IDENTIFICATION OF CRITERIA FOR SUCCESSFULLY ESTABLISHING COMPUTER-BASED TRAINING PROJECTS IN BUSINESS AND INDUSTRY

By

FITZPATRICK U. AMANZE-ANYANWU

Bachelor of Science
Oklahoma State University
Stillwater, Oklahoma
1982

Master of Science
Oklahoma State University
Stillwater, Oklahoma
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Thesis Advisor

Dean of the Graduate College

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DEDICATION

I wish to dedicate this research study to Francis Amanze-Anyanwu, my father, who died during the course of my studies overseas. Throughout his life, and as he died, with honor and dignity, he had always lived the belief that all people are worthwhile, and we as fellow human beings should take the time to listen, to help, and to be accepting. He also taught me that the quality of honesty and keeping one's word was truly the mark of success!

It is with love and respect that I make this dedication.

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CHAPTER I

INTRODUCTION

The effective use of modern technology to solve many social problems has been the subject of debate during the last decade. The potential value of the computer is well recognized, as it has become an integral part of our lives. Super viewed the computer as "just another library, a terminal as just another book with a good table of contents, a good index, and programmed interaction to insure good personal use of data." (48)

The age of the computer has come with such startling rapidity, and has had such widespread impact on society and on the individual that it is appropriately described as the electronics revolution, comparable in significance to the industrial revolution. Increasingly, computers are valued as research and professional tools in medicine, the behavioral sciences, and education and training (67).

The computer has been harnessed to perform a number of different tasks in modern society. Today, computer use is commonplace in all sectors of society. In the last two decades, the computer has been found to be as versatile and useful a tool in education and training as it has been in many other fields. Education and training administrators have found many ways to simplify their complex and

time-consuming tasks in such areas as class registration, class and course scheduling, class performance records, and in individualizing instruction. The most sophisticated among these administrators have begun to see the computer as a viable management tool for decision making. According to Hayman and Mable (29), the computer represents a highly desirable application of technology to education and training.

As Reed, Ertal, and Collart (50) states, one of the areas that educators and trainers may utilize the computer to a great advantage is in individualizing learning experiences. Computer programs can be developed to supplement traditional methods of instruction, or they can be used as the major medium of instruction. The major advantage of using the computer in this way is that it allows the trainee to progress through the learning material at the trainee's rate (3).

The computer is a valuable tool to educators and trainers because it provides a variety of instructional strategies, delivery modes, and it is a useful and exciting means of expanding learning opportunities. Because of the computer's versatility, there has been a general trend toward the use of computers, especially microcomputers, in instructional delivery in business and industry. This general trend toward the use of modern technology in education and training has tremendous implications for the training and development field. Before microcomputers entered the scene, smaller firms would send their employees to a training site where computer-assisted instructional technology is utilized; but more recently, the small firms can own their own microcomputers as stand-alone or shared network systems that they can use on-site for instructional delivery (63).

The development of the microprocessor has made it possible for the computer to become an easily accessible tool for education and training (68). Advances in computer technology will have far reaching implications for the society in general, and for the learning process in particular. Computer assisted learning is the technique that appear to be making the most impact in the way training and developments is conducted (33).

According to Trott (66),

> rapid development of microcomputers has encouraged their possible use in the training world. Like the rest of us, trainers hear a lot about how microcomputers are going to change the whole way we do things, ... and computer-based training (CBT) has been in the air long enough for it to have become a familiar idea to many people (p. 84).

In many business and industrial establishments, an efficient and productive workforce has been the watchword. Many of these business and industrial establishments have seen the application of computers to training as a necessary tool to enhance efficiency and productivity. Mitchell (44) posits that:

> One possibility that has forced upon many institutions including corporate training centers is to increase productivity by shifting education and training from a service industry relying upon teachers toward a goods industry relying upon instructional materials (p. 41).

Because of the implications of these new and emerging trends, it is important that trainers become aware of, and anticipate the challenges that these new and emerging trends will bring to the training and development field. It is with this view that Trott (66), points out that:

> Trainers are now the focus of considerable marketing efforts regarding computer-based training, and are exposed to a great deal of publicity about what others are doing in this field, and about the possibility it

> offers for improving various aspects of the training function. ... there is thus considerable demand for courses on computer-based training to help trainers to find their way round this new project (p. 84).

Statement of the Problem

The biggest problem is the inadequacy of the criteria used to justify the establishment of computerized training systems in business and industrial establishments. The criteria used are limited and in some cases subjective. There is limited information within the human resource development (HRD) profession concerning the use of adequate and objective criteria for justifying the establishment of computer-based training projects in business and industry.

Because of the notion that "computer power" is always more powerful than human power in terms of speed and accuracy, it has been the trend to accept the effect of computer-based training at face value. As Dolmatch (18) pointed out,

> Too often trainers are under extreme and constant pressure to create a particular end product -- a trained employee -- as quickly as possible, they cannot concern themselves with expenses and effectiveness as much as they should (p. 43).

The emphasis on the application of modern technology to training in business and industrial establishments calls for a systematic way of establishing such projects. More recently, because of the large sums of money channeled into employee training, and the decrease in profit due to changes in the economy, sound evaluation of the processes involved in the establishment of successful computer-based training projects in business and industry has become a necessity.

Goldstein (28), in reference to Scriven, pointed out that formative evaluation of training concerns deals with whether the training program is operational before it is put in place. On the other hand, summative evaluation concerns refer to whether the final product, and in this case a training program, is doing what it is supposed to do. These same principles apply to the establishment of computer-based training programs in business and industry.

Purpose of the Research

The major purpose of this research was to review the literature and gather and examine data to identify what criteria should be used in successfully establishing computer-based training projects in business and industry.

Significance of the Study

In John Naisbitt's book, Megatrends, there is an indication that one of the ten major transformations taking place today in our society is the shift from an industrial to an informational society (46). In a speech the futurist Alvin Toffler, during the 1981 International Training Conference, pointed out that "electronic cottages" will be seen as part of the changing society, and that this feat arises as a result of the higher cost of commuting to training stations and the decreases in the cost of telecommunications (64). In his book, The Third Wave, Toffler predicted that the use of computers will generate new theories, ideas, ideologies, artistic insights, technical advances, economic and political innovations that were unthinkable and unimaginable in the past (18).

Computers are already making a great impact and also creating a great interest and awareness in the field of HRD. Fauley (24) indicated that professionals in this field "must be alert to the new technologies that will help the mission of HRD be more efficient." Only recently the number of organizations significantly using computer-based education (CBE) for learning has been increasing at a very rapid rate. Reynolds (52) noted that the increase in the use of the CBE technique for the training of manpower in business and industry is a result of the increased awareness and interest on the part of training and development professionals.

