows:

1. Assist personnel of the USAFAS in converting TEC materials into CAI format. All CAI lessons will conform to the stated objectives of the self-paced TEC lessons.

2. Train USAFAS lesson writers in the practical steps of converting from TEC audio-visual lessons to CAI lesson materials during a three-week workshop. Two CAI lessons will be converted during this period. Four more TEC lessons will be converted during the subsequent six-week conversion period following the workshop.

3. During the TEC-to-CAI conversion process the CAI lessons constructed will incorporate identified changes required to the TEC lessons, i.e., changes in tactical doctrine, employment, etc.

4. Make available three alternative versions (i.e., CAI stand-alone, CAI/Audio-Visual Combination, Text Presentation) of each of the selected TEC lessons for use by the USAFAS.

5. A preliminary validation of the CAI materials, employing subject matter experts (lesson evaluators) and naive student subjects, will be conducted.

6. A data collection system will be designed which will permit very accurate records to be kept with respect to the length of time spent, as well as the nature and amount of difficulty encountered when converting TEC materials to CAI format.

7. A plan will be produced which will indicate how the Field Artillery School's resources could best be utilized to develop strategies for media selection in the training of field artillery personnel.

8. The lessons used in this project were selected by the U.S. Army Field Artillery School. The criteria established for selection were:

   a. The material must already exist in TEC format.

   b. The material should be relevant to several MOS's.

   c. The material should be readily amenable to performance testing.

   d. The material should be representative of different types of skills.

   The TEC lessons selected were the series of six on Observed Fire as follows:

   a. Determination of Direction, TEC Lesson #949-061-0001-F.

   b. Target Location: Polar Plot Method and Grid Coordinates Method, TEC Lesson #949-061-0002-F.

   c. Locate a Target by Shift from a Known Point, TEC Lesson #949-061-0003-F.

   d. The Call for Fire, TEC Lesson #949-061-0004-F.

   e. The Adjustment of Field Artillery Fire by the Bracketing and Creeping Methods, Part 1, TEC Lesson #949-061-0005-F.

   f. The Adjustment of Field Artillery Fire by the Bracketing and Creeping Methods, Part 2, TEC Lesson #949-061-0006-F.

APPENDIX B

PROCEDURE GUIDES FOR ACCESSING AND OPERATING THE UNIVAC 1108/EXEC 8, TEXT EDITOR AND PLANIT SYSTEMS

Preceding Page BLANK - NOT FILMed

HOW TO SIGN ON TO THE UNIVAC SYSTEM

Cue or Display	Your Action	Comment
	① CONNECT CONSOLE TO COMPUTER	
	Obtain authorized UNIVAC & PLANIT identifiers	- See Trainer or Monitor
	Turn CRT power switch ON	- to activate CRT and keyboard
	Press CONV Mode key	- puts console in interactive mode
CRT screen lights	Press print line button	- to activate printer
Printer hums	Dial phone number	- to get computer channel
High pitched tone	Place phone in coupler	- to permit data transfer
CRT carrier light ON	Key #ARIØ5 or ARIØ6 Press NEW LINE key (NL)	- identifies your console transmits to computer
Edgewood Arsenal, etc. (appears on CRT screen)		you are on-computer
	② DECLARE JOB TO EXECUTIVE SYSTEM	
	key @RUN(space)Name,(account number) e.g. @RUN HORN,(account number)	
DATE:DDMMYY TIME:HHMMSS e.g., 130277 074530	Press NEW LINE key (NL)	
> appears on screen	key @@CQUE (NL)	> will no longer appear

You can now access either the UNIVAC Text Editor ⟶
or the PLANIT CAI System ⟶

TO CORRECT YOUR KEYING ERRORS BEFORE ENTRY

Incorrect typing	Hold CONTROL key down and then press X key (before pressing NEW LINE key)	to override keyed line before transmit to computer
Cursor jumps to next line, left margin of screen	Key new replacement line (NL)	transmit corrected entry

Figure B-1. Procedure Guide to Sign on to the UNIVAC System

BUILDING THE CARD INPUT FILE

Cue or Display	Your Action	Comment
	@ED,I TECMEDIA*HORN.CCF1 (NL)	Call Text Editor to create a new lesson card file.
(several lines then)		
11:	KEY IN DATA A LINE AT A TIME Last line is $$$$$$	This builds data file.
(Prints line number)	(NL)	Blank line stops input mode.
(Prints line number)	TOP (NL)	Go to top of file.
0:	LNPRINT! (NL)	List total file at CRT and on lineprinter.
(Prints line number)	EXIT (NL)	Leave Text Editor.
(Prints total number of lines in file)		

Figure B-2. Procedure Guide for Use of Text Editor - Input Mode

UPDATING A PERMANENT FILE
USING TEXT EDITOR

Cue or Display	Your Action	Comments
	@ED,U TECMEDIA*HORN.CFF1 (NL)	call up the text editor
display several lines, then		
0:		
	AUTO (NL)	INITIALIZE SAFETY FEATURE
0:		
	GOTO 145 (NL)	Position editor to line 145
display text for line 145, then		
145:		
	D (NL)	deletes the line positioned at
145:		
	P (NL)	print the line positioned at
displays line contents 145:		
	R+ (NL)	Replace the line positioned at
+		
	text for replacement (NL)	New line contents
145:		
	I+ (NL)	Input a new line of text after the line positioned at
+		
	text for new line (NL)	Inserted line
145:		
	IB+ (NL)	Input a new line of text just before the line positioned at
+		
	text for new line (NL)	new Inserted Before line
145:		
	C /OLDTEXT/NEWTEXT/ (NL)	Change the old text to new text at the line positioned at only

