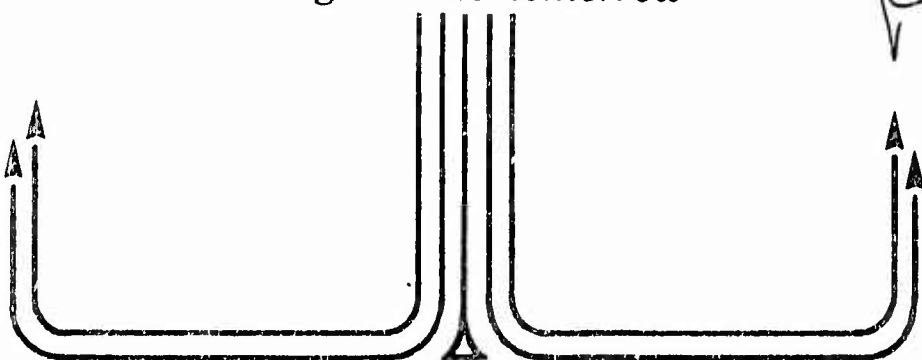②

AIR COMMAND
AND
STAFF COLLEGE

---- STUDENT REPORT ----
A COMPUTER-BASED EDUCATIONAL
APPROACH TO THE AIR COMMAND
AND STAFF COLLEGE ASSOCIATE PROGRAM

MAJOR JOHN A. GAUDET   85-0925
"insights into tomorrow"

DTIC
ELECTE
JUL 1 2 1985
S
E
D

85 06 25 080

DISCLAIMER

The views and conclusions expressed in this document are those of the author. They are not intended and should not be thought to represent official ideas, attitudes, or policies of any agency of the United States Government. The author has not had special access to official information or ideas and has employed only open-source material available to any writer on this subject.

This document is the property of the United States Government. It is available for distribution to the general public. A loan copy of the document may be obtained from the Air University Interlibrary Loan Service (AUL/LDEX, Maxwell AFB, Alabama, 36112) or the Defense Technical Information Center. Request must include the author's name and complete title of the study.

This document may be reproduced for use in other research reports or educational pursuits contingent upon the following stipulations:

-- Reproduction rights do not extend to any copyrighted material that may be contained in the research report.

-- All reproduced copies must contain the following credit line: "Reprinted by permission of the Air Command and Staff College."

-- All reproduced copies must contain the name(s) of the report's author(s).

-- If format modification is necessary to better serve the user's needs, adjustments may be made to this report--this authorization does not extend to copyrighted information or material. The following statement must accompany the modified document: "Adapted from Air Command and Staff Research Report ___(number)___ entitled ___(title)___ by ___(author)___ ."

-- This notice must be included with any reproduced or adapted portions of this document.

REPORT NUMBER   85-0925

TITLE   A COMPUTER-BASED EDUCATIONAL APPROACH TO THE
AIR COMMAND AND STAFF COLLEGE ASSOCIATE PROGRAM

AUTHOR(S)   MAJOR JOHN A. GAUDET, USAF

FACULTY ADVISOR   MAJOR PETER F. SEILER, ACSC/EDPT

SPONSOR   LT COL RICHARD M. DOUCET, ACSC/EDF

Submitted to the faculty in partial fulfillment of
requirements for graduation.

AIR COMMAND AND STAFF COLLEGE
AIR UNIVERSITY
MAXWELL AFB, AL 36112

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED		1b. RESTRICTIVE MARKINGS			
2a. SECURITY CLASSIFICATION AUTHORITY		3. DISTRIBUTION/AVAILABILITY OF REPORT			
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE					
4. PERFORMING ORGANIZATION REPORT NUMBER(S) 85-0925		5. MONITORING ORGANIZATION REPORT NUMBER(S)			
6a. NAME OF PERFORMING ORGANIZATION ACSC/EDCC	6b. OFFICE SYMBOL (If applicable)	7a. NAME OF MONITORING ORGANIZATION			
6c. ADDRESS (City, State and ZIP Code) Maxwell AFB AL 36112		7b. ADDRESS (City, State and ZIP Code)			
8a. NAME OF FUNDING/SPONSORING ORGANIZATION	8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER			
8c. ADDRESS (City, State and ZIP Code)		10. SOURCE OF FUNDING NOS.			
		PROGRAM ELEMENT NO.	PROJECT NO.	TASK NO.	WORK UNIT NO.
11. TITLE (Include Security Classification) A COMPUTER-BASED EDUCATIONAL					

12. PERSONAL AUTHOR(S)

Gaudet, John A., Major, USAF

13a. TYPE OF REPORT	13b. TIME COVERED FROM _____ TO _____	14. DATE OF REPORT (Yr., Mo., Day) 1985 April	15. PAGE COUNT 85

16. SUPPLEMENTARY NOTATION

ITEM 11: APPROACH TO THE AIR COMMAND AND STAFF COLLEGE ASSOCIATE PROGRAM

17.	COSATI CODES		18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB. GR.	

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

The ACSC Associate Program will incorporate Computer-Based Education (CBE) by the Fall of 1987. The college obtained the McGraw-Hill Interactive Authoring System as an authoring tool that has the potential to aid the faculty with CBE. The study explains the reasons for using CBE and examines the McGraw-Hill computer program for its utility to ACSC. The advantages and limitations of this authoring system are discussed. A methodology is presented which will be helpful in designing CBE. The study concludes that the McGraw-Hill Interactive Authoring System will be useful in initiating CBE. However, supplementary computer programs will be necessary to perform computer management functions. Key Words: AIR FORCE TRAINING, COMPUTER APPLICATIONS.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☒ DTIC USERS ☐	21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED	
22a. NAME OF RESPONSIBLE INDIVIDUAL ACSC/EDCC Maxwell AFB AL 36112	22b. TELEPHONE NUMBER (Include Area Code) (205) 293-2483	22c. OFFICE SYMBOL

DD FORM 1473, 83 APR   EDITION OF 1 JAN 73 IS OBSOLETE   UNCLASSIFIED

PREFACE

Computer-Based Education (CBE) is becoming increasingly popular at all levels of learning. The Air Force Professional Military Education (PME) programs conducted at installations around the world can certainly benefit from the advances in computer technology made during the past few years.

This study was inspired by the efforts of Major Peter F. Seiler, Chief of the Instructional Systems and Technology Division of the Associate Programs Directorate at Air Command and Staff College. He has been instrumental in the development of the major revisions in the Associate Program which have already taken place, and those which will be initiated in the years to come. Future plans include the inevitable incorporation of CBE into the seminar program. The McGraw-Hill Interactive Authoring System (MHIAS) was selected as a candidate package to assist in the development of CBE.

Major Seiler saw the need for a thorough review of the MHIAS. Consequently, this project was designed as a way to perform the analysis by actually exercising the MHIAS on an ACSC lesson. This report documents the many issues which must be addressed in developing CBE in the Associate Program, and offers possible courses of action to begin using this technology in PME.

The author would like to acknowledge the cooperation of Lt Col Richard Doucet of ACSC/EDP and his staff in providing the equipment necessary to accomplish this study. Special thanks is given to Major Seiler and Capt Wayne Chitwood for the many hours of fruitful discussion and useful suggestions they provided me.

The lesson developed using the MHIAS and the computer programs written to support this study are available for inspection at ACSC/EDPT, Maxwell AFB AL 3612, (205) 293-7901 or (AV) 875-7901.

ABOUT THE AUTHOR

Major John A. Gaudet ██████████████████████,
████████. He earned his commission in 1969 through the Air
Force ROTC program at the College of the Holy Cross, where he
received an AB degree in Physics. Using an educational delay, he
earned an MS in Physics from Notre Dame in 1971. John started
his active duty career as a weapons' controller in TAC and
Alaskan Air Command. After an AFIT tour, he spent five years in
Systems Command working on nuclear electromagnetic pulse issues.
Prior to entering ACSC, he was an Associate Professor of Physics
at the USAF Academy. At the Academy, he was actively involved in
the start of Computer-Assisted Instruction (CAI) in the Physics
Department, serving as the head of the Computer-Learning
Laboratory for one year. John earned his PhD in nuclear effects
from AFIT in 1981. His dissertation was entitled "The
Finite-Element Method Applied to the System-Generated
Electromagnetic Pulse Boundary Layer."

TABLE OF CONTENTS

CONTINUED

LIST OF ILLUSTRATIONS

FIGURES

EXECUTIVE SUMMARY

Part of our College mission is distribution of the students' problem solving products to DoD sponsors and other interested agencies to enhance insight into contemporary, defense related issues. While the College has accepted this product as meeting academic requirements for graduation, the views and opinions expressed or implied are solely those of the author and should not be construed as carrying official sanction.

"insights into tomorrow"

REPORT NUMBER 85-0925

AUTHOR(S) MAJOR JOHN A. GAUDET, USAF

TITLE A COMPUTER-BASED EDUCATIONAL APPROACH TO THE AIR COMMAND AND STAFF COLLEGE ASSOCIATE PROGRAM

I. __Purpose:__ To determine the capabilities and limitations of the McGraw-Hill Interactive Authoring System (MHIAS) for use by the faculty at ACSC/EDF.

II. __Problem:__ ACSC/EDF 's responsible for curriculum development of the Air Command and Staff College Associate Program. This seminar course is given at most USAF installations around the world. Revision of the current program is underway with plans to implement Computer-Based Education (CBE) by the Fall of 1987. The McGraw-Hill Interactive Authoring System (MHIAS) has been selected as a potential candidate to assist in CBE development. An evaluation of this computer software is needed to determine its overall usefulness to ACSC.

III. __Data:__ This study begins by examining the potential benefits of CBE and the characteristics of authoring tools. The benefits most important to ACSC include the ability of the computer to act as a surrogate instructor, and the capability to establish solid feedback channels in this education-at-a-distance environment. One present disadvantage in using CBE is the ACSC group strategy that minimizes the individualized learning effect of Computer-Assisted Instruction (CAI). The characteristics of authoring tools can be examined from the hardware, author and

student interactions. Specifically, the MHIAS is an authoring system which provides the instructor the capability to generate computer displays in the form of presentation screens and question screens. In addition, the MHIAS can control interactive video, grade student responses and perform some analysis on the data. Its main advantages lie in the ability of the author to access any segment of a videotape during the course of the lesson and the flexibility of its question screens. For ACSC, the biggest limitation of the MHIAS is the inability to perform adequate collection and analysis of student data. Nonetheless, the MHIAS can provide an effective means to start the CBE process with the help of a Computer Supported Development Team (CSDT). This team would be the focal point for all CBE in the Associate Program, using an instructional design strategy that integrates the nine learning events with CAI.

IV. Conclusions: The MHIAS will be a useful tool for the ACSC Associate Program. But, it will not fulfill all the school's needs. The management of student data can not be done effectively with the McGraw-Hill package, but an ACSC computer program may run from it. All faculty members will not be required to actual. use the authoring system, but they will have to understand its capabilities.

V. Recommendations: ACSC/EDF may use the MHIAS for developing CBE for the Fall of 1987. A CSDT of at least three officers be estab.ished to create the instructional design strategies needed for CBE. One of these individuals should have computer programming experience, while the others should be comfortable using microcomputers. Once adequately trained, this team will be able to guide the rest of the faculty in the lesson design process. ACSC must create its own computer-managed instructional software to use with the MHIAS. At a minimum, it must have the ability to capture all student responses and allow the generation of a relational data-base.

Chapter One

INTRODUCTION

BACKGROUND OF PROBLEM

Over the past few years, microcomputers have become an important part of many facets of our daily lives. One of the biggest beneficiaries of this revolution is the education and training field. The relatively inexpensive microcomputer has made it possible to bring the capabilities of the computer into virtually every classroom from kindergarten to graduate school, and any training situation from flight simulators to language laboratories.

Therefore, it is only natural that the Air Command and Staff College's Associate Program would investigate ways to incorporate Computer-Based Education (CBE) into their curriculum. This was done in the recent re-evaluation of the entire program. (17:--) Under this study, CBE is scheduled to be employed in Phase 3 of the new curriculum starting in the Fall of 1987.

In order to meet this schedule, the office responsible for curriculum development in the Associate Program (ACSC/EDP) carefully considered the availability of appropriate hardware and software. They recognized that IBM (International Business Machines) was quickly becoming the de facto standard in hardware design and operating systems for a wide variety of applications. Thus, the planners in ACSC/EDP felt the IBM Personal Computer, or one of its competitive compatibles (COMPAQ, Zenith Z-150, etc.), should be the first potential candidate studied for ACSC seminar use. Also, the McGraw-Hill Interactive Authoring System (MHIAS), a software package requiring an IBM PC, or compatible, was picked as the baseline tool required by the curriculum writers. (21:--)

Obviously, these decisions are not cast in concrete. As noted above, implementation of CBE into the revised Associate Program is not scheduled until 1987. During the next two years many changes in computer hardware and software are likely. It is certainly possible that the combination of an IBM PC (or a true compatible) and the MHIAS will not be the most effective system available for ACSC's use. But, it is important to start somewhere, and it is unlikely that a better combination can be found for the same price as the one picked.

OBJECTIVES OF THIS STUDY

The following are the objectives of this study:

1.   To explain the overall strategy of using computer-based education in the ACSC Associate Program.

2.   To determine the capabilities and limitations of the MHIAS on an IBM FC compatible microprocessor for use in writing CBE for Phase 3.

3.   To develop a sample ACSC lesson using the MHIAS, complete with videotape segments controlled by the computer, individual formative tests and group progress reports.

4.   To determine if a list of procedures for authors of future Associate Program lessons is needed.

These goals are important to the overall revision of the Associate Program. Proper planning requires that many months lead time be allowed for the lesson strategy process. This means that a major effort must be made soon to incorporate CBE into the modularized packages of Phase 1. It is probable that some of the officers chosen to carry out this task will not be versed in CBE or authoring systems. Therefore, this study to determine the effectiveness of a prototype system for the unique requirements of the ACSC Associate Program will, hopefully, provide a valuable service to the school.

ASSUMPTIONS AND LIMITATIONS

Several assumptions about the scope of this study are impor- tant to keep in mind. First, the prototype lesson may only use the tools immediately available to the author. This consists of a COMPAQ personal computer (an IBM true compatible), version 3.1 of the MHIAS and a BCD controller for use as the video link from the computer to the television screen

Second, the curriculum material itself must be derived from a currently developed ACSC lesson plan, one which has not been de- signed with CBE in mind.

Third, the environment of the ACSC Associate Program will, in the future, be substantially unchanged from what it is today. That is, curriculum development will be in the hands of a rela- tively few officers with expertise in their area of responsi- bility, but with little or no support from a large staff of CBE experts. Also, it is not feasible that expensive equipment (videodisc, minicomputers, high resolution graphics, etc.) will become available for the average seminar.

This study will be limited to using the McGraw-Hill programs as they currently exist. In fact, the major objective of the study is to exercise this software package for ACSC/EDP to determine how it can be used effectively. It is important to note that certain undesirable features of the MHIAS could possibly be corrected through negotiation with the vendor. This may even occur through the natural revision process. However, what is reported here is only based upon the capabilities observed during actual use of the system.

ORGANIZATION OF REPORT

The next two chapters explain the strategy of using CBE in the ACSC Associate Program and the need for an authoring system. Both concepts of computer-based education (CBE) and the assistance provided by an authoring tool are explained.

Chapter 4 addresses the MHIAS itself - that software tool chosen by ACSC as the prototype system to go from not using computers in the seminars at all, to using them as an integral part of the Associate Program.

The next chapter includes the specific information learned about implementing CBE using the MHIAS on the COMPAQ PC.

The final chapter summarizes the conclusions of this study, and makes several recommendations for ACSC based upon these conclusions.

Three appendices provide details about the use of the MHIAS. Appendix A illustrates an alternative approach to managing student data. Appendix B highlights the features of the MHIAS delivery screens. The group reports available from McGraw-Hill are demonstrated in Appendix C.