Another factor accounting for this increase is the general decrease in the cost of computer-based learning (CBL) tools, and the influx of personal computers (microcomputers) in the computer market. A 1982 United States (U.S.) Training Census and Trends Report indicated that computers are becoming an increasingly popular instructional tool among trainers. Accordingly, training departments are turning to microcomputers to fulfill their instructional needs (65).

Assumptions of the Study

To complete this study, the following assumptions were made:

1. The experts -- identified by their peers through a modified Delphi Technique -- were knowledgeable and concerned with the identification of criteria for successfully establishing CBT projects in business and industry.

2. The Delphi Technique is a useful method for assessing present problems and concerns, getting a consensus in inexact fields, and in predicting future trends.
3. The method used in designing the research instrument will yield data reflecting a measure of concensus on the criteria to be used in successfully establishing CBT projects in business and industry.

Limitations of the Study

For reasons of validity, the participants responding to the research instrument were limited to the experts identified by active professionals engaged in CBT systems for business and industry and who, having met the three-point-two-must screening criterion were extended invitation to participate in the study. The research instrument was limited in size and scope in order to focus on specific concerns relating to the criteria for successfully establishing CBT projects in business and industry, and to maximize response rate.

In the second round feedback, the elements generated from the first round were analyzed and grouped into minor task item groups and these were sent back to the respondents for regrouping into major task headings. In the second round questioning, the experts were not specifically asked to re-arrange the elements within the minor task item groups.

Definition of Terms

For the purpose of this research study, the following definitions were adopted:

Access -- Process by which information contained either in memory or mass storage is made available to another sub-unit of a computer or, ultimately, to the user. Also refers to the authority or ability to communicate with a remote computer.

Applications package -- A program, or group of programs, written to perform a specific function in computer-based training.

Author -- The person who produces the CAT course.

Author language -- A high-level computer language specifically designed for use by authors of CAT in developing educational courseware. There are various author languages, example, Pilot.

Authoring Aid (Utility) -- Special type of program which facilitates the programming of courseware by enabling a content expert to interact with the computer and have the coding performed automatically, and does not require programming knowledge or skill.

Authoring System -- The system within which the author language runs, providing such facilities as editing, checking, file handling, etc.

Branching -- A strategy of lesson development in computer-based self-teaching programs whereby students may be routed to different remedial sequences within a module appropriate to their answers to questions and problems.

Computer-aided (assisted) instruction -- The use of computer to deliver instruction.

Computer-aided (assisted) learning -- See computer-aided (assisted) instruction.

Computer-assisted training -- Training using the computer as means of tutorial instruction. Identical to computer-aided (assisted) instruction.

Computer-based training -- A generic term that covers both computer-assisted training and computer-managed learning.

Computer-managed instruction -- the use of computer to direct students through their training and produce statistical reports on student performance or system utilization.

Computer-managed learning -- See computer-managed instruction.

Computer-managed training -- See computer-managed instruction.

Computer network -- A group of computers linked together so that data can be transferred between them.

Computer program -- A series of instructions to the computer that cause programmed events to take place.

Computer validation -- In CBT, this means the checking of a course entered by an author to ensure, as far as possible, that the rules of the author language have been obeyed.

Course author -- The person who writes a CAT course.

Courseware -- The material comprising the content of training courses that support educational objectives. The programs that simply make the CBT system "run."

Debugging -- The process of identifying and removing errors from computer-based training courseware.

Delivery -- The process of delivering the learning activities to learners. Also referred to as implementation.

Delphi Technique -- A questionnaire format consisting of two or more rounds of questioning focusing on consensus of opinion in inexact

events. The literature contains few criteria for constructing a Delphi research instrument; however, the Delphi Technique used in this research study is modified to exhibit the following characteristics:

a. The format made use of a paper and pen/pencil questionnaire which was administered by mail.

b. The item(s) on the questionnaire was/were generated from the literature and the pilot group.

c. A set of instructions immediately preceded the questions.

d. Each minor task item group on the second round questionnaire was accompanied by some form of statistical feedback.

e. All the individual responses were kept anonymous for all iterations.

f. The participants did not meet or discuss the issues face-to-face, and were geographically remote from one another.

g. Iterations with feedback continued until consensus was reached, as determined by the Principal Investigator.

Drill and practice -- In CBT, it means the use of computer to provide intensive practice with feedback to develop mastery of basic routine skills.

Evaluation -- The assessment of the effectiveness of training materials during use, and the comparison of the chosen presentation method with other methods; and also surveying trainee reactions and the operating costs against estimates.

Feedback -- Output, usually displayed on a screen, to tell the trainee how successful he/she performed in solving problems.

Hardware -- Category of computer components involving the physical equipment, but excludes the instructions to the equipment, etc.

Interactive Instructional System (IIS) -- An authoring system for CBT.

Intelligent Terminal -- A terminal that can do some processing itself.

Instructional Systems Development (ISD) -- A general term that refers to the systematic approach to the design and development of training materials and systems.

Mainframe Computer -- Large and powerful systems with vast storage capacity that can accommodate several hundred geographically distributed learners simultaneously studying different materials.

Microcomputer -- An independent or "stand-alone" system used by one person.

Minicomputer -- A computer that is between a mainframe and a microcomputer in power and in price that may accommodate 20-100 trainees.

Network -- A linked group of machines which may be computers or terminals which make it possible for a user to communicate with one or more remote computers; there is always one computer in a network.

Off-line -- In computer-based learning, learning which takes place away from the CBL terminal.

On-line -- Information currently in an active mass storage device and therefore available for direct access.

Open-ended question -- A questioning technique used in CBT whereby the learner is allowed to enter a reply in his own words.

Operating System -- The computer software that coordinates the operation of the computer and peripherals.

PILOT -- An authoring system for CBT.

PLATO -- An authoring system for CBT.

Programming -- Total process of developing solutions to the problems contained in computer applications, and involving analysis, design, coding, testing, and implementation.

Summary

Computer technology has been an advantage to mankind because of its use to solve many social problems. The wide use of computers in society has been referred to as the electronic revolution. Educators and trainers now see the computer as a complementary tool in the training of students because of its potential for individualized instruction. Advances in computer technology have made it possible for trainers to utilize the computer in employee training. However, the problem faced by the trainers is the inadequacy of the criteria for justifying the establishment of CBT in business and industry. It is the purpose of this research study to review the relevant literature and to gather data to identify the necessary tasks to be carried out to insure the successful establishment of CBT projects in business and industry.