Figure B-3. Procedure Guide for Use of Text Editor - Edit Mode

HOW TO USE PLANIT TO CONSTRUCT A LESSON FROM TEXT EDITOR LESSON FILE

Cue or Display	Your Action	Comments
Completion of a lesson card images file.	(1) **ACCESS PLANIT SUPPORT MODE**	
	@ADD PLANIT*PRUNS.HOT (NL)	- to load PLANIT
String of READY messages ending with: LOGIN OR END		(PLANIT loaded)
*	Identifier (NL)	- get identifier from monitor
ENTER COMMAND		
*	& SYSTEM (NL)	- to Support Mode
ENTER SYSTEM COMMAND		(Support Mode prompt)
	(2) **READ LESSON CARDS FILE**	
*	PRESTORE Filename (NL)	- use Text Editor
	e.g. PRESTORE OB14768 (NL)	cards file name.
DONE		(card images read)
*		
	(3) **BUILD LESSON FOR PLANIT**	
	BUILD Lessonname (NL)	- to check cards &
Error Messages (if any) on screen & printer, then:	e.g. BUILD OBFIRE1 (NL)	build lesson for PLANIT.
*		(lesson constructed)
	SAVE	- to name and inventory
	e.g. SAVE OBFIRE1	the lesson
IDENTIFY YOURSELF***		
	identifier (NL)	- your authorized author identifier
DONE		
*	UNLOCK (NL)	- to be able to access lesson
DONE	& SYSTEM (NL)	
*	LIST $TOC (NL)	- to check if lesson is built
PLANIT lessons list on screen & printer		Check lesson name, your ID, & UNLOCKed status

Figure B-4. Procedure Guide to Build a Lesson Using PLANIT

Cue or Display	Your Action	Comment
	(4) To Replace Frame Code	
ENTER COMMAND *	frame, group, line, E (NL) e.g. 2, 3, 1, E (NL)	- to replace a line (replace Line 1, in Group 3, Frame 2)
(Line to be replaced appears on screen.)		
	Newline (NL)	Enter new line
*	frame, group, E (NL) e.g. 2, 3, E (NL)	- to replace a group (replace Group 3 in Frame 2)
(Group prompt message appears) * * * *	new group line 1 line 2 etc. & (NL)	enter lines of new group when finished
ENTER COMMAND *		
		- to replace a frame (replace Frame 2)
	frame, E (NL) e.g. 2, E (NL)	
Q/M/D/P *	Q, M, D, or P (NL)	select frame type
(Group 1 prompt appears)	enter Group 1 line	
(Group 2 prompt appears) ⋮	enter Group 2 line(s)	
* ENTER COMMAND	& (NL)	when finished

Figure B-5. Procedure Guide to Use of PLANIT Editing Commands to Modify (Replace) Material

HOW TO RUN A CAI LESSON WITH PLANIT UNDER COURSE DEVELOPER CONTROL

Cue or Display	Your Action	Comments
	① **ACCESS PLANIT SYSTEM**	
@RUN statement completed	@ADD PLANIT*PRUNS.HOT (NL)	- load PLANIT
LOGIN OR END *	key identifier (NL) e.g. HORN (NL)	- obtain identifier from monitor
ENTER COMMAND *		
	② **RETRIEVE CAI LESSON**	
	GET lessonname (NL) e.g. GET FDC (NL)	- use name assigned at SAVE
IDENTIFY YOURSELF***	author identifier (NL) e.g. TEAM1 (NL)	- use identifier used at SAVE
	③ **EXECUTE LESSON**	
	CLEAR (NL)	- to clear prior execution record
DONE *	EX (NL)	- to run lesson from the start
(Lesson frames are administered and appear in sequence as student would see them) when * appears	or EX framenumber (NL) e.g., EX 5 (NL)	- to run lesson from a specified frame
	answer (NL) e.g., CRID or	- give right or wrong answers. Check lesson displays and sequence.
*	&CLEAR,EX (as above)	- to re-execute
*	Sign-off PLANIT when finished	- See Sign-Off procedure

Figure B-6. Procedure Guide for Running (Executing) a PLANIT Lesson

APPENDIX C

TEC-TO-CAI CONVERSION WORKBOOK EXAMPLES

Final TEC Narration Script

Step 1 - Review TEC Lesson with Script

Step 2 - Modify Annotated Script

Step 3 - Rewrite Script in Frame Order

Step 4 - Encode Frames for CAI

Preceding Page BLANK - NOT FILMED

TITLE LAW #2 FINAL NARRATION SCRIPT (typed from cassette)

SON NO. 948-071-006F M72A2 LAW, ENGAGING THE TARGET DATE 22 July 1976

TOPIC TERRAIN CONDITIONS OBJECTIVE Identify advantages and disadvantages of terrain conditions when firing the LAW.

VISUAL	AUDIO
	1. Another important factor in firing the LAW is the terrain.
	2. Firing the LAW without considering adequate backblast area can be hazardous. (*)
	3. The area to the rear of the weapon must not be blocked by a solid obstruction. (*)
	4. The backblast danger area extends 15 meters to the rear of the LAW. Be sure you are a safe distance in front of any solid obstruction before you fire. If there is no backblast clearance, do not fire the LAW. (*)
	5. Dense undergrowth can also block backblast, but to a lesser degree than a solid obstruction. This is called limited backblast clearance. When practical, select a firing position where the vegetation will obstruct the backblast release. (*)

Figure C-1. Final TEC Narration Script

TITLE LAW #2 FINAL NARRATION SCRIPT (typed from cassette)

SON NO. 948-071-006F M72A2 LAW, ENGAGING THE TARGET DATE 22 July 1976

TOPIC TERRAIN CONDITIONS OBJECTIVE Identify advantages and disadvantages of terrain conditions when firing the LAW.