Chapter Two

WHY COMPUTER-BASED EDUCATION?

BACKGROUND

We are in the midst of a computer revolution. It has been
going on for at least five years for the general public, and
longer for certain specialists. The revolution was brought on by
the invention of the large-scale integrated (LSI) circuits which
made the "computer on a chip" possible. It wasn't long before
desktop computers, called microcomputers, not only became tech-
nically possible but economical. What seemed like fantasy only
ten years before became a reality. Powerful computers with large
storage capacities are now within the reach of small businesses
and individuals.

One only need look at the advertisements in any popular
magazine to confirm the magnitude of this revolution. In them
you can find all imaginable ranges of hardware and software
available from dozens of vendors.

Computers are becoming an integral part of the lifestyle of
many Americans. In one major U.S. city, over 40% of the local
businesses own a microcomputer. (8:8C) Also, more than 80% of
all high schools and junior high schools have computers in their
classrooms. (8:8C) This represents more than twice the number
of schools since 1981 -- only two short years! (8:8C) There are
currently 500,000 microcomputers in U.S. public schools, and it
is estimated that there will be 2 million computers in the
mainstream of the school system in another four years. (15:4)

Although it is fair to say that there are still large seg-
ments of our society who either dislike or fear the revolution
which is underway, there seems little doubt that computers will
be completely integrated into our lives within a few short years.

COMPUTERS IN EDUCATION

Computers have been involved in the educational process since
the early 1960's. (6:7) The Air Force has used computers for
training for over a decade. (16:8) Initially, the technology

5

involved large mainframe computers which were accessed by the students through slow teletype machines. Since that time, however, advances in computer hardware have brought us to smaller minicomputers, cathode-ray tube (CRT) displays, and, to the present situation of microcomputers with high-resolution, color screens.

Educational computer programs have undergone a similar transition. Today, a vast amount of computer software is available in practically every field. Additionally, very sophisticated authoring programs have been developed to assist teachers in using computers in their classrooms.

During the last three decades many different approaches have been used to integrate the computer into the educational process. This evolution has created a large, sometimes confusing vocabulary. One need only look at the glossary of a typical text in this area to confirm this fact. (3:113-120) For this reason, it is useful to explain the meaning of the terms used in the remainder of this report.

COMPUTER-BASED EDUCATION (CBE)

Computer-Based Education is a general term used to encompass all the functions that a computer can provide to the educational institution. In this context, CBE is nothing new since computers have played an integral role in the managing of school and university courses for many years. Today, however, CBE implies much more than this. And, it implies an emphasis on instructor involvement, rather than institutional involvement.

There are two distinct elements of CBE: Computer-Assisted Instruction (CAI) and Computer-Managed Instruction (CMI). CAI refers to the instructional interface of computer with student, while CMI pertains to the administrative tasks the computer can perform in the classroom. Because there are so many subtle differences in meanings of the terms used here (14:I-9), CAI and CMI will be defined more precisely.

Computer-Assisted Instruction

CAI can be defined in the following way: "Computer-Assisted Instruction (CAI) is the use of the communication and storage capabilities of a computer to provide the direct presentation of instructional materials and/or provision of practice to the learner." (14:I-10) This definition emphasizes the presentation of the instructional materials to the learner through the use of a computer. The types of instruction that can be provided by CAI can be generalized into five major categories: (1:21-36)

1. Drill and practice.

2. Tutorials using Socratic dialogue.

3. Demonstration

4. Simulations.

5. Games and play.

These forms of CAI are self-explanatory. The drill and practice mode is usually the simplest form of CAI while the simulation mode is the most complex, with the other types lying somewhere in between these extremes. Thus, CAI can be as simple as asking similar questions over and over, or as complicated as the simulation of molecular vibrations under student control.

CAI can be combined with other forms of presentation to enhance the learning process. For example, video can effectively supplement CAI through videotape or videodisc technology. (7:32-39) This type of instruction is sometimes referred to as Computer-Assisted Video Instruction (CAVI). (14:I-11)

Computer-Managed Instruction

CMI is the use of the computer to perform the functions of "testing, scheduling, allocating resources, collecting student data, and providing status reports." (14:I-13) This is clearly quite different than CAI, but equally as important in an overall CBE strategy. If used properly, CMI can provide the instructor data helpful for counseling purposes. (3:72) In effect, CMI allows one person to care for the needs of many students, similar to a student-tutor relationship. This is only possible when CAI is used in conjunction with evaluation, record-keeping and analysis; namely, when CAI is integrated with CMI.

THE ACSC ASSOCIATE PROGRAM

The ACSC Associate Program is an intermediate level Professional Military Education (PME) course conducted worldwide by a centralized organization. Written materials are sent to participants organized in seminars at bases throughout the Air Force, or to individuals enrolled in the correspondence program. The curriculum involves a variety of topics related to communications, leadership, management of resources, military force structure and military employment.

The program is unique from a number of different aspects. First, and most important for this study, is the distance-learning environment. The students, being far from ACSC, must learn without the benefit of an instructor most of the time. This has obvious negative implications from the standpoint of effective

7

instruction.

Second, the course takes nearly one year to complete, and most students must use their off-duty time for both attendance and preparation. The ability to regularly attend the seminar program is aggravated by frequent TDY (temporary duty) at other locations. Thus, the chances are great for remedial review and makeup lessons.

Third, over 5000 students each year enroll in this program. The large size of such a teaching endeavor impacts all aspects of the educational environment. For example, costs, student/instructor ratio, testing methodology, administrative course management and timely lesson materials are all affected. Also, a large, worldwide program makes the communication process from instructor to student very formidible. The feedback channel is a long and difficult one, going in both directions.

The program is currently under review. Major changes (17:--) are being planned under a six-phase revision. A restructuring of the course will take place during the first two phases, and, if the proposed revisions are fully implemented, CBE and other high technology approaches to an integrated PME course will happen under phases 3 and 4.

CBE IN THE ACSC ASSOCIATE PROGRAM

Why should CBE be implemented as soon as possible in the ACSC Associate program? Perhaps a valid, but not very satisfying, answer is that it is inevitable. After all, the trend today is towards more technology in every field, including education.

But a better answer is that CBE has come of age for such an institution as ACSC. The potential benefits of CBE are well known. (4:16; 5:20; 15:1; 16:26; 18:39) In short, CAI can provide each student with an individualized, interactive learning experience which is almost impossible to get using other forms of presentation. (14:II-1) If CMI is combined with effective CAI, the entire educational process becomes simpler to administer and much more enjoyable for the students.

Furthermore, the needs of the ACSC Associate Program clearly point towards a more automated approach to the whole process. Of critical importance is the distance-learning environment. It is impossible for the school to provide expert instructors for every seminar around the world. Timely, useful feedback is virtually impossible in the current program. Well-designed CBE can provide individual attention to each student, and, at the same time, properly guide the seminars.

Finally, one previous objection (18:9) to the use of CBE at

8

ACSC are substantially mitigated by current technology. This is
the high cost of acquiring the hardware and software necessary to
perform CBE.   Inexpensive microcomputers have virtually elimi-
nated the hardware cost problem.   The software cost problem can
be reduced by authoring systems now available for use on micro-
computers.   This is the subject of the next chapter.

Chapter Three

AUTHORING TOOLS

INTRODUCTION

An authoring tool is a computer program, or programs, de-
signed to help the instructor write CBE materials. They can
generally be classified as one of two types: authoring systems or
authoring languages. Some of these tools are more sophisticated
than others. They may include many instructor options for the
collection of student data, implementing CMI.

Although there is a lack of agreement on definitions in this
area (1:252), for the purposes of this study, an authoring system
is a set of "prepackaged courseware templates or menu-driven
editors designed to help authors create courseware without elab-
orate programming." (14:V-6) The key words in this definition
are "prepackaged...templates" and "menu-driven editors." This
implies authoring systems create CAI using fixed formats by
querying the author every step of the way. The authoring tool is
easy-to-use, but somewhat inflexible.

On the other hand, an authoring language is "a programming
language with codes specifically designed to handle major course-
ware needs such as response judging." (14:V-5) The key words
here are "programming language" and "major...needs." The true
authoring language is a high-level programming language similar
to FORTRAN, COBOL, Pascal, Ada, etc. "High-level" refers to the
fact that the user tells the computer what to do in English
words, like read or write. The lower the level of the language,
the closer the instructions get to the machine code of the com-
puter; i.e., a sequence of zeros and ones. Obviously, this type
of authoring tool has more flexibility, allowing the author
greater freedom to provide for his/her needs.

How the language is created has no bearing on whether or not
it qualifies as an authoring language. It could be written in
low-level assembly code, or a high-level general purpose language
like Ada. What is important is that they are specifically
designed to aid the instructor in the development of CAI pro-
grams.

One must be careful in making a hard and fast distinction

between an authoring system and an authoring language. Authoring
tools available today do not always fall neatly into one category
or another. For example, some authoring systems handle response
judging quite nicely, despite the suggestion from the definitions
above that this capability is only found in a language. Also,
many authoring languages use templates and editors. This is why
the generic term "authoring tool" is used here as the major focus
of study.

In order to understand the benefits, and limitations, of an
authoring tool, it is useful to review the important character-
istics found in them. This will also serve to further define the
concept of this teaching aid.

CHARACTERISTICS

There is a wide variety of authoring tools available commer-
cially. Some are designed for large computers while others
target the microcomputer. Some incorporate the capability to use
different types of input and output devices while others are very
restricted in this regard. The point is that authoring tools are
not all alike. However, all have the same basic goal of provid-
ing the instructor with assitance in the development of good CBE.
One way of viewing the different tools on the market is to
consider how they interact within the environment they operate.

Hardware Interaction

This refers to the way the authoring tool interfaces with the
computer hardware itself. For example, how much memory does it
require? How is the tool delivered? Perhaps it is sent on
floppy diskettes or reel tape. Is it one program, or a series of
programs? Is is copy-protected? Can it support a multi-user
environment? Does it support videotape and/or videodisc tech-
nology? Can lessons be developed in color, using graphics? Can
a touch screen, lightpen and/or a mouse be used to input
information into the program? What about sound? That is, can
the final product program speak to the student through a speech
sythesizer? How is printing supported for the author and user?
Will the authoring system allow other programs to be run from
within it? All of these questions, and others, focus on the
characteristics of the authoring tool as related to the hardware
which operates it.

Author Interaction

A very important area of concern in dealing with any author-
ing tool is the method of interface with the author. This is
what determines the level of sophistication of the package. Some
of them are completely menu-driven (a true authoring system);
i.e., the author is presented with a series of questions and
fill-ins in order to construct the lesson. Others use a

vocabulary of instructions (some with hundreds of words) which can be sequenced any way the author chooses (a true authoring language). Also, some of the authoring tools use templates. These are pre-designed screens which are filled in by the author. On the opposite end of the scale are products that allow freely formatted screens. Of course, these general characteristics are often not "black and white." The level of sophistication varies as these qualities are implemented in varying degrees. It is true, however, that the degree of flexibility given the author is proportional to the level of sophistication. Also, the more sophisticated the authoring tool, the more specialized the instruction (training) required to use it.

There are specific characteristics of the author's interaction which are especially important. They may be catorgorized as the management, lesson-design and response evaluation attributes of the authoring tool. Each one of these properties may vary from simplistic to complex.

The management attributes of the authoring tool, or CMI, are necessary functions of any package designed to have evaluation as one of its goals. They may be designed to record and evaluate only the most basic data like names and scores received for only a handful of students. On the other hand, the management characteristics may include complex statistical analysis for hundreds of students measured against several criteria. Many tools fall somewhere between these two extremes.

The lesson-design attributes lie at the heart of the authoring tool itself. They basically set the limits on the scope of the final CBE product. As an example, if the product only permitted the use of true-false and multiple choice question templates, the author's lesson strategy would be seriously limited. Thus, these attributes include a wide range of routines that guide the instructor through the lesson construction. As with other characteristics of the package, they may severely restrict the author, or they may provide him or her with a framework limited only by the imagination.

The last author interaction of note are the response-evaluation attributes. When the CBE program asks the student a question, how must it be posed? Must it be in a form which only allows single character responses? Or, does it allow sentence, phrase and word answers? Are questions allowed which require numerical answers, and if so, what are the acceptable ranges and formats for entering these responses? Finally, does the authoring package have ways to discriminate misspelled words, alternate acceptable responses and a range of numerical answers? These are just some of the questions that must be answered to evaluate the response-evaluation attributes.

Student Interaction

Ultimately, the most important interface of the final CBE product is with the student who uses it. The primary interaction of concern here is the ease of use for the students. The term "user-friendliness" has been coined to describe the desirable property of all computer software to be forgiving to the user. This is certainly true for educational material written using an authoring tool. Basically, the final CBE lesson should be easy to access, "bomb"-proof and "fool"-proof. All this should be accomplished in a way which is not distracting to the learner.

Ease of access refers to the preliminary steps required of the user to get "up and running" with the lesson. A complicated set of procedures for starting up the computer, peripherals and the software could be extremely distracting for the student. Certainly, many of these problems could come from equipment and procedures external to the authoring tool. However, authoring tools may contain some inherent access barriers. For example, the student may be required to enter several layers of passwords to get to the lesson. Ease of access may also refer to the ability of the student to move through the lesson (author permitting) at his/her own pace. The learner might want to browse through the material before going at a much slower pace for the details. Does the authoring tool permit this kind of student interaction?

The authoring tool is "bomb"-proof if it prevents the student from accidentally destroying the programs or data, and if it minimizes the possibility of exiting the lesson prematurely, or skipping parts of it. Of course, the former characteristic is important not only for the student but for the instructor as well. The manner in which such accidents might occur cross the spectrum of possibilities. It could include something as simple as entering a keyword unknowingly. Or, perhaps a student might lean on the keyboard, striking a magic sequence of control codes and characters. In any case, adverse actions on the part of the delivery system should be avoided.

The authoring tool should be "fool"-proof for the student. This catch-all phrase means that every consideration is given to a student who has never seen a keyboard or computer before. For example, there should be no penalty associated with using upper case instead of lower case letters. Imbedded extra characters or blanks should not throw the program into an abort sequence. Useful "HELP packages" should be available during all stages of the lesson. Finally, the authoring tool should allow the student to correct any response which will be graded before final data storage.

14

SUMMARY

The purpose of this chapter has been to set up a framework for examining a typical authoring tool. Their characteristics were examined from three perspectives: the interaction with the hardware, author and student. The list of topics presented here is not all-inclusive, but only meant to act as a guide for discussion. The underlying theme is that all authoring tools have different levels of capabilities for the author and user. Depending upon the experience of the author, some will be easier to use than others.

The next chapter examines a specific authoring tool as a candidate for use in the ACSC Associate Program. The ideas in Chapter Four will be used to guide the analysis.

Chapter Four

THE MCGRAW-HILL INTERACTIVE AUTHORING SYSTEM

INTRODUCTION

The McGraw-Hill Interactive Authoring System (MHIAS) is an authoring tool consisting of the authoring programs and delivery programs. Additionally, the MHIAS supports CMI and CAVI. It was developed by the McGraw-Hill Book Company and Educational Management Services. The most current release is Version 3.1. The documentation consists of a user guide (19:--).

Using the terminology of Chapter Three, the MHIAS is more of an authoring system than an authoring language. It does have several interesting extensions, making it a worthy candidate for examination. First, it has some computer-management features. Secondly, it has the capability to perform fairly extensive response judging. Finally, the MHIAS can operate a videotape player. The details of its capabilitites in these areas are the subject of this chapter.

This study was done using a COMPAQ personal computer which is IBM PC (International Business Machines Personal Computer) compatible. A BCD VideoLink 232 controller from BCD Associates, Inc., provided the interface between the computer and a Sony, SLO-325 Beta I, videocasette recorder. The MHIAS will be discussed in terms of the hardware, author and student interactions.