CHAPTER II

SELECTED REVIEW OF LITERATURE

Introduction

Although the topic under investigation in this research study was directed toward gathering the relevant information leading to the identification of criteria for successfully establishing computer-based training (CBT) projects in business and industry, a review of literature dealing with the historical aspects of computers and the emergence of computer-based learning (CBL) technique was deemed necessary.

The initial portion of the literature review dealt with some historical events in the development of computers, and their use in learning. The latter portion of the literature review was directed toward the examination of CBL concepts, design and development methodologies, and the implementation and management; revealing some of the criteria used to establish its effectiveness and implementation.

Short History of the Computer

It is very hard to locate the exact origin of computing devices. However, the use of computers can be traced to 30,000 B.C., with the

"counting bones," which was followed by the "sand and pebble calculators" introduced by the Egyptians. By 2,500 B. C. the "astronomical clock" was introduced by the stonehenge, followed by "placing values" introduced by the Sumarians. By the 600 B.C., the "abacus" was introduced by the Chinese.

Not until the late 19th and early 20th centuries did machine computation become prevalent. It was out of the need to tabulate United States of America (U.S.A.) census data, a task that was taking eight to ten years to complete, that the computer field received its impetus. Recently, computer history has been measured in terms of generations, with the introduction of the true computer age beginning in the early 1950's. Since then, the computer industry has moved through four generations, with each generation experiencing improvements in electronic circuitry, internal storage capabilities, external storage capabilities, and in overall system architecture, etc.

Interest in new methods of instruction and increased knowledge of computer potential have contributed to the use of computers in instructional delivery. This application of computers to classroom advantage is referred to as computer-aided (assisted) instruction (CAI). CAI is the use of computers in actual instruction processes, and this can be applied to different learning situations. CAI is an outgrowth of programmed instruction that utilize some of the basic principles of programmed instruction. It can be referred to as a sophisticated form of programmed instruction (17).

The origin of CAI dates back to the 1950's when the computer industry itself began to use it to develop the potentials of, and to

increase the effectiveness of trained computer professionals. At that time electric typewriters and teletypes were hooked to computers and this would then send programmed instruction modules stored on magnetic tape decks back to the learner. In 1960, the "first" computer assisted author language was developed by the International Business Machines (IBM) company. By 1966, the range of symbols the CAI system can handle widened, and movement and sound effects were added to the features.

In the 1970's, many computer companies developed small-scale CAI systems that can be implemented with less start-up costs. The TICCIT system which links CAI system with mass media by using television, and the PLATO System which uses a special plasma terminal to provide extensive graphic capabilities are examples of the major CAI systems of the 1970's. These CAI systems were sophisticated systems with varied terminal capabilities (44).

Concepts

Computers are continuously being used in many fields and educators and trainers are finding them useful in implementing their instructional programs and in other relevant task areas. Atkinson and Wilson (2) listed four factors influencing the rapid growth of computer use in education and training as:

1. Computers potential for individualized training;
2. The development of programmed instruction;
3. Increase in aid from the federal government; and
4. The mushrooming of electronic data processing in general (p. 74).

Solomon (60) confirmed that these factors are continually influencing the rate of growth in computer use. Perhaps the most important feature of computer use in education and training is in its integration with programmed instruction, thus making its use an efficient and effective way of presenting instructional materials.

Modes of Computer Use in Education and Training

Computers can be integrated in education and training in many ways. According to Bell (4), computers relate to instruction in three major ways:

1. Computers are used as an object of instruction;
2. Computers are used as managers of instruction; and
3. Computers are used as a medium of instruction.

In the first mode, the student learns how to operate the computer, or how the computer operates; and the method of teaching may be traditional. When the computer is used as a manager of instruction, it is used to schedule classes, either before the semester starts or during drop-and-add, and/or to grade and record test results for a specific training program. The computer can also be used as a medium of instruction. Bell (5) further identified four modes in which the computer can be used as a medium of instruction:

1. The computer can be used in tutorial exercises;
2. The computer can be used for inquiry;
3. The computer can be used in simulating real life events; and
4. The computer can be used in solving problems.

In the tutorial mode instructional material is presented to the student and the student is required to provide a response to the

question. The computer branches to another area of text depending on the student's response, and provides the student with a feedback. There are two major characteristics of the tutorial mode. These are: individual pacing and the presentation of instructional material in small steps depending on the level of student knowledge. An example of a tutorial mode is a situation where the computer gives the learner a problem and provides alternative answers to the problem, as in a multiple choice question. After the learner had selected an answer and entered it, the computer then compares the learner's answer with the internally stored correct answer, and informs the learner whether or not the chosen answer was correct. If the answer was correct, the computer directs the learner to the next sequence in the text. However, if the answer was incorrect, the computer provides an explanation of the problem, and either allows the student another try or provides the correct answer.

In the inquiry mode the learner is provided with a problem and is expected to solve it. The computer provides a list of available assistance relevant to the problem. The learner may ask for help when it is needed by invoking any of or a combination of assistance programs. In this mode the main task of the computer is to check the learner provided solutions with the most accurate solution of the problem, and to provide assistance when requested by the learner. An example of an inquiry mode is an instructional program in home management that requires the learner to provide information for solving the problem. After entering the solution, the computer checks this solution for accuracy.

In the next mode, simulation, the computer is used as an information processor and problem solver. In this mode the computer displays an experiment as it would appear in a real life situation, with options for varying the parameters. The learner then specifies the parameters to which solution of the problem is effected. As usual, when the solution is incorrect, the computer provides the appropriate response. An example of the simulation mode is a computer program that simulates the operation of an airplane. The learner is provided with many options for piloting the airplane, and is allowed to choose options for piloting the airplane to take off or to land. After the student had provided his/her options, the computer responds with the best options that would result in proper execution.

The most complex mode is the problem solving mode. In this mode, the learner must break down a problem into executable steps -- in mathematical calculations into formulas -- which are then entered or fed into the computer for processing. First, the computer enters or stores the steps or formula. When the student enters the data and executes the steps or formula, the computer then provides a solution depending on the learner's response. (3).

Computers and Programming

Computers are general purpose machines capable of processing data at a very high speed in accordance with the internal pre-programmed instructions. Computers can work independently for long hours in such a way as would exasperate a human being. They represent a new world for many students, educators and trainers, especially for the field that is largely concerned with the communication and interpretation of

instruction. In order to gain a degree of mastery in the operation of the computer, the learner has to spend a considerable amount of time learning the principles. Students, educators, and trainers understand computer operation at different levels, because computers differ widely in size and features. However, there are close similarities in the way computers manipulate data.