VISUAL	AUDIO
Add title ** Terrain Factors **	1. Another important factor in firing the LAW is the terrain.
Maybe switch	2. Firing the LAW without considering adequate backblast area can be hazardous. (*)
	3. The area to the rear of the weapon must not be blocked by a solid obstruction. (*)
	4. The backblast danger area extends 15 meters to the rear of the LAW. Be sure you are a safe distance in front of any solid obstruction before you fire. If there is no backblast clearance, do not fire the LAW. (*)
edit	5. Dense undergrowth can also block backblast, but to a lesser degree than a solid obstruction. This is called "limited backblast clearance." When practical, select a firing position where the vegetation will obstruct the backblast release. (*)

Figure C-2. Step 1 - Review TEC Lesson with Script

TITLE LAW #2 FINAL NARRATION SCRIPT (typed from cassette)

LESSON NO. 948-071-006F M72A2 LAW, ENGAGING THE TARGET DATE 22 July 1976

TOPIC TERRAIN CONDITIONS OBJECTIVE Identify advantages and disadvantages of terrain conditions when firing the LAW.

VISUAL	AUDIO
Add title ** Terrain Factors **	1. Another important factor in firing the LAW is the terrain.
	2. Firing the LAW without considering adequate backblast area can be hazardous. (*)
Present three types of areas to be avoided • solid obstructions • dense undergrowth • dry or sandy areas	3. The area to the rear of the weapon must not be blocked by a solid obstruction. (*)
	4. The backblast danger area extends 15 meters to the rear of the LAW. Be sure you are a safe distance in front of any solid obstruction before you fire. If there is no backblast clearance, do not fire the LAW. (*)
How far to the rear does the backblast danger area extend? (meters)	
	5. Dense undergrowth can also block backblast, but to a lesser degree than a solid obstruction. This is called limited backblast clearance. When practical, select a firing position where the vegetation will obstruct the backblast the least. (*)
exit	

Figure C-3. Step 2 - Modify Annotated Script

1 ** Terrain Factors **

Another important factor in firing the LAW is the terrain. Firing the LAW without adequate backblast area can be hazardous. The backblast area extends 15 meters to the rear for safety.

2 There are three types of terrain you should avoid when firing the LAW:

1 solid obstructions
2. dense undergrowth
3. dry or sandy areas

3 * Solid obstructions *

The area to the rear of the weapon must not be blocked by a solid obstruction. Be sure you are a safe distance in front of any solid obstruction before you fire. If there is no backblast clearance, do not fire the LAW.

4 How far to the rear does the backblast danger area which you must keep in mind, extend?

a. 8 meters
b. 15 meters
c. 25 meters
d. 40 meters

Hint: 15 meters is correct
Wrong: No. the danger zone extends 15 meters to the rear of the launcher

Figure C-4. Step 3 - Rewrite Script in Frame Order

1 1.Ø Q. Terr.

2 ** Terrain Factors * *@

Another important factor in firing the LAW is the terrain. Firing the LAW without considering an adequate backblast area can be hazardous. The backblast area extends 15 meters to the rear for safety.@

(Type 'go' to continue)

3 A GO

1 2.Ø Q

2 There are three types of terrain you should avoid when firing the LAW:@

1. solid obstructions
2. dense undergrowth
3. dry or sandy areas@

(Type 'go' to continue)

3 A GO

1 3.Ø Q.

2 * Solid obstructions *@

The area to the rear of the weapon must not be blocked by a solid obstruction. Be sure you are a safe distance in front of any solid obstruction before you fire. If there is no backblast clearance, do not fire the LAW.@

(Type 'go' to continue)

3 A GO

Figure C-5. Step 4 - Encode Frames for CAI

APPENDIX D

DATA COLLECTION SYSTEM

1. TEC/CAI Background Data Questionnaire
2. Daily Individual Activities Log
3. Monitor's Observation Log
4. Questionnaire (SME)
5. Guidelines for Subject Matter Review
6. CAI Lesson Review
7. Questionnaire (S)
8. CAI Student Attitude Questionnaire
9. Student Interaction Record
10. PLANIT Student Record

Preceding Page BLANK - NOT FILMED

TEC/CAI BACKGROUND DATA QUESTIONNAIRE

DATE _____

These questions will help us to understand your background experiences with respect to the TEC/CAI conversion tasks and to adjust workshop training emphasis accordingly. The data is solely for use in the TEC/CAI project and will not reveal your identity when compiled and described.

NAME _____ RANK _____ SSAN _____

GRADE _____ MOS _____ JOB TITLE _____

EDUCATION (grade or degree, year, and major) _____

RELATED TRAINING _____

ORGANIZATION _____ PHONE _____

DATE OF BIRTH _____ LENGTH OF SERVICE _____

TIME IN MOS _____ TIME IN CURRENT JOB _____

LIST MAJOR JOB DUTIES _____

_____

1. Are you familiar with the subject areas for the TEC materials to be converted? (Enter subject areas for your type of experience)