HARDWARE INTERACTION

General

The MHIAS comes as a two-diskette package designed for the IBM PC . One diskette contains all the authoring programs and the other has all the delivery programs. The actual lessons generated by the MHIAS must reside on a specially formatted, third diskette. The author and delivery diskettes are copy-protected. The package requires at least 128 kb (kilobytes) of memory and two disk drives. Videotape equipment is optional, but, if used, only certain specific hardware combinations are supported. The only means of input for either the student or author is through the computer's keyboard.

17

Video

Both IBM video modes are supported with color in the MHIAS.
That is, displays may be created which are both 40 columns or 80
columns wide. Sixteen different foreground colors, eight dif-
ferent background and border colors are available to the user.
It should be kept in mind that 80 column screens are not display-
able using composite color video processed by standard television
sets. Also, videotape pictures can not be sent to an RGB (red
green blue) color monitor. Thus, if the a MHIAS user wants 40
column color displays and videotape segments, he or she must use
a composite color monitor.

Sound

Sound is not supported by the MHIAS through the use of a
speech synthesizer. However, there is an option to only play the
audio track of a videotape. Thus, the author may place sound-
only information on a segment of the videotape and have it played
through the television at the appropriate time in the lesson. No
video would be shown, however, videotape would be used at the
same rate as if the video were displayed.

Graphics

Graphics can be done using the MHIAS in one of two ways.
First, the system provides a set of block characters and other
special characters for the author to create pictures on his/her
screens. There are also several special characters available;
e.g., math symbols, arrows, Greek letters, monetary symbols, etc.
In all, over 120 different graphics symbols are available in the
MHIAS. Enough variety exists to create almost any low-resolution
picture required for a lesson.

The only way to produce a high-resolution picture during the
lesson is to take advantage of the ability to run programs exter-
nal to the McGraw-Hill environment. That is, the author may exit
the MHIAS at any time to run his own program. So, if the in-
structor wishes, he/she may create a program to produce a high-
resolution graph. Of course, while the computer is running the
external program, the McGraw-Hill features are not available.

The ability to run one's own programs is a very important
feature in the MHIAS. It increases the power of the authoring
language by allowing the author to generate any add-ons or spe-
cial features of his or her own choosing. Examples of such
requirements will be demonstrated in the next chapter.

AUTHOR INTERACTION

The McGraw-Hill package is designed for the non-programmer.

18

It is not a true authoring language requiring a careful sequen-
cing of commands. The system is completely menu-driven. That
is, the author must respond to questions at every step in the
process of creating a screen display. The MHIAS heavily relies
on templates, requiring all displayed screens to be set up
according to one of five formats. (See below under lesson-design
attributes.) This is not as restrictive as it sounds since the
author has a lot of flexibility in the screen design. The author
interaction attributes described in Chapter Three will now be
discussed individually.

Management

The latest release of the MHIAS (Version 3.1) contains some
CMI. Authors are asked if the grading of an answer should be
tracked by the management routines. An affirmative reply trig-
gers the recording of statistics for that question when the
lesson is run by a student. A negative reply will result in that
answer not being included in the data base.

The data base is generated at the time the delivery diskette
is used and is stored there. The student must be processed by a
"log on" procedure at the start of the lesson. Up to ten stu-
dents may be stored on one delivery diskette. Unfortunately,
there is no protection to prevent an eleventh student from log-
ging on. The extra student will simply erase the data for an
earlier student. (That is, the eleventh student's data will
write over the first student's data, the twelfth student's data
will write over the second student's data, etc.) Although the
student must enter an I.D. number and section number during the
log on process, there are no restrictions preventing anyone from
successfully running a lesson using any name, I.D. number or
section number.

The information recorded during a session is limited. For
those questions which are tracked by the management routines only
the results (right or wrong) and the time spent doing the lesson
are saved. The responses, themselves, are not recorded. Statis-
tics are available based upon this data. That is, the instructor
may see summary charts and graphs of the performance of his
students by using a special password with the delivery diskette.
This information may be sent to a printer if desired. See
Appendix C for some examples.

Lesson Design

There are basically five different types of screens that the
author may create: Presentation, Multiple Choice, Fill-In-The-
Blank, Matching and Application/Simulation screens. All of them
may be combined with a video segment which runs before the screen
is displayed. A stand-alone video segment may also be generated.
When each screen is created, it is given a unique name. Any
screen may be the target of a branching action of another screen.

Response Evaluation

This is a very important part of the author interaction.
What flexibility is built into the MHIAS to evaluate student
responses? Some of the pertinent features have already been
alluded to above. Every screen except the Presentation screen
expects some type of student response. In most cases, the
response is some type of answer: a letter, word or phrase. (The
only exception to this occurs during use of the Application/Sim-
ulation screen when using function key or cursor key branching.)
Multiple Choice and Matching screens simply grade the responses
entered according to the author's instructions. Fill-In-The-
Blank and Application/Simulation screens allow the author to
enter alternative correct answers. The number of alternatives
accepted depends on the total number of characters involved.
Additionally, the Application/Simulation screen accepts numerical
answers and allows for the correct answer to lie within a given
range. (Figure 13)   Finally, there is an option to do no
checking at all.

STUDENT INTERACTION

As mentioned in the previous chapter, the student has the
most important relationship with the authoring language. Ease of
access, bombproof and foolproof software all contribute to make
student use a pleasurable task; one devoid of irritation and
frustration. The McGraw-Hill software is quite easy to use for a
student. Once the equipment is set up (quite a few cables must
be put in their correct places for interactive video use) all the
student does is place two diskettes, the delivery diskette in the
primary drive and the lesson diskette in the secondary drive, and
turn the computer on. The MHIAS immediately takes over. Every-
thing he/she must do is prompted by the system. Once the student
identifies himself or herself to the MHIAS, any lesson on the
diskette may be viewed. The author may allow the student to back
up throughout the lesson a maximum of three screens, or he may
prevent any review. Also, the author can allow the student to
stop before the lesson is complete. With this option activated,
the student can restart the lesson where he/she left off. One
potentially irritating feature of the MHIAS is that the student
must always hit the spacebar after each entry, except for cursor
branching on an Application/Simulation screen (see above).

The MHIAS has many good bombproofing and foolproofing fea-
tures. It is virtually impossible for the student to enter an
incorrect format accidentally or to press a key illegally. For
example, any keys not usable during a portion of the lesson
create a beep when pressed. This should prevent most instances
of doing a legal procedure at the wrong time by accident. There
are some potential problems, however. Some are inherent to the
small computer environment. For example, diskettes are physical-
ly easy to destroy. The delivery diskette is particularly

vulnerable to accidental loss of data. Since student data is stored on it, the author can not put a write-protect tab on this diskette. Thus, it would be easy for some or all of the files to be removed or written over. A hard disk can not remove all the risk for student error since all student lessons must be placed on diskettes anyway, regardless of the hardware situation.

One problem still remains which is an integral part of the MHIAS. Only 10 students may be used per delivery diskette. For every student beyond 10 who logs on to the system, one student's data gets erased. Apparently, this problem exists even if a hard disk pack is used. Hopefully, future versions of the McGraw-Hill package will address this potentially serious deficiency.

SUMMARY

This concludes this brief examination of the MHIAS. Only the major characteristics of the system were discussed. There are two important features of this particular authoring tool which stand out and are related to its interactive nature. First, a videotape player may be controlled by the system. This is done by first electronically marking the tape. Then, the author can branch to a screen which runs the desired segment of the tape. (Figure 12)

The second feature which stands out is that the system is designed to interact with the student by asking questions in a variety of formats. Many combinations of branching are possible depending on student response. Remediation, review and skipping ahead can be designed into the lesson flow.

The biggest limitation of the MHIAS lies in its student management ability (CMI) and its limited ability for on-screen simulation of events. The latter refers the inability to sequence screens in groups without student input. The only way this type of advanced simulation would be possible is through an author-generated external program. Of course, specific management utilities may be implemented this way as well.

Next, the MHIAS will be examined from the standpoint of using it in the ACSC Associate Program. How can CBE created with the help of this tool be effective in the seminar program? This question is addressed in Chapter Five.

Chapter Five

USING THE MCGRAW-HILL INTERACTIVE AUTHORING SYSTEM
IN THE AIR COMMAND AND STAFF COLLEGE ASSOCIATE PROGRAM

FACTORS AFFECTING METHODOLOGY

The previous chapters have discussed in general terms the concepts of CBE, authoring tools and one particular authoring system from McGraw-Hill. The primary reason for investigating CBE is the desire of ACSC to improve the distance-learning of professional military education in the field. As mentioned in Chapter One, plans are well under way to update and modernize this program. With Phase 1 of the new program set to start in the Fall of 1985, it is now time to decide how to effectively incorporate CBE into the program by Phase 3 scheduled for a 1987 start. An important part of this planning process is to establish a methodology for the integration of CBE into the Associate Program.

The methodology must be based upon sound educational practice while keeping in mind all the environmental factors associated with lesson development and delivery. There are three very important environmental factors that will have a significant impact on any CBE methodology. These are: (1) distance-learning, (2) group approach and (3) faculty expertise.

Distance-learning refers to the fact that the ACSC Associate Program is managed from Maxwell AFB in Montgomery, Alabama while students in the program exist at virtually every base around the world. Currently, the ACSC budget can only afford to send the Faculty Instructor to each of his/her assigned bases three times each school year. Hence, the responsibility for the quality of the program rests with the students. CBE can provide an important quality control mechanism for such an expansive distance-learning situation. (5:20) This suggests that a methodology be found which enforces some minimal standard of behavior from each student. That is, the CBE lesson should, whenever possible, attempt to fill the gap created by the nonavailability of instructors.

The group approach to the Associate Program is due to many factors. The most important reason seminars are used as the preferred method of instruction is to allow mutual support in
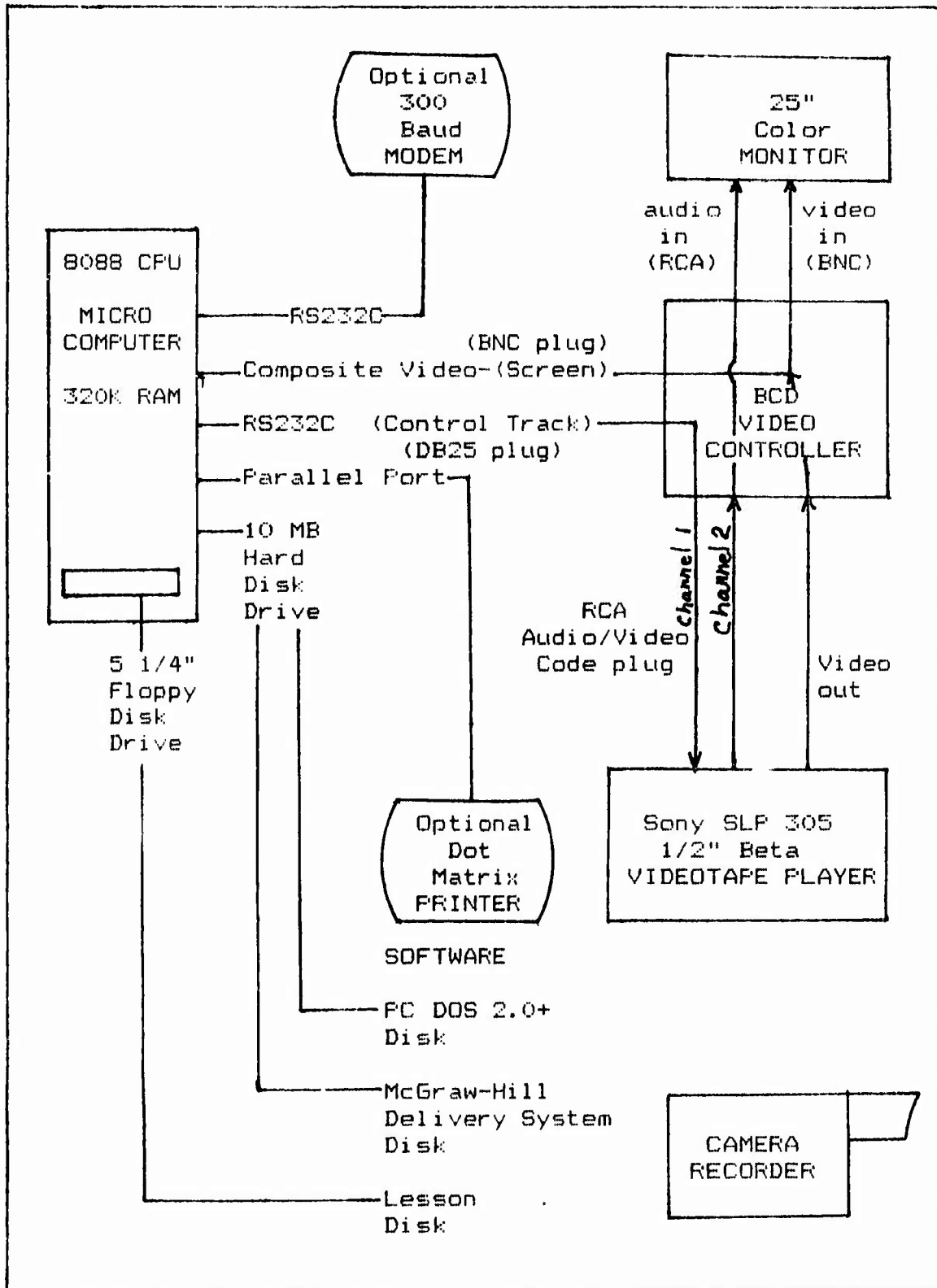
Figure 1. Proposed ACSC Seminar Instructional System

this "intructorless" environment. Also, many of the topics at ACSC are complicated political, economic and military issues. Comprehension is greatly assisted by discussion in the seminars. This approach is used successfully at the resident school.

Seminars, however, provide an interesting challenge to the effective use of CAI. A widely used phrase describing the instructional advantage of CAI over other traditional approaches is that it's "individualized, interactive" learning (14:II-1). Consider the key word "individualized". There is no doubt that the CBE environment (a computer terminal) is ideally suited for one-on-one instruction. The classic CAI instructional modes of drill and practice, tutorials and simple games all have as their premise the computer replacing the teacher in a one-on-one en-counter. The other modes, simulation and complex games, can be as suited for a many-on-one situation as a one-on-one situation.

The last environmental factor of significance is the faculty expertise. Under the present arrangement, the bulk of the curriculum design is done by line Air Force officers who have some experience in their particular block of instruction but do not necessarily have an education background. Of course, they also don't necessarily have experience with CBE. This is the most important limitation in the use of CBE in the Associate Program. It will have a large impact on the way ACSC creates CBE.

METHODOLOGY

A methodology for implementing CBE in the ACSC Associate Program will be based upon the factors mentioned above and the hardware/software combination. The latter is assumed to be the MHIAS and the associated videotape equipment described in Chapter Four. The total planned system is diagrammed in Figure 1 (20:--).

Fortunately, much work has been done in developing instruc-tional design strategies in the past. Smith and Boyce (9:--) have taken Gagne's nine events of instruction (3:--) and applied them to CAI alternatives. It is appropriate to now review these instructional steps with the Associate Program and the MHIAS in mind.

Step 1 - Gaining Attention

This is the classic first step in the teaching process. CBE provides a lot of flexibility in carrying out this event. Using the MHIAS, an appropriate videotape segment could be shown to gain attention. Or, perhaps a pre-seminar quiz could be used to focus on the reading assignments. (Implementation of individual testing in the seminar environment will be addressed more fully below.) For a mature seminar, the best approach might be not to

use an attention step at all, or to make it very subtle, such as simply pointing out the need for pursuing this branch of study.