Characteristics of the Computer

The notion that computers are intelligent machines is a misnomer in that they possess no inherent reasoning ability unless it is pre-programmed into them as in artificial intelligence. Instead of referring to them as thinking machines, they can be more aptly described as a thinking man's machine. In other words, the man behind the machine is more important than the machine itself. However, computers possess significant attributes, one of these attributes is an unusual flexibility. Computers can be programmed to manipulate data in many different ways utilizing programmed instructions. A given program may contain few or more lines of instructions called statements. The statements make up the program which is written by a human being called a programmer.

One other characteristic of computers is their ability to store and process data electronically. Information stored in a computer, for instance, students' test scores or course grades can be retained or processed on a continuum, without loss of detail.

Programming the Computer

Every computer has a number of pre-programmed instructions that are executable upon demand, by issuing specific commands. These instructions constitute the basic building blocks of an executable program. Computers respond to instructions commanding them to execute the pre-programmed instructions, by using special codes, usually a combination of letters, digits, or symbols. A given code directs the computer to manipulate data in a specific way. Whenever a program is to be executed within the computer, the instructions must follow some specified operational procedures (36).

According to Reed, Ertel, and Collart (51), the design and development of a CAI program should be done by an individual who:

1. Has a mastery of the contents of the subject matter;
2. Has an understanding of the proposed subject content; and
3. Accepts and understands the challenge inherent in working with an educational medium.

Before a program is written, an outline of the proposed program should be written. As Salisbury (57) pointed out, there are four major steps in the development of a computer program:

1. The objective to be addressed should be specified;
2. A criterion test should be developed to test whether or not the objective is met;
3. The subject content should be embedded in the medium as required so as to meet the objective;
4. The material should be tested and revised until it meets the specified requirement, and the student achieves the objective (p. 48).

Are Balo (3) confirmed that utilizing these procedures would help to ensure a well developed program.

Direct Instruction by Computer

In schools, colleges, universities, and business and industrial establishments, new ways are continually being explored to help in the delivery of instruction. Educators and trainers have long recognized the need to individualize instruction where practicable. As in any experimental approach to instruction, the question remains whether there are advantages that outweigh the obvious disadvantages. It is obvious that the relationship between the learner and the computer lacks human qualities that characterize the relationship between the learner and instructor. Communication between the learner and the computer remains a superficial one, in contrast to the free exchange of ideas possible between the learner and a human instructor.

The impersonal aspects of the communication between the learner and the computer as against the personal communication between the learner and the human instructor are partially balanced by the tailoring of the instructional material to the need of the learner, and the provision for the learner to work at his/her own pace. In essence, one can say that the computer, when accurately programmed, can "understand" better than the human instructor, what learning materials are needed for a particular learning situation, for a particular learner, and for particular feedback to the learner.

Although computers offer no simple solution to instructional delivery, they have been used to provide intensive and individualized. learning experiences, utilizing the modes of drill and practice,

inquiry, tutorial, simulation, and problem solving. Computers can utilize their speed, accuracy, and interactive capabilities to select, present, evaluate, and manage instruction, to the advantage of learners and instructors.

Research and development in the area of CAI has been an on-going process, and many years may elapse before appropriate roles are assigned to the computer, and also evaluated in relation to the cost/benefits of utilizing this method of instruction. New ways in which the computer may be integrated into the educational process will continue to rise as new and better ways are being advanced in computer's electronic circuitry. If students were allowed to spend many hours ploughing through the materials presented by the computer, without having the opportunity to interact with human instructors, their reactions may be different. Hansen (29) reflected on a number of articles written for individualizing instruction, and one conclusion was that the potential use of CAI materials and adapting the materials to different personality characteristics had only just begun to be explored.

Although the period of utilizing computers as the only instructional medium is far from reality, it seems reasonable to assume that the research and development being done in this field will have far reaching implications in the future of instructional delivery. When one reflects on the extensive and creative work being done in this area, one will find that the projects have demonstrated a number of ways in which computers can be used to assist the human instructor in the instructional process to produce a variety of high

quality instructional programs. This feat has major implications for the way education and training are being conducted.

Educational Research by Computer

Some understanding of the advantages and limitations of a computer as a research tool is almost a requirement in today's research activities. Today, research utilizes tools from statistics and measurement in addition to its use of the computer. Acquiring a thorough understanding of all the technicalities involved in a research activity requires extensive training and a considerable experience with applied problems. Additionally, there is the continuing need to keep abreast of new instructional methods and technology.

Researchers in the area of computer assisted instruction have attempted to determine its effectiveness. Suppes and Morningstar (62) have conducted several such studies. One study was designed to evaluate a drill-and-practice program in elementary-school mathematics while a second study was designed to evaluate a tutorial program in elementary Russian. The drill-and-practice program in elementary-school mathematics was introduced to students in grades 1 through 6. The study was conducted over a three year period with approximately 2700 students in three states participating in the program. The primary goal of the program was to provide drill and practice in the skills of arithmetic, especially computations, as a supplement to regular classroom instruction.

To evaluate the effectiveness of the drill-and-practice program, the arithmetic portion of the Stanford Achievement Test was

administered to both control and experimental classes in October and again in May. The increase in performance level for students in the experimental classes was significantly greater than that for students in the control classes. The second type program that was evaluated was a tutorial computer program designed to teach first and second year courses in Russian at the college level. Course materials were presented by the computer. The study was conducted over a period of three quarters. Two sections of the courses served as the control group and two sections were asked to volunteer for the CAI courses.

To evaluate the CAI program, students were ranked according to their performance on the final examination. The average number of errors on the examination was lower for the computer-based students during each quarter. The difference was statistically significant for two of the three quarters. Suppes and Morningstar (62) found that 73 percent of the students originally enrolled in the computer-based program completed all three quarters compared to only 32 percent in the regular class. Suppes and Morningstar (62) suggested that this might be an indication that the computer-based class held the interest of the students better than the regular class did.

Durrett, Browne, and Edwards (19) developed a computer-based module, on the physical development of young children. The module consisted of a set of slides on the various stages of a child's growth. The computer presented the student with a checklist that checks the knowledge obtained by the students from the slides. After that the computer provided immediate feedback and assistance. The computer then asked the students to identify certain characteristics of stages of physical development. To help identify the

characteristics the student could ask the computer for more information. The student was then given feedback on the characteristics that should have been identified.