   Attended classes: Yes _____ No _____

   Taught classes: Yes _____ No _____

   Observed procedures: Yes _____ No _____

   Practice or combat use: Yes _____ No _____

2. Have you written behavioral tasks, training objectives, and standards?

   Yes _____ Subject area(s): _____

   No _____

3. Have you developed Army performance tests? (yes/no)

   Yes _____ Printed tests? _____ Standards? _____

   No _____ Live/Simulated tests? _____ Standards? _____

4. Have you written printed training support materials? (e.g., lesson plans)

   Yes _____ Instructor materials _____

   No _____ Trainee materials _____

Figure D-1. TEC/CAI Background Data Questionnaire

5. Have you developed audiovisual training materials? (e.g., UTEC)

Yes _____ Type materials _____

Updated only _____

No _____

6. Have you developed programmed instruction (PI) booklets?

Yes _____ Subject areas: _____

No _____

Linear? _____ Branching? _____ With pictorials? _____

7. Have you made use of training aids production facilities on this post?

Yes _____ Graphic arts? _____ Photographic? _____

No _____ Reproduction? _____ Other _____

8. Are you familiar with computer-assisted instruction (CAI)?

Yes _____ Name of CAI system _____

No _____ Have you written CAI lessons? _____

Yes _____ CAI language used _____

No _____ Subject area(s) _____

9. Have you revised training materials based on review by Army subject-matter experts (SMEs)?

Yes _____ Subject area(s) _____

No _____

Type materials: AV _____ PI _____ Other _____

10. Have you evaluated the effectiveness and trainee acceptance of training materials by collecting trainee data?

Yes _____ Subject area(s) _____

No _____ Type materials _____

Trainees: Officer _____ Enlisted _____ Civilian _____

COMMENTS: _____

Figure D-1. TEC/CAI Background Data Questionnaire (Cont.)

DAILY INDIVIDUAL ACTIVITIES LOG

NAME (last name first):	RANK/GRADE	(Check One)	DATE:
		WORKSHOP	
		CONVERSION	

ACTIVITY		HOURS	REMARKS
ADDS use (by self or instructor)	TP		
Other Training Activity	TW		
Review a CAI Lesson	C1		
Review TEC Lesson to be Converted	C2		
Prepare TEC for CAI Conversion	C3		
Prepare Material in PLANIT	C4		
Evaluate and Revise Materials	C5		
	X		

OTHER CODES			
	A		(A)rmy conflicting work.
	P		(P)ersonal absence.
	H		(H)oliday.
	S		(S)ick.

ENTER IDENTIFIERS AND DATE. RECORD HOURS AND DIFFICULTIES AT END OF WORKDAY. SUBMIT LOG AT START OF NEXT WORKDAY.

WORKSHOP / CONVERSION – Check (✓) as appropriate: during Conversion WORKSHOP / during CONVERSION of materials

ACTIVITY – Keep track of daily training or conversion activities.

HOURS – Enter time started, time ended on daily activities.

DIFFICULTIES – Concisely describe any major difficulties by activity.

OTHER CODES – Enter time started, time ended, for any activities done outside of assigned workday (X) or for absence from assigned workday (A P H S). For (X) enter ACTIVITY codes to left and note any DIFFICULTIES.

Figure D-2. Daily Individual Activities Log

MONITOR'S OBSERVATION LOG

DATE	ACTIVITY CODES		
	TP-PLANIT on-line training	C1-Review CAI Lesson	C4-Prepare in PLANIT
	TW-Other workshop training	C2-Review TEC Lesson	C5-Evaluate
		C3-Prepare for Conversion	

ENTER ACTIVITY, DIFFICULTIES, ACTIONS UNDER "COMMENTS".
IDENTIFY EQUIPMENT USED AS APPROPRIATE.

NAME		NAME	
TIME	COMMENTS	TIME	COMMENTS

Figure D-3. Monitor's Observation Log

Date: _____

QUESTIONNAIRE (SME)

Name _____ Grade _____ SSAN _____

Unit _____ MOS _____ Phone _____

Duty Position _____ Length of Military Service _____

Six TEC lessons are being converted into a computer assisted instruction (CAI) mode. These are:

	TEC Lesson No.	Title
1.	#949-061-0001-F	Determination of Direction
2.	#949-061-0002-F	Target Location: Polar Plot Method and Grid Coordinates Method
3.	#949-061-0003-F	Locate a Target by Shift from a known point
4.	#949-061-0004	The Call for Fire
5.	#949-061-0005	The Adjustment of Field Artillery Fire by the Bracketing and Creeping Methods, Part I
6.	#949-061-0006	The Adjustment of Field Artillery Fire by the Bracketing and Creeping Methods, Part II

1. Which of the subjects, 1 to 6 above, are you currently proficient? Check (X) which areas.

1. 0001 _____	3. 0003 _____	5. 0005 _____
2. 0002 _____	4. 0004 _____	6. 0006 _____

Figure D-4. Questionnaire (SME)

2. Which of the subjects, 1 to 6 above, have you been an instructor. Check (X) which ones.

1. 0001 _____	3. 0003 _____	5. 0005 _____
2. 0002 _____	4. 0004 _____	6. 0006 _____

Figure D-4. Questionnaire (SME) (Cont.)

GUIDELINES FOR SUBJECT MATTER REVIEW

1. Is the task information and data technically accurate and complete?
2. Is the procedure described for performing the task in line with current or upcoming Army doctrine (use)?
3. If Army doctrine does not prescribe an exact procedure for performing the task, is the procedure described adequate? Efficient? Similar in basic respects to the way you would perform it?
4. Are there any written statements or visuals which require clarification--that is, the information looks "right", but seems hard to understand or could be misinterpreted?
5. Is the language "Army"?
6. Are there any typographical mistakes in answers to exercises and tests or incorrect alternatives that could be considered correct.

Please write comments directly on the lesson materials (listings and exhibits) concerning these points where this is practical. Correct answers when you can. Thanks for your help.