Step 2 - Informing the Learner of the Objective

The student needs to know what the objective of the lesson is, no matter how it is presented to him or her. Again, CBE provides more flexibility in doing this. Obviously, a presentation screen of the MHIAS may be used to present the objectives of the lesson. This can be more effective than a written presentation in a book by using blinking, color and other highlighting features of the authoring system. Or, a graphics display may be able to emphasize the objective. A much more creative approach is to simulate the desired learning objective for the learner. However, the MHIAS has limited simulation capabilities, and most lesson objectives in the ACSC program are not be suitable for simulation.

Step 3 - Stimulating Recall of Prerequisite Skills

The goal here is to ensure that the student has the necessary knowledge to proceed with the new objectives. This can be accomplished using the McGraw-Hill package to ask the student pertinent questions. This could be integrated as part of the pre-test, if that option were implemented. Should the student fail to show sufficient recall, the CBE could provide immediate review. There are two problems in doing this here. First, the MHIAS can only deliver lessons placed on a floppy diskette even if the computer has a hard disk available. The problem here is that a lesson diskette is restricted to a total of 70 screens. Hence, it is unlikely that extensive review of previous lessons could be put on a single one or two lesson diskettes. Second, seminar time is not the appropriate time for individual students to pursue material presented in previous lessons.

Step 4 - Presenting the Stimulus Material

This is the portion of the CBE lesson which presents the material to be learned by the student. The MHIAS offers a number of different ways to go about doing this. Presentation screens allow textual or graphical (low resolution) information to be displayed using color and blinking to enhance the visual effect. A limited amount of animation is possible using the Application/Simulation screen. Videotape segments can be particularly effective in driving home a point through the use of expert testimony or action sequences. Or, if desired, only the audio portion of the videotape may be played to deliver a specific idea in exactly the same way to all seminars. One big advantage of a CBE presentation over simply reading the same material in a book (the primary means for information transfer in the current ACSC seminar curriculum) is the ability to pace the learner. That is, the CBE author can force the student to accept only certain portions of the lesson in one eyeful. This grouping process can

aid the student in placing emphasis where needed.

Step 5 - Providing Learning Guidance

This step is closely linked to the preceding one. It is
simply the continuation of step 4 from one logical piece of
information to the next. In fact, learning guidance may be
supplied within the presentation of the stimulus material itself.
Some techniques available in the MHIAS were already mentioned,
such as blinking and color. Of course, the guidance could be
provided as a separate screen or screens when appropriate. This
is also the time in the lesson when so-called "help packages" may
be useful. The McGraw-Hill system has the capability to provide
the student with help lines. This feature is only available on
Application/Simulation screens. Up to two lines per blank area
may be set up for student use when he presses a special function
key. However, there is no way to restrict use of this feature.
That is, if help is available, it can be accessed by the learner
on demand. This somewhat limits its usefulness.

Step 6 - Eliciting Performance

One might call this a self-evaluation tool for the student.
After he or she has been presented a certain amount of infor-
mation, a good CBE lesson will determine how well this student
has understood it. The McGraw-Hill system is ideally suited to
do this. All forms of questioning templates may be used from a
matching test to a multiple fill in the blank statement. It is
best to allow for gradation in the possible correct answers when
the question is set up. In this way, branches may be created
which directs the student to the appropriate feedback screen.
Here, seminars present a challenge since each member may actually
require different treatment but only a consensus choice is
allowed. It may be useful on some occasions to use a polling
technique while eliciting the seminar's performance. That is,
the CBE lesson could ask for the number of students who believe
each answer is correct. Then, each student's answer could be
addressed. The amount of time required to do this may be a
potential drawback.

Step 7 - Providing Feedback

Of course, the feedback itself is highly important in the
learning process. This is particularly true for the ACSC
seminars because of the absence of trained instuctors during the
seminars. Feedback may be constructed in any of the allowable
MHIAS forms. The feedback loop may be quite simple or very
complicated. The author may choose to tell the student that
his/her answer was wrong and then give him/her the correct
response. Or, the CAI author may choose to initiate an entirely
new sequence of instruction when an incorrect response is given.
In the seminar mode, neither extreme is desirable. The former
because it doesn't enhance the learning process, and the latter

because several students in the seminar may not need detailed remediation. Obviously, a happy medium should be sought.

Step 8 - Assessing Performance

This is another function which is difficult to perform frequently in today's Resident Program. The only time performance can be evaluated are on three formal examinations. This is not desirable since it tends to discourage adequate routine preparation; students will usually wait until the last moment to prepare for the formal exams. The net result is frequent superficial learning. This type of testing procedure also totally fails to simulate an actual classroom environment where the instructor almost continuously evaulates students' progress. With CBE, assessing performance can easily be done even for a distance-learning program. The pre-test concept may determine individual progress. Or, a final quiz given to the seminar could be the vehicle to determine if lesson objectives were met. In either case, the MHIAS has the capability necessary to perform this instructional task quite nicely, with the exception of the following case. Smith and Boyce (9:10) suggest that a good way to use CAI to assess performance is to have the computer tailor the quiz based upon previous responses. The program would select the questions from a test bank. The only way to implement this excellent suggestion would be to write one's own program to access such a test bank. This undertaking would be so large that it probably would overshadow the MHIAS itself.

Step 9 - Enhancing Retention and Transfer

This is the last of Gagne's instructional events. As Smith and Boyce point out (9:10), CBE can be particularly effective in performing this often neglected step. Unfortunately, the MHIAS would not be particularly suited for carrying out this task. This is due to the inability to recover student responses while the lesson is in progress. (The instructor and student may see the performance only after the lesson has been completed.) Thus, there is no way to tailor the review of lesson objectives to actual performance. In this case, an author-supplied program won't help either. While the student responses could be captured and evaluated using such a procedure, there still would be no way to get the data back into the MHIAS for use in branching decisions.

Gagne's nine events of instruction presents a systematic way of constructing CBE. It points out the tremendous flexibility available to the student if the lesson is carefully developed. The MHIAS has its limitations. The seminar approach also restricts some of the advantages inherent to CAI. However, if properly employed, the McGraw-Hill System will gain significant benefits over the non-CBE system for both the student and the faculty.

ADMINISTERING CBE

The instructional design strategy is affected by corporate decisions as to how the educational materials are administered. This is particularly true for the ACSC Associate Program because uniform standards must be applied for each lesson of each seminar, regardless of location. The need for uniformity is further reinforced by the frequent transfer of faculty. This section will examine some of the questions related to the administration of CBE using the MHIAS.

Recall that one of the major advantages of using CBE in the seminar program is the ability to assess student performance on a frequent basis. This implies that one of the objectives in using CBE should be the evaluation of a seminar's performance. This requires not only the testing of the learner's progress, but the capturing of the data for faculty analysis. Unfortunately, the McGraw-Hill package is not very well suited to meet this objective for a large program like ACSC. Although management functions are available on the latest release, their limited scope reduces its usefulness for ACSC.

The primary limitation is the inability to record student responses. The only information saved by the MHIAS is the result of the evaluation; i.e., whether the question was answered right or wrong. The system is not able to record student answers so that potential weaknesses may be studied. One possible solution to this problem is for ACSC to develop a management system of its own which can be accessed by the MHIAS at the appropriate time. This approach would also help eliminate some of the problems inherent with the group CBE. For example, the administrative officer of the seminar could be tasked with entering the pre-test responses for all seminar members during the break period. This would occur after each member has had the opportunity to view all pre-test questions before the seminar starts. Sample programs illustrating how this might be done are included in Appendix A.

However, these programs don't answer many questions about the logistics of using diskettes; i.e., how students would be able to take make-up lessons in a different seminar. After all, these diskettes must be returned (or transmitted) to ACSC if student data is stored on them. Also, frequent absences of students require easy methods for making up lessons, preferably in the seminar environment. The best solution to the latter problem is to have a master list of students for each base on each delivery diskette. Then, at least students from the same base may attend each others' seminars and still use the CMI. A student from out-of-town would have to take the tests upon return to his home station, however. This solution could be implemented if ACSC writes its own CMI programs. Should the MHIAS CMI be used, the location of the seminars would also have to be the central repository for all seminar diskettes.

Another aspect of administering CBE in the Associate Program is the proper sequence of events. This is complicated by the seminar environment. Should CAI be used for every part of every lesson? How will CBE be used to get everyone involved in the material? How will the evaluations (pre-lesson and post-lesson) be administered? Of course, the specific answers to each of these questions may depend on the lesson itself. However, some general guidelines are possible.

First, CAI should not be used just because it is available. To do so, could result in having a detrimental effect on the learning process rather than a beneficial one. This can happen when CAI is inappropriately used; creating a CAI module to emphasize a point better suited to discussion is one example. Studies have shown that 100% self-paced courses are not as successful as courses which combine self-pacing with other instructional modes (14:II-20). Similarly, computer-assisted instruction will not be the best approach for all educational goals. CAI should be treated as a tool, albeit a powerful one, and should not be abused.

There is no doubt that portions of the ACSC curriculum are not suited for widespread use of CAI. A past study by Maj. Sparkman (18:--) evaluated portions of of the resident ACSC curriculum for possible CAI implementation. The author draws the following conclusion: "Although most of the ACSC core curriculum is not suitable for the application of CAI, the core curriculum does contain areas of instruction suitable for the use of CAI." (18:39) This somewhat somber statement, while supporting the use of CAI, suggests that its benefits to the overall program may be minimal.

Two important facts bear on this conclusion. One is that the study was done in 1976. This was well before the advent of the microcomputer explosion and the proliferation of computer pro-grams supporting educational goals. It was also before other technologies, such as videotape and videodisc, were linked to the computer in a cost-effective way. The other significant fact about Maj. Sparkman's study is his emphasis on tutorial CAI. He is not writing about computer-based education in the context defined here. Rather, he is referring to just one of the many ways a computer can act as a surrogate instructor. Nonetheless, his study makes a valid point concerning the inevitable unsuita-bility of parts of the ACSC curriculum for tutorial CAI. This does not negate any of the above discussions about potential benefits of CBE for the entire program. It does reaffirm that prudent care be given to unnecessary CAI in the main part of the instructional process.

When the faculty determines CBE is appropriate to use during the lesson, the next problem is the integration of CBE into the seminar process. The seminar and CBE are essentially competing

vehicles of instruction. The former requires interaction with other people to be successful, while the latter is an intrinsically one-on-one (individual - computer) process. How can both techniques be used simultaneously? The answer must be found by examining the best qualities of both approaches and designing the lesson to employ the optimum strategy for each objective. The major benefit of seminar instruction is that it "reinforces readings and lectures, enabling you to share your personal experience and expertise with others." (13:9) This is normally done through the use of discussion questions by the seminar chairperson. On the other hand, CBE's main benefits stem from the ability to make branching decisions depending upon students' responses. The MHIAS has the added benefit of being able to control operation of videotape players. Thus, the goal in lesson design should be to encourage discussion when it will help clarify the topic for the seminar members, and to use the capabilities of CBE to move the seminar through the correct educational path while pointing out why other paths are not valid. In effect, the computer may replace the seminar chairperson entirely, providing the best possible guidance for each seminar.

THE AUTHORING PROCESS

There are two questions which need answering about the authoring process for ACSC. First, who is going to do it? Second, how should it be done? The answers to these questions will undoubtedly play a major role in determining the degree of success in using CBE for the Associate Program at ACSC. Each issue is driven by many factors, some of which have already been addressed here. Both questions deserve careful consideration.

Who

It is generally agreed that the ideal approach to authoring CAI packages is through the use of the development team concept. (9:5) Such a team consists of at least three persons: a subject matter expert, an instructional designer and a CAI programmer. Each individual has a vital role to play, and, in many respects, an independent one. That is, the final product may be better served if each team member never considers the area of responsibility of the others on the team. For example, the instructional designer should not consider the problems associated with programming the computer while producing the lesson flow. Whether or not this strict philosophy is adhered to, the experts agree that the ingredients supplied by each team member must be considered. While the development team works well for large organizations, it is often impractical for others. ACSC can not afford to take this costly approach to CBE, requiring the hiring of experts in instuctional design methods, computer programmers and subject-matter specialists for its wide-ranging curriculum.

Fortunately, there are several variations to the ideal team approach. (14:II-12 - II-15). Two are of interest for ACSC: the "Computer Guided Author" and the "Computer Supported Development Team. In the first variation, CAI is put together entirely by the subject matter expert with the help of sophisticated authoring tools. The idea is that an individual who is naive in computer programming but expert in his subject can write good CAI with the aid of elegant computer progams. The second variation again allows the subject experts to put most of the lesson on the computer using specific instructional design techniques and authoring aids. The differences here are (1) final design decisions lie with the instructional designer; (2) a programmer may be needed to do special procedures; and consequently (3) the authoring tools used by the subject experts don't have to be as sophisticated as required for the Computer Guided Author approach.

How does all this impact the ACSC implementation of CBE? It is reasonable to assume that the type of sophisticated authoring tools required for the Computer Guided Author approach will not be available in the next several years due to cost and software limitations. (14:II-15) However, a small group of several (three or four) officers who are comfortable with microcomputers may be either hired or found on the present staff. (Recently, one individual was hired as a computer specialist.) Therefore, the Computer Supported Development Team (CSDT) is a reasonable approach for ACSC. But, rather than allowing the subject experts to do the actual lesson input into the computer, the process would be facilitated by letting the group do this task, at least initially. A savings in training personnel can be realized by using the skills already existing on the faculty to be part of the CSDT and to do the bulk of the software creation. Gradually, the lesson authors may wish to help in this process; this would make CBE more efficient.

Thus, all lesson writers would be first briefed by the team as to the standard lesson format (the instructional design done by the CSDT). Then, they would prepare their lessons as they normally would, except they would keep in mind CBE. The actual creation of the CBE is done by a CBDT member. Occasionally, the programmer may have to supply in-house programs to accomplish a desired learning objective, but this would be the exception, not the rule.

How

There can be no single answer to this question. How the CBE lesson is put together will depend upon too many variables to establish one single pattern for all situations. But, general guidance based upon the known factors can be useful in laying a foundation for action.

The first issue which must be resolved in answering the

question "How?" is one of software support. The CAI Decision Handbook, ATC Pamplet 50-4, offers some useful guidance in this area worth considering:

> Because an authoring system can be effectively and quickly used by regular instructional personnel, it imposes the least demand on the establishment of unique organizational structures to accommodate the courseware development process. **An authoring system is the best choice when CAI courseware has to be integrated into the work environment as an additional duty of the instructional staff.** (14:III-51)

The emphasis is in the original text. The main point here is the recommendation to use an authoring system rather than an authoring language. (Recall that the MHIAS is essentially the former.) Thus, the faculty constraints and the need for a CSDT both suggest the requirement for an authoring system. Now that the type of hardware and software support has been decided upon, the focus turns to the authors themselves.

The author must first decide on the goals for the learner. What abilities should the student acquire after accomplishing all lesson objectives? At the same time the lesson objectives should be drafted since they are closely tied to the goals. Once this is done, then the mode of presentation for each lesson segment can be selected. For the seminar environment, any number of techniques will be available such as readings, videotape segments, discussion questions, demonstration, simulation, etc. All support necessary for a good presentation for every technique must be assembled and ordered into a logical sequence.

At this point, the author then determines how CBE can assist in the seminar process. The nine instructional steps listed in earlier in this chapter should provide an excellent guide to both organize the lesson and decide the best use of CBE. For example, if discussion is the best method to achieve the goals of a certain objective, then CBE will not play a major role in step 4, presenting the stimulus material. However, the next step, providing learning guidance, may best be done entirely through CAI. On the other hand, the exact opposite may be true where CAI presents the stimulus material, and the learning guidance is done through some other feedback mechanism. A concrete example of the latter situation might be some type of written exercise which requires faculty grading.

The computer and an authoring system such as the MHIAS provide the ACSC curriculum designer one additional tool to use in his bag of tricks. It is a powerful device that can be integrated within the entire learning process. The lesson should be laid out on paper, including the screens which comprise the CBE. This can then be given to the programmer for testing development on the computer.

Since one of the important functions of CBE will be interactive video, this subject is treated separately.