The module was tested by use of an experimental group and a control group which were two sections of a beginning course on child development at the college level. The control group observed children in a nursery school while the experimental group used the module. To test the effectiveness of the module both groups were given a test which contained five questions pertaining to physical development. The experimental group scored higher on the five questions than the control group while the overall test average was the same for both groups. Durrett, Browne and Edwards (19) concluded that the computer offers students a useful and valid substitute for direct observation when learning physical development concepts.

Hall (28) used a computer assisted instructional program to teach modern mathematics teaching methods to 387 elementary and secondary teachers. The tutorial computer program was integrated with printed instructional materials. The participants were administered a pretest and posttest of mathematics content and posttest of attitude toward CAI. Results of the achievement test showed that the mean performance of the students advanced from 53 percent correct on the pretest to 73 percent correct on the posttests. Results of the posttest of attitude toward CAI revealed a strong positive attitude toward the individualized instruction provided by computer assisted instruction.

Solomon (60) conducted a study using a tutorial CAI system to teach a college level accounting principles course. Instruction was on a computer terminal with the computer program consisting of both

presentation of material and questions. To evaluate the CAI programs the time required by the instructor to present the material was compared with the time required by the CAI program to present the material. Results of the study revealed that tutorial CAI can present material in 33 to 41 percent less time than traditional lecture methods (3).

Overview of Computer-Based Learning Techniques

Since the advent of computers in the learning situation was pioneered by university research, it has been referred to as computer-based education (CBE). Donald Bitzer, "the father of CBE," described it as "anytime a person and a computer get together and one of them learns something." (53). As other organizations began to use computers for learning, the term computer-based learning (CBL) was substituted as it reflects today's emphasis on learner-centered approach. This latter name received wide-spread acceptance, as it was more appropriate in the various settings it was used, including the worlds of academic, business and industrial concerns. CBL, which is readily substituted for computer-based training (CBT), consists of all activities described by CAI, computer-managed instruction (CMI), and computer-support learning resources (CSLR). (52, 53).

According to Boyd (7)

> ... CBL has been in existence for more than two decades, large numbers of training and education departments are just beginning to use it. A recent survey of Fortune 500 Companies indicate that 50 percent of the respondents now use some form of CBT and nearly half of the remaining firms will begin using it next year (p. 1).

Computer-Based Learning Techniques

CBL technique is simply the use of computers in managing and presenting lessons to trainees. When the computer is utilized in this way the learner is able to receive individualized and self-paced instruction, and is also able to choose when and where in the text to begin and end lessons, depending on what is to be learned or on what has been learned. With this technique, one is capable of pursuing specific interests and applications in any preferred mode, including graphic, audio, video, or verbal.

Relevance of CBL Technique As An Instructional Delivery System

The presence of video discs, satellites and cable communications, slow-scan television, and the computer have had tremendous implications on how to teach and train others. According to Butler (10), there are four revolutionary trends impacting on training technology:

1. Integrated Technologies -- Components such as video discs, stereophonic units, computers, cable television, satellite and telephone communications, etc., will be used together as flexible multi-faceted instruction systems;
2. Multi-Purpose Communication and Information Systems -- Massive amounts of information will be stored and will become readily available for use in a variety of situations;
3. Increased Emphasis on Human Interface -- Training curricula will be based on less rigid behavioral or competency-based learning models, and more on inquiry oriented types;

4. Rapidly Decreasing Costs -- Savings will be made since media and computer-based training systems decrease learning time, facilitate remote learning sites, and multi-faceted use of new technologies.

Since the development of CAI, it has been the subject of various experiments; and the results of these experiments have been encouraging. Many of the studies have shown that it produced an equal or increased learning effectiveness and reduced learning time, as compared with the conventional methods of instruction. Some other studies have shown that under the right conditions, the cost of CAI can be very competitive with that of conventional methods (58).

The literature also indicates that the use of video discs and computers are creating a great impact in the way training programs are conducted, and also in increasing organizational efficiency and effectiveness. These technologies offer other potentials, especially in the field of international training, where satellites are used to transmit training programs to remote locations, as in teleconferencing. In this type of delivery system, the television is connected to a terminal that receives controlled signals called teletex signals, and interact with the computer in the form of videotex (20). This combination of video discs and the computer realizes the possibility of "people-people" and technologists communication. This combination can enhance trainee productivity by achieving prompted cognizance, evaluated judgement, progression, and pre-experience training (33).

Rationale for Adopting Computer-Based Learning Techniques

The major feature of the CBL management capability is that it affords the learner enhanced flexibility, by diagnosing learner responses, choosing and following the most effective instructional strategy for each learner, and remedying deficient skills and knowledge. In addition, it offers immediate and exact feedback. Another feature of this technique is the benefit Human Resources Development (HRD) departments gain from its use, in terms of cost and energy savings. With this technique, courses can be updated quickly from a central location, huge amounts of information can be stored and processed, and evaluation can thus be improved. The CBL technique also reduces cost by eliminating travel to training stations. It also decreases time for training by pinpointing the necessary amount of instruction required for a particular learning outcome to be achieved.

As Boyd (7) states, CBL technique caters for a variety of needs, especially in situations where:

1. large numbers of trainees, geographically dispersed, and requiring simultaneous instruction are involved;
2. training is dangerous like in nuclear facilities, or locations for toxic chemical experiments;
3. expensive equipment is in short supply or in danger of destruction, like landing an airplane on a carrier flight deck; and
4. trainees are to benefit from fast improvement. (p. 1).

Boyd (7) reported that more than 75 studies indicate that CBL learners achieve more in half the average training time.

In a study conducted by Thomas (65) on the difference in achievement level between CAI and the conventional methods, it was revealed that the CAI was at least equivalent in effectiveness. The study also reported a 10 to 50 percent increase in favor of CAI application; and that CAI showed positive result in supplementing other course materials and the lecture. Other studies indicated that CAI achievement gains accounted for between 10 to 90 percent over the conventional methods of instruction. These studies also revealed that CAI trainees learned "significantly faster" than they did under conventional methods (56). Also trainees exposed to CAI methods showed favorable attitudes toward study materials more often than did non-CAI trainees (65).

In terms of cost effectiveness, when the time required to teach a skill is limited, CAI usually reduces the time it takes to achieve top level mastery of skill; therefore, the trained worker is returned to the job more quickly. This phenomenon also accounts for the reduced training costs, including indirect costs such as overtime hours spent when trainees are in training during off hours. It also reduces pay for substitute workers, instructor time, overnight accommodation costs, and meal expenses. There is also a consistency in trainees' productivity on the job, especially when CAI trainees acquire higher levels of skill mastery (65).