Figure D-5. Guidelines for Subject Matter Review

Date: _____

CAI LESSON REVIEW

Lesson Name: _____ Reviewer: _____

A. What is your overall impression of this lesson? _____

_____

_____

_____

_____

_____

B. Is the lesson technically accurate and complete? Yes_____ No_____

Please comment: _____

_____

_____

C. Is the material in line with current or upcoming Army doctrine (use)? Yes___

No _____ Please comment: _____

_____

_____

D. Were any parts of the lesson particularly good? Yes_____ No_____

Please comment: _____

_____

_____

E. Were any parts of the lesson particularly bad? Yes_____ No_____ Please

comment: _____

Figure D-6. CAI Lesson Review

CON'T: CAI Lesson Review "E"

F. Will students be able to understand the language used in the lesson? Yes___

No _____ Please comment: _____

G. Compare the TEC lesson with the CAI lesson. (From the student's view point)

H. Are the objectives of the CAI lesson the same as the TEC lesson? yes___ no___

If no, please comment on how they are different _____

Figure D-6. CAI Lesson Review (Cont.)

Date: _____

QUESTIONNAIRE (S)

Name _____ Grade_____ SSAN _____

Unit_____ MOS _____

Duty Position_____ GCT Score_____ Education____

1. How long have you been in the Army? _____

2. Have you had previous military service? Yes _____ No _____

3. When did you complete BCT (date) _____

4. Are you currently in AIT (Advanced Individual Training)? Yes_____

   No _____

5. Have you had Land Navigation (Map Reading)? Yes_____ No _____

6. Can you read a military map? Yes _____ No _____

Figure D-7. Questionnaire (S)

CAI STUDENT ATTITUDE QUESTIONNAIRE

NAME AND GRADE _____ SSAN _____

UNIT _____ PHONE _____ DATE _____

1. What did you think of the Observed Fire CAI Lessons that you have just completed?

_____

_____

_____

_____

_____

2. My attitude toward CAI material was that I...

( ) disliked it very much
( ) disliked it
( ) neither liked nor disliked it
( ) liked it
( ) liked it very much

3. Instructions for taking the lessons were...

( ) very difficult to understand
( ) difficult to understand
( ) borderline
( ) easy to understand
( ) very easy to understand

4. Which Observed Fire CAI Lessons did you take? (check)

____ Determination of Direction
____ Target Location: Polar Plot Method and Grid Coordinates Method
____ Locate a Target by Shift from a Known Point
____ The Call for Fire
____ The Adjustment of Fire by the Bracketing and Creeping Methods, Part I
____ The Adjustment of Fire by the Bracketing and Creeping Methods, Part II

Figure D-8. CAI Student Attitude Questionnaire

5. Did you have any problems or difficulties in using the console or interacting with the computer?

( ) Yes ( ) No

If Yes to item 5, please describe your most serious problem or difficulty.

6. The lessons covered the areas listed in (4) above. Were any of these, or parts of these, particularly good, and tell why.

7. Were any of the lessons particularly bad and tell why.

Figure D-8. CAI Student Attitude Questionnaire (Cont.)

8. I think that this CAI method of instruction/learning is...

( ) very effective
( ) effective
( ) borderline
( ) ineffective
( ) very ineffective

9. For satisfactory understanding of the subject being studied, the amount of time provided was:

( ) much too long
( ) fairly long
( ) about right
( ) fairly short
( ) much too short

10. For satisfactory understanding of the subject being studied, the amount of material (information) provided was:

( ) much too large
( ) fairly large
( ) about right
( ) fairly small
( ) much too small

11. The technical detail provided was:

( ) very satisfactory
( ) satisfactory
( ) borderline
( ) unsatisfactory
( ) very unsatisfactory

Figure D-8. CAI Student Attitude Questionnaire (Cont.)

12. The organization of the material presented was:

( ) very satisfactory
( ) satisfactory
( ) borderline
( ) unsatisfactory
( ) very unsatisfactory

13. My understanding of the material presented was:

( ) very satisfactory
( ) satisfactory
( ) borderline
( ) unsatisfactory
( ) very unsatisfactory

14. The quantity of the off-line course exhibits provided was:

( ) very satisfactory
( ) satisfactory
( ) borderline
( ) unsatisfactory
( ) very unsatisfactory

15. Were any of the exhibits inaccurate?

( ) Yes ( ) No

If Yes, please describe: _____

_____

_____

16. Were any of the exhibits irrelevant or unnecessary?

( ) Yes ( ) No If Yes, which? _____

_____

_____

Figure D-8. CAI Student Attitude Questionnaire (Cont.)

17. Can you think of any other exhibits that should be added to the set?

( ) Yes ( ) No If Yes, please describe: _____

_____

18. If you had to carry out the tasks on observed fire covered in the course, how well could you do them?

( ) very effectively
( ) effectively
( ) borderline
( ) ineffectively
( ) very ineffectively

19. Have you ever had this type (CAI) training before?

( ) Yes ( ) No

20. Does this type of training make Army instruction better?

( ) Yes ( ) No

Why? _____

_____

_____

21. Is this type of training interesting to you?

( ) Yes ( ) No ( ) Not Sure

Why? _____

_____

_____

Figure D-8. CAI Student Attitude Questionnaire (Cont.)