CONTROLLING THE VIDEO

The McGraw-Hill Authoring System has a major advantage over many other authoring packages on microcomputers in its ability to interface with a videotape player. This is of particular significance to the seminar program at ACSC due to the large amount of video support materials used in the past. Video can, of course, be of immense value in providing the student with active, alive, dynamic support. There are several advantages to using interactive video.

First, the author can cue the students about what to look for during the playing of the video immediately before they see it. This is much more effective than giving a long list of subjects to watch for prior to the viewing, particularly if the videotape plays more than a few minutes.

Second, portions of the videotape can be selectively edited out of the lesson by each individual seminar. That is, the author could allow the students the option to skip certain parts of the video if they display some pre-determined behavior. As an example, a correct response to a question about one issue on the video allows the seminar to move on to other topics while eliminating the necessity to see that segment.

A third benefit of using CBE to control the video is the ability to review selected portions for remediation or enhancing retention. The students could automatically be shown the video segment again, or it could be seen at their option. In either case, CBE gives quick access to the right part of the tape with no student action required.

The ability to show out-of-sequence segments is the last benefit of CBE controlled video mentioned here. This is particularly useful when an unedited videotape is used containing information out of order for the author's purposes. Using the MHIAS, the author can program the computer to show segments in any order. This will be a very valuable option for the ACSC Associate Program.

One cautionary note should be made at this point. The MHIAS can control any videotape once properly marked. Obviously, the easiest, least expensive method is to use unedited tapes, similar to the way tapes are used today. This, however, is not the ideal way to use the tape. It is useful to have pauses between the segments and to have them sequenced as close to their expected use as possible. This is true because the tape will be shown in segments under control of the computer, and there is some inac-

curacy involved in locating a given spot on the tape.   This
inaccuracy is inherent in the videotape player's ability to stop
the tape at the exact position desired.   The error usually is no
more than a few seconds of playing time.   Also, videotape players
can not rewind the tape from one end to another very quickly.
This can sometimes create a wait of several minutes for long
tapes.   Thus, more professional CBE will be possible if the tape
is edited in the manner described. (19:T6.8)

THE SAMPLE LESSON

     In order to understand the capabilities and limitations of
the MHIAS for ACSC use, a sample lesson was developed using the
hardware and software described in Chapter Four.   A lesson was
picked from the current seminar program without modification.
The lesson, from the last block of instruction, is entitled
"Nonstrategic Nuclear, Chemical and Biological Operations",
Lesson 45 (10:--; 11:--; 12:--).   One videotape is used in the
lesson, a BBC (British Broadcasting Corporation) production
called "A Higher Form of Killing" which discussed the chemical
and biological threat to NATO (North Atlantic Treaty Organ-
ization).

     Various types of approaches were ried using this lesson.   A
sample pre-lesson quiz is given before the lesson starts.   Video-
tape segments are made available at various times during the
lesson.   Lead-off discussion questions, and feedback loops are
used.   Some of the special features of the MHIAS are exercised
including blinking, color, cursor key branching and temporary
exiting of the lesson to run an author-created program.   Some
sample lesson screens and further discussion are included in
Appendix B.

Chapter Six

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

1.   The McGraw-Hill Interactive Authoring System is a useful tool
to assist the Air Command and Staff College Associate Program
develop Computer-Based Education.

2.   The advantages of this system are its ease-of use through
menus and templates, interactive video capability, and branching
characteristics.

3.   The limitations of this system are the lack of useful manage-
ment tools, high-resolution graphics and sequential screen
viewing.

4.   ACSC will not be able to use the management utilities pro-
vided by the MHIAS, hence, will have to develop its own.

5.   A systematic approach to lesson development will be essential
to successful implementation of CAI.   This can be accomplished
with the creation of a Computer Supported Development Team (CSDT)
and the use of Gagne's nine events of instruction.

6.   With the use of the MHIAS _and_ the CSDT, a list of procedures
for every ACSC faculty author will not be required, since the
bulk of the computer interfacing will be done by team members.

RECOMMENDATIONS

1.   ACSC should exploit the strengths of the MHIAS.   Because it
is relatively easy to use, most of the lesson authors can become
familiar with its capabilities.   This will aid them in the CBE
design process.   Also, interactive video should be used whenever
practical to enhance the student learning.   Additionally, the
process of guiding the learning through appropriate questioning
will be an effective use of this software.

2.   ACSC should avoid the weaknesses of the MHIAS.   Very little
simulation or demonstration can be done with this authoring

system. If such methods are absolutely essential to the lesson, separate computer programs should be written to be executed from the MHIAS.

3. A team should be developed consisting of at least three officers who would have primary responsibilty for creating instructional design criteria for the rest of the faculty. This CSDT (Computer Supported Development Team) could be initially trained at the Academic Instructor School to acquire the skills in instructional design using CBE. The CSDT should focus on implementing the computer interface with the curriculum. Other faculty members, once aware of the MHIAS capabilities, will do most of the actual lesson design. At least one of the CSDT members should have programming skills to augment the MHIAS when necessary.

4. A management system should be created which will interface with the MHIAS. It should have the capability of (1) recording student answers for evaluation by the faculty, and (2) performing statistical analysis functions on the student data.

5. ACSC should study the possibility of using CBE for both missed lessons by the seminar students and for the correspondence course. Several limitations associated with the seminar environment are not present under these circumstances. The full advantages of a single student - single computer could then be exploited.

BIBLIOGRAPHY

A. REFERENCES CITED

Books

1. Coburn, P., Kelman, P., et al. Practical Guide to Computers in Education. Reading, Mass.: Addison-Wesley Publishing Co.,Inc., 1982.

2. Gagne, R.M. The Conditions of Learning (3rd ed.). New York: Holt, Rinehart, and Winston, 1977.

3. Rushby, Nicholas J. Computers in the Teaching Process. New York: John Wiley & Sons, Inc., 1979.

Articles and Periodicals

4. Fahy, Patrick J. "Learning About Computerized Instruction with Adults: One School's Trials, Errors, and Successes." Educational Technology, July, 1984: pp. 11-16.

5. Garrison, Randy. "Microcomputers and CAL in Adult Education." Lifelong Learning: The Adult Years, June, 1982: pp. 20-23.

6. Holmes, Glyn. "Computer-Assisted Instruction: A Discussion of Some of the Issues for Would-Be Implementors." Educational Technology, September, 1982: pp. 7-13.

7. Sanders, Mark. "VCR and CRT: The Latest Media Marriage." inCider, January, 1985: pp. 32-39.

8. Smith, Brad. "More Computers Bring More Schools." The Journal and Advertiser, Montgomery, Al., December 9, 1984: p. 8C.

9. Smith, Patricia L. and Boyce, Barbara A. "Instructional Design Considerations in the Development of Computer-Assisted Instruction." Educational Technology, July, 1984: pp. 5-11.

Official Documents

10. U.S. Department of the Air Force: Air University: Air Command and Staff College: Associate Programs. Member

Guidance, Seminar Course 31, Lessons 39-50. Maxwell
AFB, Alabama, 1984, pp. 45-1:45-4.

11. U.S. Department of the Air Force: Air University: Air
     Command and Staff College: Associate Programs.
     "Nonstrategic Nuclear, Chemical and Biological Oper-
     ations." Lesson Leader Guidance, Seminar Course 31,
     Lesson 45. Maxwell AFB, Alabama, 1984.

12. U.S. Department of the Air Force: Air University: Air
     Command and Staff College: Associate Programs.
     Readings Book, Lessons 39-50. Maxwell AFB, Alabama,
     1984, pp. 45-1:45-26.

13. U.S. Department of the Air Force: Air University: Air
     Command and Staff College: Operations Handbook.
     Maxwell AFB, Alabama, 1985.

14. U.S. Department of the Air Force: HQ Air Training Command.
     The CAI Decision Handbook, ATC Pamphlet 50-4. Randolph
     AFB, Texas, September, 1984.

15. U.S. House of Representatives: Committee on Science and
     Technology: Subcommittee on Investigations and Over-
     sight. Computers and Education, Washington, D.C.,
     Hearings conducted 28-29 September, 1983. Government
     Printing Office. 1984.

Unpublished Materials

16. Moore, Patrick C., Maj. USAF. "An Analysis of Air Force Use
     of Computers in Education/Training." Unpublished Re-
     search Study 79-1635, Air Command and Staff College, Air
     University, Maxwell AFB, Alabama, May, 1979.

17. Seiler, Peter F., Maj. USAF. "Proposed Phase Revision of
     the ACSC Associate Program." Report prepared for Air
     Command and Staff College (EDP), Air University (ATC),
     Maxwell AFB, Alabama, 1984.

18. Sparkman, Simeon C., Maj. USAF. "Guidelines for the Appli-
     cation of Tutorial Computer Assisted Instruction to the
     Air Command and Staff College Curriculum." Unpublished
     Research Study 76-2570, Air Command and Staff College,
     Air University, Maxwell AFB, Alabama, May, 1976.

CONTINUED

Other Sources

19. Gleason, Gerald A., ed. _McGraw-Hill Interactive Authoring System_, Computer software documentation, New York: McGraw-Hill, Inc., 1984.

20. Seiler, Peter F. Maj. USAF. ACSC/EDPT. "Support for Converting to 1/2" Beta VT Format for Officer PME", draft letter to HQ AF/XOORV, 21 January 1985.

21. ------. Private conversations, January 1985.

22. _Turbo Pascal_, Reference Manual, Version 2.0, Computer software documentation, Scotts Valley, California: Borland International, undated.

B.   RELATED SOURCES

Books

Dean, Christopher and Whitlock, Quentin. _A Handbook of Computer-Based Training_. London: Kogan Page Ltd., 1983.

Smith, Christopher ed. _Microcomputers in Education_. New York: John Wiley & Sons, Inc., 1982.

Articles and Periodicals

Gagne, R.M., Wager, W., and Rojas, A. "Planning and Authoring Computer-Assisted Instruction Lessons." _Educational Technology_, September, 1981: pp. 17-26.

41

Appendix A

EXAMPLE COMPUTER-MANAGEMENT PROGRAMS

Chapter Five points out several serious limitations in the
existing MHIAS management utilities. Basically, McGraw-Hill has
designed a useful CMI package for a course with a small number of
students. It is not capable of managing the collection, storage
and analysis of hundreds of students over a nine month instruc-
tional period, as required by the ACSC Associate Program.
Clearly, this task must be carefully implemented to insure the
quality of data collection, an integral part of the revised
program.

Fortunately, the MHIAS provides the ability to access user-
generated software at any time with immediate return to the
delivery system once finished. From the students' point-of-view,
they are unaware of this operation. Therefore, it is feasible
for ACSC to develop its own, tailored management system which has
the potential of easily surpassing the usefulness of any commer-
cially produced product.

One strategy suggested by ACSC/EDP is to use a program which
records the answers of the students (recall that this is one
feature lacking in the MHIAS) at some convenient time during the
seminar. Presumably, all seminar members will have viewed the
pre-seminar quiz, recording their answers for later entry into
this system. The actual entry process could be done individ-
ually, or by someone tasked to do this for everyone. Clearly,
maintaining the integrity of the entire quizzing process will
have to be addressed by ACSC.

This appendix documents three example programs developed to
illustrate some of the concepts suggested by this strategy. The
first program is "Files". It would only be run by the ACSC fac-
ulty to set up student files and correct answer files for each
seminar. Then, the program "Score" is run from within the MHIAS.
It "prompts" the students to enter their answers which then are
stored on the delivery diskette. Finally, a program is needed to
access the information gathered by "Score". This is the job of
"ReadFile". It prints out the student answers and grades them
using the correct answer file set up during the running of
"Files".

The reader should be cautioned that these programs are only

43

meant as examples. Many other functions in a good management system would be desirable for ACSC which are not included here. One obvious missing area is a program to collect week-by-week results and do statistical analyses on them. That is, some sort of data-based relational management system must be devised.

The commented source listings and sample runs are included below for reference. The programs are written in Turbo Pascal (22:--). Figures 2-4 illustrate what the user would see while running these programs. The executable codes (which can run on either the IBM, COMPAQ or Zenith Z-100 personal computers) reside with ACSC/EDPT.

THE "FILES" PROGRAM

```
program Files;

{This program is written in Turbo Pascal Ver 2.0 by Maj John
 Gaudet as a demonstration program for an SPS project.  It
 creates  two disk files,
              INPUTNAME.DAT  and INPUTNAME.ANS
 on the A: drive, where InputName is entered by the user.

 INPUTNAME.DAT is a data file used to record student answers.
 Up to 20 students can be entered with 10 responses of 10
 characters each.

 INPUTNAME.ANS is a data file used to store the correct answers
 for the questions asked of the students.  Again, up to 10
 answers may be stored each of no more than 10 characters.

 Once INPUTNAME.DAT is created by the instructor, the program
 SCORE is run
 by the student using the McGraw-Hill Authoring System to enter
 the student's answers.}

const
 MaxStudent = 20;
type
 student = record
            NumQuestions : integer;
            StuNum : integer;
            name : string[20];
            answers : array[1..MaxStudent] of string[10];
            SaveFlag : boolean;
          end;
  RightAnswers = record
                  CorrectAnswers : array[1..MaxStudent] of
                                        string[10];
                end;
var
 i, j, NumStudents,temp : integer;
```

44

```
   StudentRec : student;
   StudentFile : file of student;
   FileName,InputName : string[14];
   istr : string[2];
   RightAnswerRec : RightAnswers;
   RightAnswerFile : file of RightAnswers;


begin   {main}

   {prepare INPUTNAME.DAT}

   writeln; write(' ENTER FILE NAME TO BE CREATED: ');
   BufLen := 8; read(InputName);
   writeln; write(' NUMBER OF STUDENTS IN FILE: ');
   repeat readln(NumStudents)
    until NumStudents in [1..MaxStudent];
   FileName := 'A:'+InputName+'.DAT';
   assign(StudentFile,FileName);
   rewrite(StudentFile);

   with StudentRec do  {get student names, etc.}
   begin
     write(' NUMBER OF QUESTIONS: ');
     repeat readln(NumQuestions)
      until NumQuestions in [1..10];
     temp := NumQuestions;
     writeln; writeln;
     for i := 1 to NumStudents do
      begin
       writeln; write('STUDENT NAME: ');
       BufLen := 20;
       read(name);
       StuNum := i;
       SaveFlag := false;
        for j := 1 to 10 do
          answers[j] := ' ';
       write(StudentFile, StudentRec);
      end; {for}
   end; {with}
close(StudentFile);

{prepare INPUTNAME.ANS}

FileName := 'A:'+InputName+'.ANS';
assign(RightAnswerFile,FileName);
rewrite(RightAnswerFile);

with RightAnswerRec do  {get correct answers}
 begin
   writeln; writeln;
   for i := 1 to temp do
   begin
```

```
      str(i,istr);
      write('ANSWER TO QUESTION # '+istr+': ');
      BufLen := 10; readln(CorrectAnswers[i]);
    end; {for}
  write(RightAnswerFile,RightAnswerRec);
  end; {with}
close(RightAnswerFile);
end.
```

Note: **Boldface** indicates responses by user.

```
ENTER FILE NAME TO BE CREATED: student
NUMBER OF STUDENTS IN FILE: 5
NUMBER OF QUESTIONS: 3


STUDENT NAME: John Jones
STUDENT NAME: Mary Smith
STUDENT NAME: Harry Murphy
STUDENT NAME: Howard Johnson
STUDENT NAME: Dean James

ANSWER TO QUESTION # 1: a b d a
ANSWER TO QUESTION # 2: binary
ANSWER TO QUESTION # 3: true
```

Figure 2.   Example Run of "Files"

THE "SCORE" PROGRAM

```
{$I-,U+}      {special compiler directives}
```

program score;

{This program was written in Turbo Pascal, Ver 2.0, by Maj John
 Gaudet as a demonstration program for an SPS project. It is
 designed to be run from the McGraw-Hill Authoring System in
 order to record students answers for later evaluation. Since
 this program accesses STUDENT.DAT on the A: drive, the program
 FILES must be run first to create a file named STUDENT.