According to Jernstedt (1), the rationale for adopting CAI is the computer's ability to aid and speed up the trainee's learning by multiplying (making available) the scarcest of training resources: time. Consequently, CAI makes up for those things the trainer cannot provide each trainee effectively, such as critical monitoring of

trainee's activities and the provision for immediate feedback and remediation. He also stated that when functions such as drill and practice, precise question-answering, review of material covered by the trainer, testing of achievement, record keeping, and material generation are handled by the computer, the trainer is freed from these time consuming tasks and is ready to perform more difficult and meaningful training tasks. These tasks include individual trainee support, counselling, and other training functions, such as providing training concepts, principles, applications, and other extrapolation of materials.

Advantages and Disadvantages in Adopting Computer-Based Training Technique

McLagan and Sandborgh (43) identified some of the advantages and the disadvantages of using CAI systems in training and development as follows:

Advantages

The advantages are:

1. It forces careful design;
2. It is available "anytime;"
3. It may be available wherever a terminal is available;
4. It reduces trainee learning time;
5. It reduces instructor staff;
6. It automatically keeps records of transactions between the learner and the instructor;
7. It provides immediate feedback;

8. It has high acceptance by disadvantaged trainees due to "exactly even" treatment given by computer to people;
9. One change can show on every terminal or work station; and
10. It has the potential for delivering instruction in a situation that parallels having one's own private instructor.

Disadvantages

The disadvantages are:

1. It has high startup cost and effort;
2. It requires sophisticated technical staff to support it;
3. It takes up resources on computer;
4. It takes long lead time to develop materials; and
5. Many sophisticated learners dislike overly structured learning situations (inflexibility without support facilities) that occur in most CAI, especially tutorial type situations.

CBL provides the HRD person (learning specialist) with more opportunity to work with more people since CBL is an individual form of learning. However, it should not be used in a situation requiring a high degree of human interaction for learning to take place (52).

Computer-Based Training Delivery Systems

The development of the microcomputer has led to the expansion of CAI delivery systems. According to Eldridge (21):

> If trainers can teach a subject using a book, they can teach it using a computer. Computer presentation has much greater versatility and potentially greater impact than the printed page. ... The delivery system you

> select will influence the quality of your presentation. A thorough review of the course requirements will indicate the computer capabilities necessary to fulfill your goals. ... help you align your instructional needs with the appropriate system. (p. 7).

Centralized Network

Time sharing, which is an aspect of a centralized network, is more practical and quite common with organizations that have branch offices since there would be a consistency of instruction and a centralized source for all training records to be built into the system. However, for smaller organizations without branch offices, and with less than half a dozen trainees at any one time, time-sharing may not be as practical. One example of a centralized network is the Control Data Corporation's (CDC's) PLATO. This is a standard CAI system, that uses one or more Central Processing Units (CPUs) to store and process data. Any software to be used is fed to the CPU from the display terminals scattered all over the U.S. In this system a PLATO user in any part of the country who is tied to the CPU based at the CDC's headquarters is part of a time-sharing system bidding for computer time slice against other users elsewhere. (21).

Fauley and Eldridge (25, 21, p. 7) discussed the advantages and the disadvantages of Centralized Networks:

Advantages

1. Refinements and "fixes" of courseware bugs is instantaneous;
2. Data on trainee progress, performance, course completion, and responses are complied centrally, and may be reported on demand;

3. Hardware, software, and courseware problems can usually be resolved by central staff support;
4. Instructors can monitor and control the sequence of instruction as it is going on;
5. Greater range of instructional strategies can usually be supported;
6. Has faster computing speed that permits free language simulations and other CPU bound strategies;
7. There is opportunity to " piggyback" on existing hardware;
8. It is less expensive to conduct instruction because there is sharing of cost among other functions;
9. Geographically dispersed terminals provide communication links among instructors, learners, and courseware developers;
10. Centralized data storage location provides considerable security of students' records and course materials; and
11. There is the availability of selected courses on this system by Vendors because Vendor support of hardware and software is fairly reliable.

Disadvantages

1. Communication line charges may be costly, and are incurred for each training hour;
2. Network and remote terminal problems must be resolved by Vendor support staff;
3. Hardware is expensive; CAI application rarely justify the purchase of a large mainframe;

4. Complete systems are more difficult and time consuming to install;
5. It has slower response time because it shares time with other business functions -- rapid system response time is not guaranteed;
6. Currently used terminals may not be adequate to conduct the system's instructional programs, especially with changes in the "host" or main computer system;
7. Rearrangement of priorities in the processing center may delay changes in courses and updates of files;
8. Problems with the central processor affects all terminals because system failure results in discontinued service to all training sites; and
9. Delays in program delivery can be caused by breakdowns in other segments of the network.

Dedicated Network

In a dedicated system many terminals are connected by cable and telephone lines to a central mainframe computer that is used only for instruction because the system is dedicated for that single purpose. Eldridge (21, p. 7) discussed the advantages and the disadvantages of dedicated networks:

Advantages

1. Hardware is inexpensive;

2. Terminals may be scattered over wide distances and can interact with each other so as to allow trainees to communicate with other trainees and with their instructors;
3. Response time is faster because it has only one function. Also, testing and results analyses are performed quickly;
4. It provides maximum security because it stores material in a central location, and codes it for use only by authorized individuals;
5. Courses and files are readily updated using terminals -- done by course developers and instructional designers; and
6. It provides a variety of capabilities for audio-visual and tactile stimuli, including light pens, touch panels, and other devices that help users to communicate with computers via the screen.

Disadvantages

1. The system's special capabilities require expensive terminals;
2. Irresponsible learners can use the communication system to send personal, irrelevant, and discriminatory messages;
3. It has limited application and is rarely considered cost-efficient;
4. Delays in training program delivery can be caused by problems in the segment of the network; and
5. Problems with the CPU affect all terminals.

Stand-Alone System

Stand-Alone systems function independently, using a microcomputer, a keyboard, a CPU, a visual display unit (VDU), a floppy disc drive, and if needed, a printer. Access to the system is done individually so that the equipment must be duplicated at each site where CAI is being used. Lesson material or courseware is usually developed at a central location and distributed to a remote site on a floppy disc.