22. Does this type of training make it easy for you to learn?

( ) Yes ( ) No ( ) Don't Know

Why? _____

_____

_____

23. Do you like this type of training?

( ) Yes ( ) No ( ) Undecided

Why? _____

_____

_____

Figure D-8. CAI Student Attitude Questionnaire (Cont.)

```
                    **TARGET LOCATION**

THE OBJECTIVE OF THIS TEST IS TO EVLAUATE YOUR ABILITY TO:

    1. LOCATE A TARGET BY POLAR PLOT WHEN THE TARGET-REFERENCE POINT
       IS KNOWN

    2. LOCATE A TARGET BY POLAR PLOT BY ESTIMATING DATA FROM A MAP

    3. LOCATE A TARGET BY GRID COORDINATES BY ESTIMATING DATA
       FROM A MAP

                        (TYPE 'GO' TO CONTINUE)

*
GO

SUCCESSFUL COMPLETION OF THIS TEST INDICATES THAT YOU ALREADY
POSSESS THE NECESSARY SKILLS TO LOCATE TARGETS BY THE POLAR
PLOT METHOD AND THE GRID COORDINATE METHOD,AND WILL NOT HAVE
TO TAKE THE LESSON ON **TARGET LOCATION.**
DO YOU HAVE A PENCIL, PAPER, AND THE TARGET LOCATION TEST HANDOUT?
IF NOT, GET THEM FROM THE MONITOR. WHEN YOU ARE READY,

                    (TYPE 'GO' TO CONTINUE)

*
GO

THE INFORMATION TO LOCATE A TARGET BY THE 'POLAR PLOT METHOD' IS
SHOWN IN FIGURE 1, OF THE HANDOUT. DIRECTION TO THE KNOWN REFERENCE
POINT (HILLTOP 610) IS 315 DEGREES. THE ESTIMATED ANGLE FROM
HILLTOP 610 TO THE TARGET IS 10 DEGREES. THE ESTIMATED DISTANCE
TO THE TARGET IS 3000 METERS, AND THE VERTICAL SHIFT TO THE
TARGET IS +10 METERS.
STUDY FIGURE 1.
                        (TYPE 'GO' TO CONTINUE)

*
GO

THE RELATIVE LOCATION OF THE OBSERVER,REFERENCE POINT AND TARGET,
ALONG WITH THE KNOWN INFORMATION, IS SHOWN IN FIGURE 1. WHEN
LOCATING THIS TARGET BY THE POLAR PLOT METHOD, WHAT TWO ELEMENTS
OF TARGET LOCATION MUST BE SENT TO THE FIRING UNIT? TYPE THE
LETTER CORRESPONDING TO YOUR ANSWER. (A,B,C, OR D)

                    A.  DISTANCE AND RANGE
                    B.  DIRECTION AND DISTANCE
                    C.  DISTANCE AND TARGET TYPE
                    D.  ELEVATION AND DISTANCE

*
B
```

Figure D-9. Student Interaction Record

```
SUMMARY ONLY (Y/N)?
* N

N
DATE   0/0/1                                                    STUDENT HISTORY
LESSON NAME  BCB,  STUDENT NAME
  FRAME    TYPE    TIME     NEUTRAL    ANSWER    LABEL
                   MIN/     RIGHT+       TAG
                   SEC      WRONG-

START                                                    0/0/1     0.00
   1.00      Q     63.59        0          A       BCBPRE
   2.00      Q     63.59        0          A
   3.00      Q     63.60        0          A
   4.00      Q     63.61        0          A
   5.00      Q     63.63        0          A
   6.00      M     63.60        +          B
   7.00      Q     63.63        0          A
   8.00      M     63.63        +          A
   9.00      D     63.63        0
  10.00      Q     63.62        0          A
  11.00      Q     63.58        0          A
  12.00      M     63.61        +          C
  13.00      Q     63.60        0          A
  14.00      M     63.62        +          B
  15.00      Q     63.63        0          A
  16.00      Q     63.60        0          A
  17.00      Q     63.61        0          A
  18.00      Q     63.63        0          A
  19.00      M     63.60        +          B
  20.00      M     63.58        +          D
  21.00      M     63.62        +          B
  22.00      M     63.61        +          B
  23.00      M     63.61        +          C
  24.00      D     63.63        0
  25.00      Q     63.58        0          A
  25.50      Q     63.61        0          A
  26.00      Q     63.63        0          A
  27.00      Q     63.61        0          A
  28.00      M     63.63        +          C
  29.00      M     63.59        +          A
  30.00      M     63.60        +          C
  31.00      M     63.62        +          A
  32.00      M     63.60        +          A
  33.00      M     63.60        +          D
  34.00      D     63.63        0
  35.00      Q     63.59        0          A
  36.00      Q     63.59        0          A
  37.00      Q     63.63        0          A
  39.00      Q     63.59        0          A
  40.09      Q     63.62        0          A
  41.00      M     63.59        +          B
NUMBER RIGHT    16
NUMBER WRONG    0
NUMBER ENTRIES    41
NUMBER TIME-OUTS    0
TOTAL TIME    2624.37
```