 The students are prompted through a series of questions to enter
 the information. For the purposes of this demonstration,
 students are identified by a student number 1 thru 20. Some

46

```
   amount of foolproofing is built in.}

label done;

const
 MaxStudent = 20;
type
 students = record
              NumQuestions : integer;
              StuNum : integer;
              name : string[20];
              answers : array[1..MaxStudent] of string[10];
              SaveFlag : boolean;
            end;

var
 StudentFile : file of students;
 StudentRec : students;
 pnr, NumStudents : integer;
 finished : boolean;
 ans : char;

procedure initialize; {set up STUDENT.DAT}
 begin
  assign(StudentFile, 'A:STUDENT.DAT');
  reset(StudentFile);
  NumStudents := FileSize(StudentFile);
 end;

procedure intro;   {Welcome students}
 begin
  writeln(' WELCOME TO THE ACSC ASSOCIATE PROGRAM ');
  writeln('       PRE-TEST SCORE RECORDER ');
  writeln;
  writeln('     ENTER 99 WHEN YOU ARE DONE.');
  writeln;
  writeln('       Press RETURN to continue.');
 end;

procedure clear; {clear screen by scrolling}
 var i : integer;
 begin
  for i := 1 to 24 do
    writeln;
end;

procedure GetNum;   {get student number, make sure its correct. }
var ok : boolean;
begin
  pnr := 0;
  repeat
   ok := true;
   writeln;
```

```pascal
      writeln(' Please enter the information');
      writeln('       requested below:');
      writeln;
      write('   STUDENT #: ');
      buflen := 2;
      read(pnr);
      writeln;
      if not (pnr in [1..NumStudents,99]) then
        begin
          ok := false;
          writeln;
          writeln; writeln('INCORRECT STUDENT NUMBER!');
          writeln;
        end; {if}
      if IoResult   0 then
        begin
          ok := false;
          writeln;
          writeln; writeln('YOU CAN ONLY ENTER ONE');
          writeln(' OR TWO DIGIT NUMBERS!');
          writeln;
        end; {if}
    until ok;
  end;

procedure hello;  {i.d. student by name}
  begin
    seek(StudentFile, pnr-1);
    read(StudentFile,StudentRec);
  with StudentRec do
    begin
      writeln; writeln('RECORDS FOR: ', name);
      writeln;
    end; {with}
  end;

procedure GetAnswers; {get and store answers in answer array}
  var i : integer;
      ichar : string[2];
  begin
    with StudentRec do
      for i := 1 to NumQuestions do
        begin
          str(i,ichar);
          write(' QUESTION # '+ichar+' ANSWER: ');
          buflen := 10; readln(answers[i]);
        end; {if}
  end;

function AnswersCheck : boolean;  {check for change of heart}
var ans : char;
  begin
    AnswersCheck := false;
```

48

```
   writeln;
   write(' ARE THESE CORRECT? (Y/N): ');
   read(ans);
   if ans in ['Y','y'] then
    AnswersCheck := true
   else
    begin
     writeln;
     writeln('    ANSWERS NOT SAVED!');
     writeln;
    end; {else}
  end;

procedure SaveAnswers; {save answers if not already stored}
 begin
   with StudentRec do
   begin
    if SaveFlag = true then
     begin
      writeln;
      writeln('SORRY, ANSWERS FOR ', name);
      writeln('     ALREADY SAVED!'');
      writeln;
     end  {if true}
    else
     begin
      seek(StudentFile, pnr-1);
      SaveFlag := true;
      write(StudentFile, StudentRec);
     end; {if false}
   end; {with}
 end;

begin {main}
 finished := false;
 initialize;
 clear;
 intro;
 read(ans);
 clear;
 repeat
  repeat
    GetNum;
    if pnr = 99 then goto done;
    hello;
    GetAnswers;
  until AnswersCheck;
  SaveAnswers;
 until finished;
done: close(StudentFile);
end.
```

Note: Boldface indicates responses by user.

```
WELCOME TO THE ACSC ASSOCIATE PROGRAM
       PRE-TEST SCORE RECORDER!

     ENTER 99 WHEN YOU ARE DONE.

     Press RETURN to continue.

   Please enter the information
         requested below:

   STUDENT #: 1

RECORDS FOR John Jones

   QUESTION # 1 ANSWER: a,b,c,a
   QUESTION # 2 ANSWER:   binary
   QUESTION # 3 ANSWER: TRUE

   ARE THESE CORRECT? (Y/N): y
   Please enter the information
         requested below:


   STUDENT #: 2

RECORDS FOR Mary Smith

   QUESTION # 1 ANSWER: A-B-D-C
   QUESTION # 2 ANSWER:   BINARY
   QUESTION # 3 ANSWER:  false

   ARE THESE CORRECT? (Y/N): n
    ANSWERS NOT SAVED!
```

Figure 3.   Example Run of "Score"

```
            Please enter the information
                requested below:

        STUDENT #: 1

        RECORDS FOR John Jones

            QUESTION # 1 ANSWER:  a,b,c,d
            QUESTION # 2 ANSWER:
            QUESTION # 3 ANSWER:   true

            ARE THESE CORRECT? (Y/N): y
        SORRY, ANSWERS FOR John Jones
                ALREADY SAVED!!

            Please enter the information
                requested below:

        STUDENT #: 99
```

Figure 3.   Example Run of "Score" (Cont'd)

THE "READFILE" PROGRAM

```
{$U+}    (compiler directive)
program ReadFile;

{This program was written by Maj John Gaudet in Turbo Pascal,
 Ver 2.0, for an SPS project.  It reads a file input by the user
 and grades the student answers contained on it.  The program is
 intended to use files created with SCORE and FILES.  Each
 question for each student is graded according to information in
 the RightAnswerFile. Extraneous blanks and other non-alphabetic
 and non-numeric characters are removed from the correct answer
 and the student answer for comparison.  If a student did not
 respond to the question, the program says so. Program output may
 be sent to screen or printer.}

const
  MaxStudent = 20;
type
  WorkString = string[10];
  students = record
                numquestions : integer;
                StuNum : integer;
                name : string[20];
```

51

```
                      answers : arra  1..MaxStudent] of string[10];
                      SaveFlag : b     on;
                    end;
     RightAnswers = record
                     CorrectAnswers : arrayLi..MaxStudent] of
                                       string[10];
                   end;
var
  i,j,NumStudents : integer;
  studentrec : students;
  StudentFile : file of students;
  FileName,InputName : string[14];
  num : string[2];
  ans,dev : char;
  RightAnswerRec : RightAnswers;
  RightAnswerFile : file of RightAnswers;
  StudentAnswer,CorrectAnswer : string[10];
  device : text;
  ok : boolean;

procedure massage(var line : WorkString);   {removes unwanted
characters}
  var  ch : char;
       i : integer;
       temp : string[10];
begin
  for i := 1 to length(line) do
   begin
    ch := copy(line,i,1);
    if ch  ' ' then
     begin
      ch := upcase(ch);
      if ch in ['A'..'Z','0'..'9'] then temp := temp + ch;
     end; {if}
   end; {for}
  line := temp;
end;

begin  {main}
 repeat  {get file name}
   writeln; write(' ENTER FILE NAME TO BE READ: ');
   BufLen := 8; read(InputName);
   FileName := 'A:'+InputName+'.DAT';
   assign(StudentFile, FileName);
   {$I-} reset(StudentFile) {$I+};
   ok := (IoResult = 0);
   if not ok then writeln('Cannot find file ', InputName);
 until ok;

            {get other info}

 writeln; writeln(' SEND STUDENT DATA TO');
 write(' P = PRINTER / T = TERMINAL? ');
```

```
    BufLen := 1; read(dev);
    writeln;
    if dev in ['p','P'] then assign(device,'lst:')
     else assign(device,'con:');
    reset(device);
    reset(StudentFile);
    FileName :='A:'+InputName+'.ANS';
    assign(RightAnswerFile,FileName);
    reset(RightAnswerFile);

    with RightAnswerRec do   {access file}
     begin
       seek(RightAnswerFile,0);
       read(RightAnswerFile,RightAnswerRec);
     end; {with}
    NumStudents := FileSize(StudentFile);
    writeln(device,'NUMBER OF STUDENTS: ',NumStudents);

    with studentrec do   {take students one at a time}
     begin
       for i := 1 to NumStudents do
        begin
          seek(StudentFile, i-1);
          read(StudentFile, studentrec);
          writeln(device); writeln(device);
          writeln(device,'STUDENT NUMBER: ',StuNum);
          writeln(device,'STUDENT NAME: ' name);
          writeln(device,'ATTEMPTED QUEST ONS? ', SaveFlag);
           for j := 1 to numquestions do
            begin
              str(j, num);
              writeln(device);
              writeln(device,'QUESTION '+num+' ');
              with RightAnswerRec do
               begin
                StudentAnswer := answers[j];
                CorrectAnswer := CorrectAnswers[j];
                massage(StudentAnswer);
                writeln(device,'Student Answer: ',answers[j]);
                massage(CorrectAnswer);
                writeln(device,'Correct Answer: ',CorrectAnswer);
                 if StudentAnswer = CorrectAnswer then
                  writeln(device,'  RIGHT') else
                  writeln(device,'  WRONG');
                 end; {if}
               end; {with}
              if not (dev in ['p','P']) then read(ans);
          end; {for j}
        end; {for i}
    close(StudentFile);
    close(RightAnswerFile);
    close(device);
    end.  {main}
```

```
ENTER FILE NAME TO BE READ: student

SEND STUDENT DATA TO
P = PRINTER / T = TERMINAL? p
NUMBER OF STUDENTS: 5

   STUDENT NUMBER:  1
   STUDENT NAME: John Jones
   ATTEMPTED QUESTIONS? TRUE

   QUESTION 1
   Student Answer: a,b,d,a
   Correct Answer: ABDA
     RIGHT

   QUESTION 2
   Student Answer:   binary
   Correct Answer: BINARY
     RIGHT

   QUESTION 3
   Student Answer:   TRUE
   Correct Answer:   TRUE
     RIGHT

   STUDENT NUMBER:  2
   STUDENT NAME: Mary Smith
   ATTEMPTED QUESTIONS? FALSE

   QUESTION 1
   Student Answer:
   Correct Answer: ABDA
     WRONG

   QUESTION 2
   Student Answer:
   Correct Answer: BINARY
     WRONG

   QUESTION 3
   Student Answer:
   Correct Answer: TRUE
     WRONG
```

(Note: Listing continues with rest of data.)

Figure 4.   Example Run of "ReadFile"

54

Appendix B

EXAMPLE SCREENS FOR AN ACSC LESSON

The purpose of this appendix is to provide the reader with a
sampling of screens developed during the course of this study.
Every screen is not reproduced here, but there is adequate repre-
sentation of the types of instructional strategies possible using
the McGraw-Hill System in the manner discussed in Chapters Four
and Five.

It is not possible to properly display the visual impact of a
CAI screen on the written page. After all, the variety of the
visual medium of CAI is one of the powerful advantages it has
over textual materials. Unfortunately, neither was a screen dump
utility available in the authoring system which would have pro-
vided an easy way to make hardcopies of each display. Therefore,
what is used here is the actual method provided to the CAI author
to assist him/her in lesson preparation. It is a utility that
prints all "printable" characters on the screen while displaying
the non-printable graphics characters as asterisks. (Note:
according to the documentation, an IBM graphics printer will
produce all the graphics characters faithfully if used with the
IBM Personal Computer. [19:GS2.9]) For the sake of clarity,
all codes and abbreviations used by the MHIAS are expanded here.
When appropriate, comments are added between screens. However,
to appreciate the full effect of the CAI possible with the MHIAS,
the reader is referred to the actual software available from
ACSC/EDPT.

As mentioned in Chapter Five, the sample lesson used as a
vehicle to understand the role the McGraw-Hill System could play
in the ACSC Associate Program was entitled "Nonstrategic Nuclear,
Chemical and Biological Operations." One videotape was available
which pointed out the historical perspective of chemical and
biological warfare.

Note: The typical print screen format is as follows: the
top third of the page displays the type and name of the screen;
the middle third shows the screen itself; the bottom third con-
tains the color and branching data for the screen.

Figures 5 and 6 show the screens that introduce the lesson
goal and objectives.

```
        1.   SCREEN NAME:     BANNER

SECTION:               1
VIDEO:                 yes
TYPE OF SCREEN:        presentation
------------------------------------------------------------

        ******   ******   ******   ******
        *    *   *        *        *
        *    *   *        *        *
        ******   *        ******   *
        *    *   *             *   *
        *    *   *             *   *
        *    *   ******   ******   ******

                ASSOCIATE PROGRAMS

        *        *****   **  *     *   *   *****
        *        *       **  *     *   *   *
        *        *****   *  * *     ****    *****
        *            *   *   **           *
        ****     *****   *   *         *   *****

------------------------------------------------------------

FOREGROUND COLOR:           black
BORDER COLOR:               red
BACKGROUND COLOR:           white
DISPLAY SPEED:              by page
FORMAT:                     full page
COLUMNS:                    40 columns
BRANCH:                     GOAL
```

Figure 5.   Presentation Screen "BANNER"

This screen, named BANNER, does a simple branch to the screen
named GOAL.

56

```
            2.   SCREEN NAME:     GOAL

SECTION:              1
VIDEO:                yes
TYPE OF SCREEN:       presentation


- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -


                   LESSON 45

                EDUCATIONAL GOAL

      Following this period of instruction,

    you should know the basic US and Soviet

    capabilities in the areas of nonstra-

    tegic nuclear, chemical and biological

    operations and comprehend the issues

    surrounding the use of these weapons.


- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -


FOREGROUND COLOR:          black
BORDER COLOR:              none
BACKGROUND COLOR:          white
DISPLAY SPEED:             by page
FORMAT:                    full page
COLUMNS:                   40 columns
BRANCH:                    DOTEST
```

Figure 6.   Presentation Screen "GOAL"

    This screen uses the blinking feature to highlight the key
words: nuclear, chemical and biological.   The student is then
sent immediately to the DOTEST screen to determine if a quiz
should be given at this point.

57

```
      3.  SCREEN NAME:     DOTEST

SECTION:                  1
VIDEO:                    yes
TYPE OF SCREEN:           multiple choice
INCLUDED IN REPORTING:    no
-----------------------------------------------------


           DO YOU WANT TO TAKE PRE-TEST

           OR GO DIRECTLY TO LESSON?


              A.    TAKE PRE-TEST

              B.    GO TO LESSON




-----------------------------------------------------


FOREGROUND COLOR:         white
BORDER COLOR:             red
BACKGROUND COLOR:         white
DISPLAY SPEED:            by page
FORMAT:                   full page
COLUMNS:                  40 columns
NUMBER OF ANSWERS:        2
CORRECT ANSWER:           0
LAST JUDGEABLE ANSWER:

BRANCH(A):                TEST1
BRANCH(B):                OBISCNO
```

Figure 7. Multiple Choice Screen "DOTEST"

Figure 7 shows a multiple choice screen used to move the
student to the next logical step in the lesson, giving the option
to take a pre-test now or go directly to the lesson. This

provides one method of testing each seminar member separately, if the MHIAS management system is used. Note that the answer to this question is not included in the reporting for the management process.