Fauley and Eldridge (25, 21, p. 7) discussed the advantages and the disadvantages of a Stand-Alone system:

Advantages

1. It offers greater portability;
2. It is more appropriate for small-scale training operations;
3. Installation of hardware is easier and faster;
4. It maximizes the benefit of individualized instruction because it provides maximum flexibility of instruction and curriculum;
5. It is the least expensive system when compared with the centralized or dedicated networks; because there are no communication line costs, and it is less expensive per learner;
6. There is a wide variety of off-the-shelf courses for the user to purchase;
7. Its response time is faster than network systems due to the systems independence. The response time is guaranteed in

programs not requiring large system down time or large amounts of computation; and

8. System breakdowns do not affect more than one terminal or more than one learner.

Disadvantages

1. Vendor support of hardware and software is generally not well established;
2. Learners, course developers, and instructors cannot communicate with each other as they can using the networks. Therefore, refinement and "fixes" of courseware bugs cannot always be accomplished in a timely fashion;
3. Stand-Alone system software provides limited instructional methods, strategies, and materials;
4. Trainers must gather results from each learner. Learner response data is difficult to compile. If there is a large trainee audience, this may be very time consuming because learner progress and performance reports are not always available on time; and
5. Revised and updated courseware must be distributed to each learner or to each training site because courseware must be duplicated and shipped to each learner or training site.

Guidelines for Selecting Computer-Based Training Delivery Systems

In selecting effective CBT delivery system Boyd (7) suggested that the following should be borne in mind:

1. The number of trainees to receive the training;
2. The background and education of the trainees in terms of:
    a. whether they already have applicable knowledge of CBL such as course prerequisites; and
    b. whether they have any hands-on experience
3. The training objectives in terms of:
    a. what the trainees will be capable of of doing after the training;
    b. what new skills or information they will have; and
    c. how these skills or knowledge acquisition will be measured;
4. A plan to track the progress of trainees in terms of whether they should have more control of their learning experience than the conventional instruction allows;
5. The required audio-visual support for the instructional material;
6. The time frame for administering and completing the training program;
7. Whether:
    a. CBL will be combined with other instructional media to save costs;
    b. the combination of CBL and other instructional media will help in achieving the stated goals; and
8. Why CBL technique is the most appropriate medium for the situation, reflecting on whether there are other more appropriate instructional media for the purpose (p. 1).

Guidelines for Successful Computer-based Training Project

Choosing a Quality Software

Boyd (7) listed a number of ways to ensure successful CBT projects:

1. Investment should be made on high quality courseware -- a tested and proven material with a track record of effectiveness;
2. Start off CBT by securing extensive Vendor support, especially when the trainer is a novice in computer field;
3. An accurate assessment of the entire system's future growth potential needs should be made in terms of:
   a. whether the system is likely to improve over time, and
   b. whether the system is easy to adapt.
4. Attention should be paid to the basic features of a program, objectively, and first focusing on the learner's view, and then on the evaluator's view; because if the equipment or procedures are too difficult to work with, trainees interest would be rapidly lost and they become disillusioned;
5. CBT program should fulfill its promises. For example, if it claims to move smoothly through a fixed amount of material it should do that. Ensure that there are no mechanical or procedural blocks and also that all topics can be covered;
6. Pay attention to strong and clearly defined capabilities because the CBT should be easy to enter and exit, especially when leaving and returning to the same place or at the

beginning of the lesson, as this is essential for the learner; and

7. Pay attention and pinpoint inaccuracies, misspellings, and crowded text screens as these are also the same problems that detract from non-computer instructional materials (p. 4).

Improving Training

Boyd (7) also suggested that training can be improved by following these guidelines:

1. Provide the names and numbers of technicians to contact if trainees experience difficulty during a practice session, when the instructor may not be present to assist trainees;
2. Ensure that training takes place away from work stations and job-related pressures and interruptions;
3. To ensure better retention, distribute learning material over time, and allow sufficient breaks that are not too long or too many to prevent trainees from forgetting what they have learned;
4. Take advantage of the computer's versatility by combining CBT and off-line activities so as to increase effectiveness and trainee participation. Use instructional management system to:
   a. prescribe activities that involve other media;
   b. track trainees' progress;
   c. schedule reading assignments;
   d. prescribe seminars and video tapes; and

e. administer an on-line examination.

5. When there is a limited number of terminals, establish usage priorities by deciding which users should have priority access to the equipment: instructors helping trainees, trainees learning skills, programmers, or authors;
6. Involve learners in some aspect of the design and development of the CBT program to give them pride of ownership, and to help them accept CBT as they may offer constructive suggestions for course content and learning aids: on-line glossary, examples, tables, graphics, etc.;
7. Always allow trainees to know how the CBT system will change their job tasks. Managers and instructors should identify the training needs and the available resources, and also the level of training effectiveness. The CBT system should take on some of these roles: developing course materials, managing and scheduling activities, testing, providing resources, keeping records, and producing reports. When these functions are undertaken by the CBT system the trainer is freed to become more involved with tutoring, learner support, and counselling; and
8. Make an effort to accommodate the needs and fears of the trainees, and promote the new CBT system as an asset that makes training and jobs easier and more enjoyable (p. 4).

Projected Demand for Computer-Based Training Techniques

As society shifts from an industrial to an informational structure one of the major tasks facing trainers will be to keep skills and knowledge current. McLagan and Sandborgh (42) states that:

> we will see the average adult spending three times as much time working on "learning projects" in the 1980's, more than his/her counterparts did in the 1960's. The training profession is a beneficiary of this movement of course. More learners, more dollars, more management support of our job's professionalism, and even more government recognition of our importance are coming our way. But we are also having to change the way we work and the systems, tools and techniques we use to accomplish our goals. In some instances, an appropriate tool for our future effectiveness will be computer-aided instruction. (p. 48).

According to Eldridge (21), an increasing number of trainers are becoming aware of the uses of computers for instructional purposes. The idea of instructional delivery by computers such as in the case of CAI has been receiving continuous attention for the past five to ten years. The literature indicates that more and more trainers are using the computers to access information banks. Richard Davies of Bell Laboratories stated that about 10 percent of all industrial training will use computers in some form by the 1990's, and this trend will increase to about 50 percent by the year 2000. (21)

Kirby (40) quoted Ron Gordon, the founder and developer of the Telemart System, an electronic university, an education innovation at San Francisco as saying that "the electronic correspondence study will be the future of adult education." (p. 6). One such program is the unconventional campus at San Francisco with a network of about 10,000 personal computer users who receive college level instruction from a

central computer. In this system, the courses are delivered over the telephone lines to the learners' terminals, while the computer's CPU assigns each learner an electronic "mailbox," which stores the lessons and the assignments. This system also permits the learner to retrieve the study materials by using a modem to access the computer from a terminal keyboard, and to pursue studies at his/her own pace.

University registration is accomplished by purchasing a start-up kit along with signing up and paying for courses. The kit purchased by the learner consists of a telephone modem and a set of telecommunication software that will enable him/her to communicate with the university instructors and other learners. It is also reported that the credits received through this university are acceptable equivalents of a college level work in the State of California.