Figure D-10. PLANIT Student Record

APPENDIX E

TEC-TO-CAI CONVERSION WORKSHOP SCHEDULE

CONVERSION WORKSHOP SCHEDULE

BLOCK 1 (WEEK 1): PREPARE TEC MATERIAL FOR CAI CONVERSION

MONDAY - SET-UP	TUESDAY - DAY 1	WEDNESDAY - DAY 2	THURSDAY - DAY 3	FRIDAY - DAY 4
SCHOOL COORDINATION • Brief/coordinate • Contact local persons & get phone numbers • Obtain TEC production backup materials • Determine workshop attendees (names) • Determine assigned workday hours & effective time FACILITIES CHECK • Review/arrange workshop area • Survey graphics & repro facility • Unload/check general supplies • Unload/arrange training support materials EQUIPMENT CHECK • Checkout TEC materials on Cue-See • Checkout console & PLANIT operation PREPARATION • Week 1 time schedule • Week 1 materials	WELCOME & PROJECT BACKGROUND • Army & school requirement • SDC role & people NINE-WEEK PREVIEW • Schedule • Production goals • Training goals • Need for data • Q/A WORKSHOP PREVIEW • What it is & isn't • Workshop format • Conversion blocks (major tasks/milestones) • Product goals by block • Product standards (checkpoints & checklist) • Q/A CUE-SEE FAMILIARITY • (Demonstration & hands-on checkout) TEAM EXERCISE ON CUE-SEE • (Teams of 2 each review a TEC LAW topic with TEC script & Topic Conversion Examples) DEBRIEFING • Use of TEC materials & Conversion Notebook ADMINISTRATIVE • Assigned workday • Daily Task Log • Complete Background Questionnaire	WHAT IS CAI? (visual) PLANIT OVERVIEW (visual) USE OF CAI CONSOLE • Post Cue-Card • Demonstrate console use • Teams of 2 take lesson INTRO WHAT IS A TYPICAL CAI MODULE? • Objectives (visual) • Structure (visual) TASK 1.0 REVIEW A CAI LESSON • Convene group at console • Assign console operation & listing review tasks to individuals • Rotate positions while taking lesson TEC-TO-CAI DESIGN REQ'TS • TEC/CAI similarities • TEC/CAI differences • Reading a listing FRAME-THINKING, I: PRESENTING INFORMATION & QUESTIONS • Header (sequence) • Type questions • Textual display • Question display • Answer choices • Answer feedback GROUP EXERCISE • Given examples, identify frame types & components	TASK 2.0 REVIEW TEC LESSON & MATERIALS • Teams use Cue-Sees • Determine what can transfer to CRT • Identify required visuals • Label existing script information • Label answer choices & feedback • Note misleading content, unclear instructions or confusing words REVIEW EXAMPLE CONVERSION NOTEBOOK TASK 3.0, STEP 1 PREPARE TEC FOR CONVERSION • Deskwork with scripts • Specify type question for existing questions • Draft new practice questions • Mark changes in ordering • Select any exhibits & specify changes FRAME-THINKING, II: WRITING DECISIONS • Types of decisions • English examples GROUP PRACTICE • Given examples, identify conditions (standards) & actions (feedback & control)	CAI CONSIDERATIONS • Size guidelines • Character set • Other TASK 3.0, STEP 2 • Rewrite script in numeric sequence • Rewrite existing questions for CAI • Incorporate new questions • Write lesson topic decisions TEC/CAI TESTING REQUIREMENTS • Review TEC test & key • Review decision requirements for CAI pre-post tests • Guidelines for preparing alternate item forms TASK 3.0, STEP 3 • Prepare post-test items • Prepare pretest items • Select visuals • Write pretest decision • Write post-test decision • Write review element • Organize material DESKCHECK NOTEBOOKS • Cross-team check • Content • Design elements • Frame elements • Visuals • Sequence BLOCK 1 PROGRESS CHECK (SDC) • Conversion notebook • Design standards checklist • Critique & help

Figure E-1. Conversion Workshop Schedule Block 1 (Week 1): Prepare TEC Material for CAI Conversion

CONVERSION WORKSHOP SCHEDULE

BLOCK 2 (WEEK 2): PREPARE MATERIAL IN PLANIT

MONDAY - DAY 5	TUESDAY - DAY 6	WEDNESDAY - DAY 7	THURSDAY - DAY 8	FRIDAY - DAY 9
REVIEW FROM BLOCK 1 PROGRESS CHECK • (More work, if needed) PREVIEW OF BLOCK 2 PLANIT CONVENTIONS & LEGALITIES: M & Q FRAMES, I • Summary of Groups • Header data • Line-skip control • Illegal characters • Difference between Group 3 in M & Q frames • Group 3 answer tags • Correct answer symbol REVIEW REFERENCES & Q/A TASK 4.0, STEP 1: ENCODE Q & M FRAMES • Block group numbers on page margins • Transfer Step 3 presentations & questions to pages • Add Group 2 control characters • Add frame headers • Add Group 3 to M-frames MONITOR PROGRESS & PROVIDE INDIVIDUAL OR GROUP HELP	PLANIT CONVENTIONS & LEGALITIES: M & Q FRAMES, II • Constructed responses • Phonetic matching • Keyword matching • Effect of Group 3 line order • Group 3/Group 4 answer tags • Group 4 action commands • Unanticipated answers REVIEW REFERENCES & Q/A TASK 4.0, STEP 1 (CONT'D) • Encode Group 3 of Q-frames • Encode Group 4 actions all frames • Add Q-frame unanticipated answer actions • Check Q/M frame entries & sequence MONITOR PROGRESS & PROVIDE INDIVIDUAL OR GROUP HELP	PLANIT CONVENTIONS & LEGALITIES, III: D-FRAMES • Student-lesson Record data (example) • Effect of TRACE • Summary of pattern forms (examples) • Control (IF & ELSE) • Connectives (AND, OR) • Relationals • Q/A GROUP DECISIONS PRACTICE • Relationals drill • Translate English decision statements to PLANIT REVIEW REFERENCES TASK 4.0, STEP 2: ENCODE DECISIONS • Review English decision statements in Conversion Notebook • Encode PLANIT D-frames • Insert frames in Conversion Notebook • Check entries and sequence MONITOR PROGRESS & PROVIDE INDIVIDUAL OR GROUP HELP	ENTERING FRAMES TO THE COMPUTER • Demonstration of UNIVAC Text-Editor • Demonstrate use of PLANIT to build lessons entered to text editor • Review Commands Reference List • Review procedures example • Backup: Take CAI Lesson PLANIT2 on direct entry to PLANIT TASK 4.0, STEP 3: ENTER FRAMES (TEAM 1) • Input frames at keyboard • Correct typing errors with local edit key • Build lessons using PLANIT • Name & save lesson • Obtain errors list at printer • Obtain lesson listing at printer TASK 4.0, STEP 3: (Repeat for Team 2) TASK 4.0, STEP 4: DESK-CHECK MATERIALS • Check errors list & listing • Mark changes to be made in listing BLOCK 2 PROGRESS CHECK: FRAMES ENTRY (SDC) • Listing & notebook • Standards Checklist	EXECUTING, CHECKING & EDITING WITH PLANIT • Obtain PLANIT Error Messages Reference List • Team 1 takes CAI lessons PLANIT3 & PLANIT 4 (1.5 hours) • Team 2 takes PLANIT3 & 4 • Q/A and help TASK 4.0, STEP 5: ONLINE CHECK & EDITING (TEAM 1) • Make Step 4 editing changes • Execute lesson with student exhibits • Determine cause of error messages • Check exhibits • Mark changes on listing and/or exhibits • Use edit commands for CAI changes • Reexecute & check • Save CAI changes • Obtain updated listing at printer TASK 4.0, STEP 5: (Repeat for Team 2) BLOCK 2 PROGRESS CHECK: LESSON EXECUTION (SDC) • Frames notebook • Updated listing • Execution records • Standards Checklist