Figure 8 shows one of the pre-test questions.

```
        6.  SCREEN NAME:      TEST2

    SECTION:                  1
    VIDEO:                    yes
    TYPE OF SCREEN:           application
    INCLUDE IN REPORTING:     yes
    ---------------------------------------------------

                    ACSC LESSON #45

                PRE-TEST QUESTION #2

        _____  chemical munitions are preferable

    weapons because they provide significant

    safety during their entire life cycle.
    ---------------------------------------------------

    FOREGROUND COLOR:         black
    BORDER COLOR:             blue
    BACKGROUND COLOR:         white
    DISPLAY SPEED:            by page
    FORMAT:                   full page
    COLUMNS:                  40 columns
    REDO:                     no

    NUMBER OF TIMES TO REDO:  1

    MODE:                     Interactive

    Entry 1 Information:
    COLUMN:                   2
    ROW:                      11
    SIZE OF INPUT FIELD:      9
    EXECUTION ORDER:          1
    TYPE OF FIELD:            All Characters
    TYPE OF CHECKING:         Set
```

Figure 8.   Application Screen "TEST2"

```
VALID ANSWER SET:              *binary*two-part*2-part*
                               double*

HELP LINES:

QUESTION RESPONSE BRANCHING

RESPONSES:          BRANCHES

All correct         test3

ALTERNATIVE COMBINATIONS


Otherwise           test3
```

Figure 8.   Application Screen "TEST2" (Cont'd)

This is a good example of the MHIAS capabilities for a Fill-
In-The-Blank question. Notice the branching alternatives and the
correct answer set. In this case, branching is simple since it
is one question in a forced sequence, but the possibilities here
are obvious.

After the pre-test, the next screen might be like Figure 9.


```
          5.  SCREEN NAME:    OB1SCNO

SECTIO.:                 1
VIDEO:                   yes
TYPE OF SCREEN:          application
INCLUDE IN REPORTING:    no
------------------------------------------------
  IF YOU WOULD LIKE TO VIEW ALL OR PARTS OF THE
  VIDEO TAPE FOR THIS LESSON, PRESS THE APPRO-
  PRIATE FUNCTION KEY.
```

Figure 9.   Application Screen "OB1SCNO"

60

```
   F1.   ALL VIDEO (APPROX. 30 MINUTES)

   F2.   BASIC PROBLEM IN CHEMICAL WARFARE
         FACED BY US AND ALLIES

   F3.   HISTORY OF CHEMICAL WARFARE

   F4.   USE IN AFGHANISTAN

   F5.   SOVIET ABILITIES

   F6.   FUTURE OF CHEMICAL AND BIOLOGICAL WEAPONS

   F7.   CONTINUE LESSON
   ----------------------------------------------------------


   FOREGROUND COLOR:              white
   BORDER COLOR:                  white
   BACKGROUND COLOR:              purple
   DISPLAY SPEED:                 by page
   FORMAT:                        full page
   COLUMNS:                       40 columns
   REDO:                          yes

   NUMBER OF TIMES TO REDO:       6

   MODE:                          Interactive

   FUNCTION KEY BRANCHING
    PF   key            Branch

      1                 01SOTV1
      2                 01SOTV2
      3                 01SOTV3
      4                 01SOTV4
      5                 01SOTV5
      6                 01SOTV6
      7                 obj1
      8
      9
     10                 EXIT
      .
      .
     16
```

Figure 9.   Application Screen "OB1SCNO" (Cont'd)

This is an example of function key branching. It can be used
to provide the students with an author-programmed menu. In this
case, the keys have been programmed to branch to screens which
will run videotape segments (01SOTV1, 01SOTV2, etc.). When the
student elects to continue the lesson, the screen obj1 is dis-
played. Notice that the author has programmed a hidden EXIT
(which terminates the lesson) at the F10 key. Figures 10 and 11
show the use of selective feedback.

```
┌─────────────────────────────────────────────────────────────┐
│                                                               │
│           17.   SCREEN NAME:     OB1SCN2                       │
│                                                               │
│       SECTION:                  1                             │
│       VIDEO:                    yes                           │
│       TYPE OF SCREEN:           multiple choice               │
│       INCLUDED IN REPORTING:    no                            │
│       ──────────────────────────────────────────────         │
│                                                               │
│        WHICH CHOICE BELOW BEST FITS YOUR ASSESSMENT           │
│                                                               │
│        OF US CAPABILITIES IN CHEMICAL/BIOLOGICAL              │
│                                                               │
│        WARFARE?                                               │
│                                                               │
│            A.   US HAS LITTLE OR NO ABILITIES.                │
│                                                               │
│            B.   US HAS ONLY OFFENSIVE WEAPONS.                │
│                                                               │
│            C.   US MAINTAINS DEFENSIVE POSTURE ONLY.          │
│                                                               │
│            D.   US TRAINS REGULARY FOR COMBAT UNDER           │
│                 CHEMICAL/BIOLOGICAL ATTACK.                   │
│       ──────────────────────────────────────────────         │
│                                                               │
│       FOREGROUND COLOR:          black                        │
│       BORDER COLOR:              white                        │
│       BACKGROUND COLOR:          white                        │
│       DISPLAY SPEED:             by page                      │
│       FORMAT:                    full page                    │
│       COLUMNS:                   40 columns                   │
│        VIDEO SCREEN                                           │
│          START ADDRESS:          0                            │
│          END ADDRESS:            0                            │
│          NEXT ADDRESS            9900                         │
│       AUDIO TRACK:               track 1                      │
│                                                               │
└─────────────────────────────────────────────────────────────┘
```

Figure 10.   Multiple Choice Screen "OB1SCN2"

62

```
AUDIO ONLY:                    no

NUMBER OF ANSWERS:             4
CORRECT ANSWER:               D
LAST JUDGEABLE ANSWER:        D

BRANCH(A):                    01S2BA
BRANCH(B):                    01S2BB
BRANCH(C):                    01S2BC
BRANCH(D):                    OB1SCN3
```

Figure 10.   Multiple Choice Screen "OB1SCN2" (Cont'd)

This multiple choice question has only one correct answer.
If either of the wrong answers is chosen, the student is required
to view a video segment related to the option he/she chose. For
example, if the student picked option B, the following screen is
displayed:


```
            19.  SCREEN NAME:    01S2BB

 SECTION:              1
 VIDEO:                yes
 TYPE OF SCREEN:       presentation
 -----------------------------------------------

  NO, THE US DOES HAVE SOME OFFENSIVE CHEMICAL
  WEAPONS.
  LET'S WATCH A SHORT VIDEO SEGMENT WHICH DISCUSSES
  THE SOVIET THREAT AND OUR CURRENT CAPABILITIES.
 -----------------------------------------------

 FOREGROUND COLOR:             white
 BORDER COLOR:                 red
 BACKGROUND COLOR:             white
 DISPLAY SPEED:                by page
 FORMAT:                       full page
 COLUMNS:                      40 columns
 BRANCH:                       TV1
```

Figure 11.   Presentation Screen "01S2BB"

Thus, the student is told that he/she was wrong, and support for the correct response is provided from the videotape found at screen TV1 which plays the correct portion of the tape. Actually, TV1 is not a screen at all, but refers to the data required to play that portion of the videotape requested. This information may be called a separate "screen", or created in conjunction with a real visual screen. This latter procedure actually saves disk space and is recommended when possible. The data at TV1 is staightforward and is illustrated below:

```
    22.   SCREEN NAME:        TV1

  SECTION:                    1
  VIDEO:                      yes
  TYPE OF SCREEN:             video only

  VIDEO SCREEN

    START ADDRESS:            9850

    END ADDRESS:              14730

    NEXT ADDRESS              18300

  AUDIO TRACK:                track 1

  AUDIO ONLY:                 no

  BRANCH:                     OB1SCN4A
```

Figure 12.   Video Only Screen "TV1"

This "screen" (nothing is actually shown on the computer screen) branches to screen OB1SCN4A, which means that after the student has viewed the videosegment represented by TV1, he/she will see OB1SCN4A.

Figure 13 shows a typical application screen which allows a range of numeric responses.

64

```
             27.   SCREEN NAME:    OB1SCN5

SECTION:                      1
VIDEO:                        yes
TYPE OF SCREEN:               application
INCLUDE IN REPORTING:         no
----------------------------------------------------------


   WHEN COMPARING US AND USSR CHEMICAL WARFARE

   CAPABILITIES IN TRAINING TIME, DEDICATED PER-

   SONNEL AND MOBILE DECONTAMINATION DEVICES, A

   GOOD ESTIMATE IS THAT THE USSR HAS ABOUT

   A _____ TO 1 ADVANTAGE.
----------------------------------------------------------

FOREGROUND COLOR:             red
BORDER COLOR:                 purple
BACKGROUND COLOR:             white
DISPLAY SPEED:                by page
FORMAT:                       full page
COLUMNS:                      40 columns
REDO:                         no

NUMBER OF TIMES TO REDO:      1

MODE:                         Interactive

Entry 1 Information:

COLUMN:                       3
ROW:                          13

SIZE OF INPUT FIELD:          4

EXECUTION ORDER:              1

TYPE OF FIELD:                Numeric

TYPE OF CHECKING:             Range
```

Figure 13.   Application Screen "OB1SCN5"

```
┌─────────────────────────────────────────────────┐
│                                                 │
│   RANGE:                       7 to 12          │
│                                                 │
│   HELP LINES:                                   │
│                                                 │
│   QUESTION RESPONSE BRANCHING                   │
│                                                 │
│   RESPONSES:          BRANCHES                  │
│                                                 │
│   All correct        OB1SCN6                    │
│                                                 │
│   ALTERNATIVE COMBINATIONS                      │
│                                                 │
│                                                 │
│   Otherwise          CHEMCAP                    │
│                                                 │
│                                                 │
└─────────────────────────────────────────────────┘
```

Figure 13.   Application Screen "OB1SCN5" (Cont'd)

For the question given in Figure 13, only the answers which
lie in the range 7 to 12 will be accepted as correct.

Figures 14-16 demonstrate the ability of the MHIAS to perform
"immediate" branching upon pressing a key. It is referred to as
cursor-key branching.   These screens also demonstrate the block
graphics capabilities of the authoring system. Unfortunately,
the printer displays all these characters as asterisks.

66

```
                    SCREEN NAME:      INF4

        SECTION:                  1
        VIDEO:                    yes
        TYPE OF SCREEN:           application
        INCLUDE IN REPORTING:     no
        ────────────────────────────────────────────────

             WARHEADS ON LAUNCHERS
        1200*        PAST AND FUTURE
           *
        1050* **                              WARSAW PACT
           *
        900*                    *
           *                    *
        750*                 ***
           *                 *
        600******************
           *
        450*
           *
        300*
           *
        150*
           *
           *
           ****************************************
            71       74       77       80       83       86

                 LONGER RANGE INF   (YEAR)
```

Figure 14.   Application Screen "INF4"

```
FOREGROUND COLOR:            red
BORDER COLOR:                black
BACKGROUND COLOR:            white
DISPLAY SPEED:               by page
FORMAT:                      full page
COLUMNS:                     40 columns
REDO:                        no

NUMBER OF TIMES TO REDO:     1

MODE:                        Interactive

CURSOR KEY BRANCHING

   Cursor      Branch

   Up
   Down
   Right       INF5
   Left        INF3
```

Figure 14.   Application Screen "INF4" (Cont'd)

```
             SCREEN NAME:     INF5

 SECTION:                     1
 VIDEO:                       yes
 TYPE OF SCREEN:              application
 INCLUDE IN REPORTING:        no
_____

        WARHEADS ON LAUNCHERS
 1200*       FAST AND FUTURE  ***
    *                          ***
 1050* **                                WARSAW PACT  *
    *                    *****
 900* **                                 NATO        *
    *                       *
 750*                    ***
    *                    *
 600*********************
    *
 450*
    *
 300*
    *
 150*                              *
    *                              *
    *                              *
    *******************************************
     71      74      77      80      83      86

          LONGER RANGE INF   (YEAR)
```
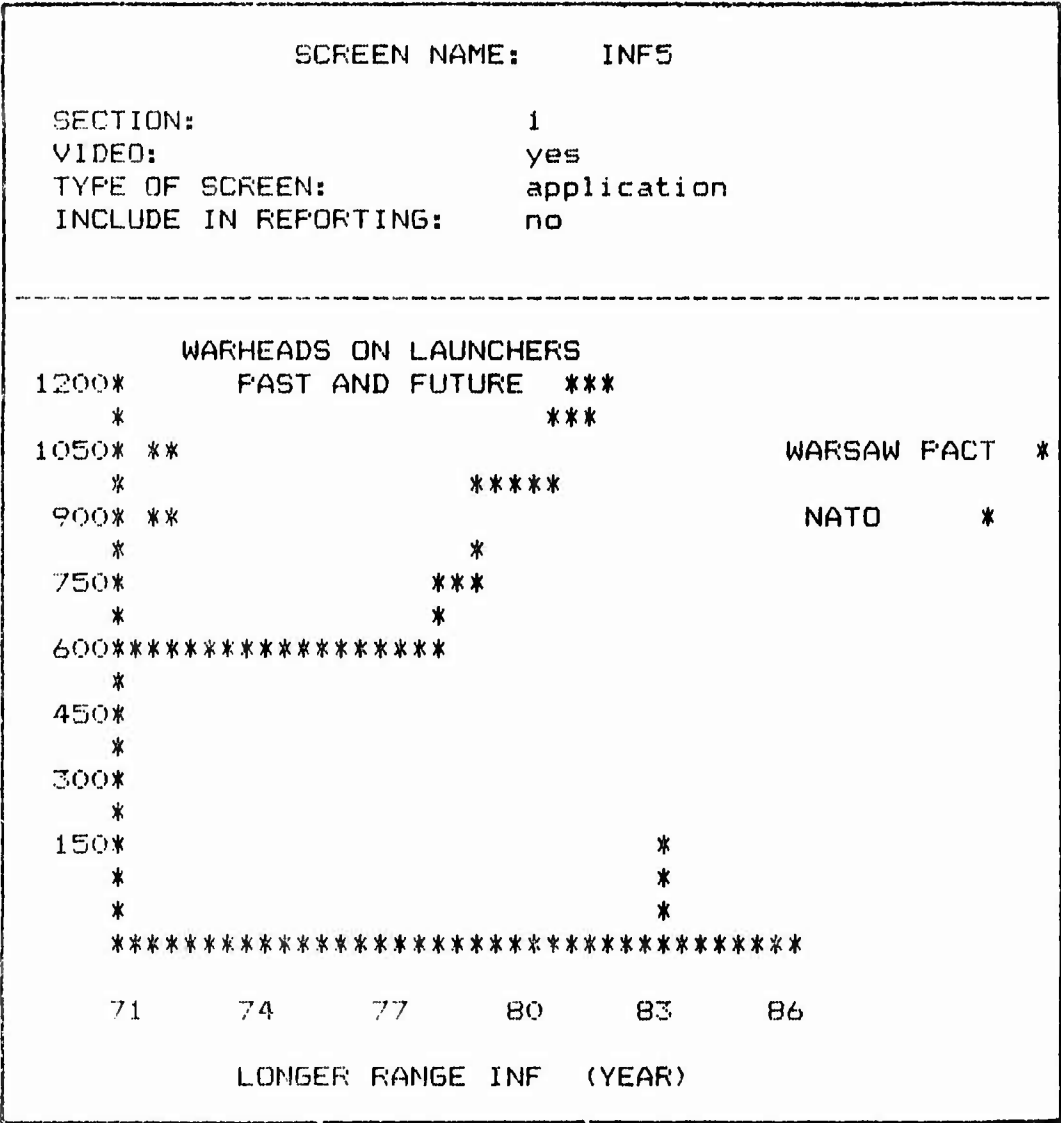
Figure 15. Application Screen "INF5"

```
FOREGROUND COLOR:          red
BORDER COLOR:              black
BACKGROUND COLOR:          white
DISPLAY SPEED:             by page
FORMAT:                    full page
COLUMNS:                   40 columns
REDO:                      no

NUMBER OF TIMES TO REDO:   1

MODE:                      Interactive

CURSOR KEY BRANCHING

   Cursor      Branch

   Up
   Down
   Right       INF6
   Left        INF4
```