Figure E-2. Conversion Workshop Schedule Block 2 (Week 2): Prepare Material in PLANIT

CONVERSION WORKSHOP SCHEDULE

BLOCK 3 (WEEK 3): EVALUATE & REVISE CONVERTED MATERIALS

MONDAY - DAY 10	TUESDAY - DAY 11	WEDNESDAY - DAY 12	THURSDAY - DAY 13	FRIDAY - DAY 14
REVIEW FROM BLOCK 2 PROGRESS CHECK • (More work, if needed) PREVIEW OF BLOCK 3 SME REVIEW • SME schedule • Review procedure • Guidelines TASK 5.0, STEP 1: PREPARE FOR REVIEW (TEAMS 1 & 2) • Prepare updated copy of exhibits • Obtain updated lesson listing at console printer TASK 5.0, STEP 2: SME REVIEW (TEAM 1, LESSON 1) • Team leader briefs SME on how to read listing with exhibits • SME checks technical accuracy & doctrine • SME annotates listing or visuals with lesson-writer • SME determines priority of changes • Lesson team compiles changes & determines most efficient way to incorporate changes	TASK 5.0, STEP 2: SME REVIEW (REPEAT FOR TEAM 2,LESSON 2) TASK 5.0, STEP 3: EDIT MATERIALS PER SME REVIEW (TEAM 1) • Specify any changes to student exhibit masters • Make changes to exhibit masters • Request reproduction of exhibits for student tryouts • Make CAI lesson changes at console • Execute & check edited CAI lesson • Obtain updated copy of lesson listing at printer TASK 5.0, STEP 3: EDIT MATERIALS PER SME REVIEW (REPEAT FOR TEAM 2) BLOCK 3 PROGRESS CHECK: SME CHANGES MADE (SDC) • Compiled list of SME changes • Change specs for student exhibits • Updated lesson listing • Lesson Standards Checklist	PREPARING FOR STUDENT TRYOUTS • Briefing students • Student instructions • Monitoring • Manual recording • Computer records • Attitudes scale • Q/A & practice TASK 5.0, STEP 4: CONDUCT STUDENT TRYOUTS (TEAM 1, LESSON 1) • Obtain reproduced student exhibits • Set-up terminal & monitor positions • Brief students as they arrive • Students 1, 2 & 3 take lessons in sequence • Monitor & record comments & observations • Administer attitude scale to students as they finish	TASK 5.0, STEP 4: CONDUCT STUDENT TRYOUTS (Repeat for Team 2, Lesson 2) DETERMINING REVISIONS REQUIRED • Use of PLANIT Student Record to determine post-test performance • Use of records to compile time data • Use of attitude scale to determine acceptance • Use of comments & observations to locate priority revisions • *Q/A* TASK 5.0, STEP 5: COMPILE DATA & DETERMINE REVISIONS (TEAM 1, LESSON 1) • Compile post-test scores • Compile time data • Rate acceptance • Analyze comments • Determine priority revisions • Specify revisions to be made	TASK 5.0, STEP 5: DETERMINE REVISIONS (Repeat for Team 2, Lesson 2) BLOCK 3 PROGRESS CHECK: LESSON EFFECTIVENESS & ACCEPTANCE (SDC) • Do for Teams 1 & 2, in sequence • Post-test scores • Lesson online times • Attitude indices • Revisions specified by lesson team • Lesson Standards Checklist • Review priority changes *with team* TASK 5.0, STEP 6: MAKE FINAL REVISIONS (Teams 1 & 2, as required) • Make CAI lesson changes at console • Obtain required copies of listings at printer • Request any changes to exhibit masters • Request reproduction & binding of exhibits for copies required REVIEW SCHEDULE & PRODUCTION REQUIREMENTS FOR TEC-TO-CAI CONVERSION PERIOD

Figure E-3. Conversion Workshop Schedule Block 3 (Week 3): Evaluate and Revise Converted Materials