Figure 15.   Application Screen "INF5" (Cont'd)
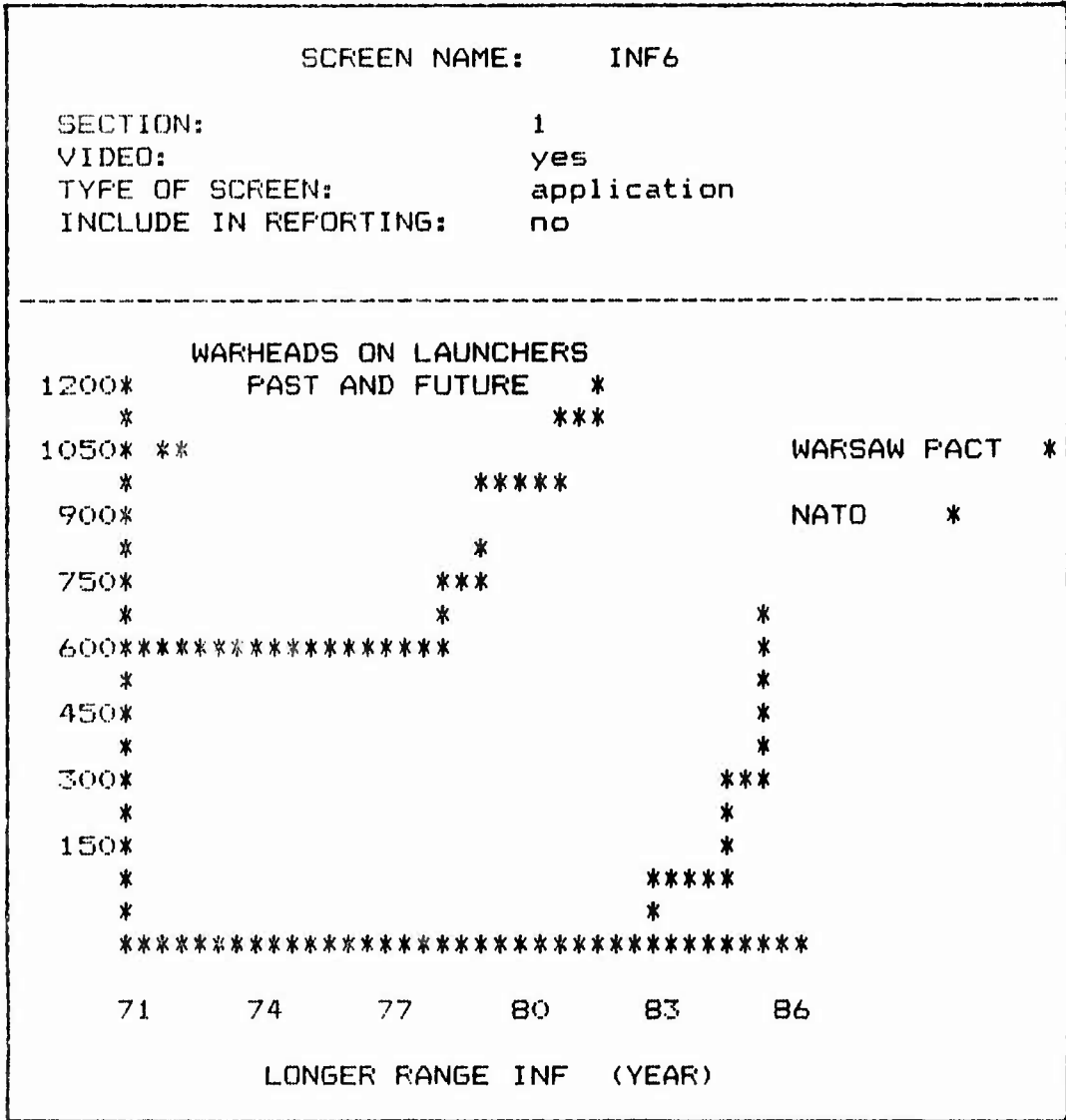
```
                    SCREEN NAME:      INF6

    SECTION:                     1
    VIDEO:                       yes
    TYPE OF SCREEN:              application
    INCLUDE IN REPORTING:        no
    ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─

              WARHEADS ON LAUNCHERS
    1200*      PAST AND FUTURE     *
       *                         ***
    1050* **                                   WARSAW PACT   *
       *                     *****
    900*                                        NATO       *
       *                    *
    750*                  ***
       *                 *                          *
    600******************                          *
       *                                           *
    450*                                           *
       *                                           *
    300*                                         ***
       *                                         *
    150*                                         *
       *                                   *****
       *                               *
    *********************************************
       
        71      74      77      80      83      86

              LONGER RANGE INF   (YEAR)
```

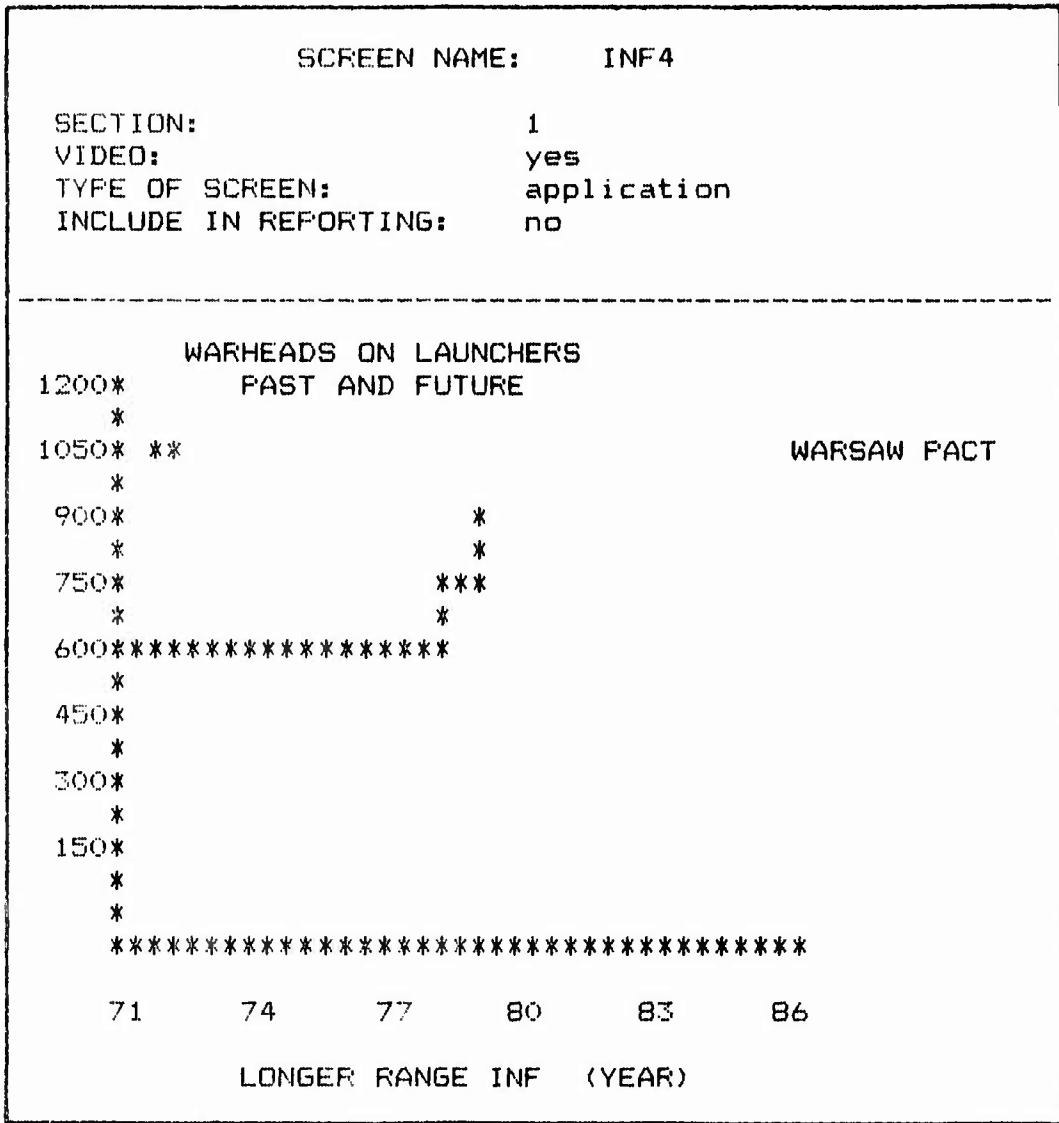Figure 16.   Application Screen "INF6"

71

```
FOREGROUND COLOR:          red
BORDER COLOR:              black
BACKGROUND COLOR:          white
DISPLAY SPEED:             by page
FORMAT:                    full page
COLUMNS:                   40 columns
REDO:                      no

NUMBER OF TIMES TO REDO:   1

MODE:                      Interactive

CURSOR KEY BRANCHING

   Cursor      Branch

   Up
   Down
   Right       OB2SCN2
   Left        INF5
```

Figure 16.   Application Screen "INF6" (Cont'd)

The effect of using cursor-key branching is to allow the
student to move through several screens fairly quickly, although
disk access slows down the process enough (about one second) to
invalidate true simulation.   In the sequence above, a chart is
being built as the student strikes the right arrow key.   This
could be useful in emphasizing some important trend in the chart.
Note that the student may back the chart up if he/she desires.

Appendix C

THE MCGRAW-HILL LESSON REPORTS

This appendix demonstrates the capabilities of the MHIAS
individual and group reporting functions. As in Appendix B, the
information presented below appears exactly as it would to the
instructor using a typical dot-matrix printer. The statistics
are gathered only for those questions requested by the lesson
author.

First, Figure 17 shows how a sample Student Question Report
would appear.


```
+-----------------------------------------------------------+
|                                                           |
|              STUDENT QUESTION REPORT                      |
|                                                           |
|               Lesson: LESSON45                            |
|                                                           |
|               Date:   1/2/85                              |
|                                                           |
|     John Jones                             1111           |
|    ***************************************************    |
|     Screen       *Sec*Type*Times*Num *Min:sec             |
|     Name         *Num*Ques*Tried*Cor *Used                |
|    ***************************************************    |
|     TEST1        * 1 * MC *  1  *   1*  0:57              |
|     TEST2       _1 * 1 * AP *  1  *   1*  0:02            |
|     TEST3        * 1 * MT *  1  *   1*  0:41              |
|                                                           |
+-----------------------------------------------------------+
```

Figure 17. MHIAS Student Question Report

In the above table, the three questions are named TEST1,
TEST2 and TEST3. For example, see page Appendix B, Figure 8, for
the actual screen for TEST2. Notice that the number of times the
student took the question, the results and the amount of time
spent on the question are all recorded.

73

Next, Figure 18 demonstrates the Student Section Report which provides individual results of students for different sections of the lesson. That is, the lesson may be segmented, and questions reported on separately for each section. Note that only one section was used in this lesson.

```
        STUDENT SECTION REPORT

          Lesson: LESSON45

          Date:  1/2/85

    John Jones                          1111
****************************************************
  Section* Times *Number* Per    *Min:sec
  Number * Tried * Cor. * Cent   * Used
****************************************************
      1   *     3 *     3 *  100% *   1:40
          *       *       *       *
          *       *       *       *
          *       *       *       *
  Totals  *     3 *     3 *  100%*   1:40
```

Figure 18. MHIAS Student Section Report

```
          ITEM-BY-ITEM REPORT

          Lesson: LESSON45

**********************************************************
  Screen      *Sec*Type*Times*Num *Min:sec
  Name        *Num*Ques*Tried*Cor *Used
**********************************************************
  TEST1       * 1 * MC *  6 *    5 *  1:08
  TEST2       * 1 * AP *  6 *    4 *  0:11
  TEST3    _1 * 1 * MT *  6 *    4 *  1:31
```

Figure 19. MHIAS Item-by-Item Report

74

The data shown in Figure 18 is self-explanatory.

The instructor may also receive an Item-by-Item Report using the MHIAS. This report summarizes the results for each graded question. Figure 19 shows an example of this report. There is also a Section Summary table available.

One of the most valuable reports that the MHIAS produces is the Lesson Summary Report which gives in one table the overall results for each student. Figure 20 shows an example.

```
              LESSON SUMMARY REPORT

              Lesson: LESSON45

********************************************************
*  Student Name and ID     * Date* Num * Num*Per *Min:sec  *
*                          *     *Tries* Cor*Cent* Used    *
********************************************************
*  John Jones      1111    * 1/2*  3 *  3 *100%*  4:37   *
*  Mary Smith      2222    * 1/2*  3 *  1 * 34%*  0:50   *
*  Howard Johnson  3333    * 1/5*  9 *  7 * 78%*  2:24   *
*  Dean James      4444    * 1/7*  3 *  2 * 67%*  0:50   *
*                                                        *
********************************************************
```

Figure 20.   MHIAS Lesson Summary Report

Finally, time and correct percent graphs can be produced by the McGraw-Hill System. To avoid confusion, Figure 21 only shows an example of the percentage graph.

In summary, the MHIAS CMI does provide the author with several useful evaluation tools. They are based upon the answers provided by the students for those questions chosen to be graded by the author. The most important feature lacking in the System is that the instructor does not know what wrong answers were selected. This makes evaluation of the CBE materials difficult. Another capability not currently available using McGraw-Hill is the ability to feed the results into a relational data-base manager and spreadsheet programs. Thus, there is no way to keep a running score of student records as the course progresses.

```
┌──────────────────────────────────────────────────────────────────┐
│                                                                    │
│                   LESSON PERCENTAGE GRAPH                          │
│                                                                    │
│                   Lesson: LESSON45                                 │
│                                                                    │
│                                                                    │
│  J. Jones    ************************************************      │
│  M. Smith    ****************                                      │
│  H. Johnson*******************************************             │
│  D. James    *******************************                      │
│              ***************************************************   │
│              0   10  20  30  40  50  60  70  80  90  100           │
│                                                                    │
│                                                                    │
└──────────────────────────────────────────────────────────────────┘
```
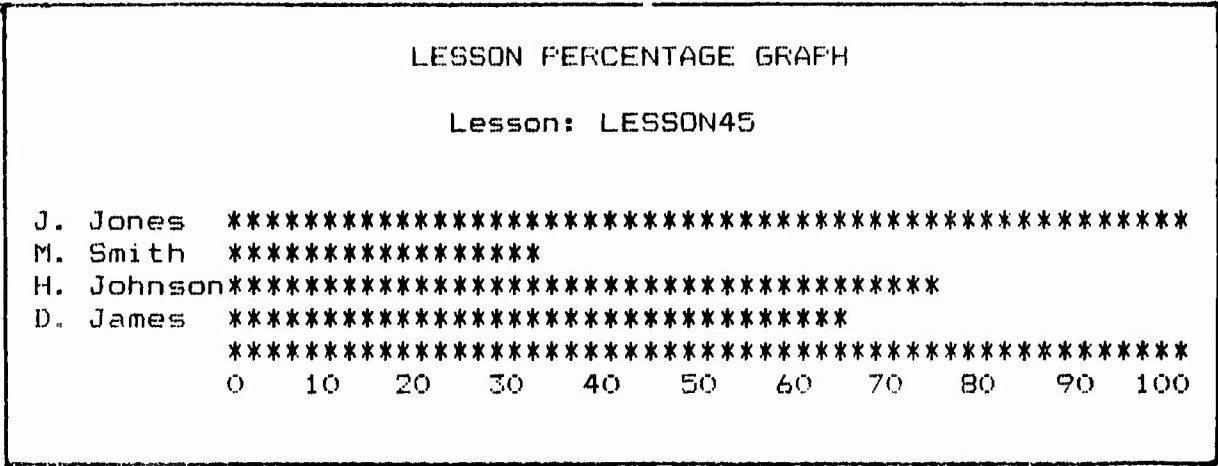
Figure 21.   MHIAS Lesson Percentage Graph

(Note: Full names are printed by the MHIAS.   Abbreviations were used here only to fit the page.)