Computer-Based Training Courseware Development

According to Eldridge (21):

> Optimal courseware provides clear instructions, adequate help, and recourse when items are answered incorrectly. It also allows difficult information to be presented in alternate forms such as video, lecture, discussion, and less demanding on-line instruction. It allows a high level of learner interaction with the system, and applies effective instructional decisions and feedback to learners' responses. (p. 8).

Eldridge (21), further discussed the guidelines for effective courseware design as follows:

1. Begin by providing clear and simple instructions on the use of the equipment and the course; and divide instructions into easy steps that follow in logical sequence;

2. Provide for both printed or off-line instructions such as the manual and on-line instructions that can be easily accessed by the trainee. This should include appropriate illustrative and reference materials such as slides, audio or video tapes, and glossary explaining computer terminology;
3. There should be provision for effective feedback through computer interactivity whereby the computer will explain to the trainee why the responses were wrong. This should include hints or coaching that will help the trainee answer correctly;
4. Decision should be made as to whether the design should provide fixed choices; for example, true or false, matching columns or multiple choice, or fill-in the blanks. The trainee original answer should give a clearer indication of the learning status so as to reduce the possibility of guessing the correct answer from a list of choices;
5. A considerable amount of knowledge should be gained in learning the difficulties and the expenses inherent in developing hints and feedback for original answers as opposed to developing fixed choices;
6. Misspelled answers, incorrectly typed in answers in the correct case should be accounted for when developing the feedback or answer identifiers, if credit is to be given for these;
7. Lessons should be designed at different levels of difficulty as some of the learners need less time and assistance than

others. Slow learners should be able to easily review earlier portions of the lesson, and also be able to return to their current segment;

8. A specific learning objective should be chosen for each learner as well as its corresponding test unit such that learners are able to complete lessons and test units in one session;
9. An estimate of the length of the lesson material should be made by allowing time to read, think about, perform calculations, and respond to each screen display;
10. Users should be informed and reminded to use the various kinds of aids available for their use so that they do not forget how to obtain access to them. The course aids should include, spelling and editing features, a glossary, and additional examples of graphs and tables;
11. A single key press should be built into the design to provide a screen that explains all the various learner controls. The learners should be provided with an easy reference source for the operating procedures such that the trainee is not confused with the vast amount of information displayed on the screen;
12. In order to provide an organization-wide input into and support of the system, continued in-house programs should be set up and hosted by different development team members, and attended by all employees; and
13. A pilot lesson for evaluating and debugging interactive sequences should be scheduled (p. 8).

Cost of Computer-Based Training Systems

According to Fisher (26): "the key to effective training outcomes are a systematically developed instructional design and a systematically implemented training delivery." Fisher indicated that most CBT hardware and contingent services may be leased or purchased.

Mainframes

The price of mainframe CBT cover a wide range of systems. The smallest of these systems cost about $17,000 dollars while the larger ones among these systems cost over $1,000,000 dollars. These prices and values of the equipment increase with added capabilities and improvements.

Minicomputers

The price of minicomputer systems range from $6,000 to $25,000. However, a minicomputer-based CBT system may cost between $30,000 to $80,000 dollars.

Microcomputers

The price of microcomputer systems range from $1,000 to $3,000 dollars.

Off-the-Shelf CBT Software Packages

The prices of off-the-shelf CBT software packages range from $250 to $500 dollars, and some exceed this amount.

Generally, the pro rata cost of either the mainframe, the minicomputer, or the microcomputer including installation, maintenance

costs, peripherals and salaries of programmers, and other computer specialists, etc., will range from $6,000 to $15,000 per training station.

According to Fisher (26), in the area of computer training:

> Vendors offer a variety of services. Customers may purchase materials and classroom instruction that are usually selling features of products. Manuals may be purchased at $50; audio-visual cassettes $150, on-site consultation $50 per hour; and classroom instruction $150 per day and per student. Courses generally last from 2 1/2 - 4 1/2 days and are aimed primarily at increasing productivity. They cost between $400 and $2,000 each (p. 9).

Some Computer-Based Training Projects in Operation

Rahmlow (50), in a survey of the extensive use of computers in training, concluded that "computers are emerging as cost effective technology for training in business and industry." Accordingly, he believed that applications were becoming more flexible and that computers would become an integral part of the trainer's tool kit.

Several organizations that initiated computer based learning in their HRD programs have indicated remarkable results from this method of training. The following cases illustrate the various applications of computer based learning or computer assisted instruction which have proven cost effective are being initiated based on previous experience with CBL programs.

Caisse Nationale of Credit Agricole

The training department of this French bank conducted an experiment in computer assisted learning for several rural branches in

1980. Because these banks are small, bank employees can only go for training every few years. A control group of employees attending conventional training programs was also part of the experiment. The experiment revealed that computer training saved a lot of time since employees using computer terminals achieved in one hour what conventionally trained employees achieved in half a day. Both groups retained the same amount of information three months after the experiment (34).

Comshare, Incorporated

The Commander Learning State (CLS) was developed to conduct new a computer based customer training program in 16 domestic offices and at client sites. Comshare, a computer service firm, designed this program to take advantage of state-of-the-art training technology and to improve the availability and effectiveness of its client instruction. The program uses microcomputer technology to combine color, sound, videotaped animation and a personal interactive format into entertaining and educational computerized lessons. Courses are in short modules making clients devote less than an hour at a time to a course. Client responses to the new program have been good since clients like the ability to schedule training at their own time and the opportunity to control their learning pace within a non-competitive, private environment (14).

Development Dimension International

Computer assisted instruction is being applied to behavior modeling training for supervisors at this Pittsburgh company. The CAI

training program simulates critical employee situations that first level supervisors handle occasionally such as absenteeism or interpersonal conflict with an employee. The learner receives basic interactive skills training in the classroom using behavior modeling technology before undergoing the computer assisted supervisory training. A microcomputer linked to an interactive videotape is used to simulate situations and get the learner to interact. The computer gives the learner feedback at the end of the simulation as preparation for handling the real interaction with the employee (12).

Mead Johnson Pharmaceutical Division

During a three-day meeting in 1982 to introduce a new anti-depressant to 600 sales representatives, Mead Johnson reported that "computer assistance was effective in teaching and accurately assessing the knowledge level of each individual representative." A computerized registration and information center was used to process pertinent information about each sales representative and computerized interactive learning centers presented the representative information through the use of a computerized "Multi Term System" which allowed involvement and group interaction through a "Computerized Interactive Television" program. This system also assessed each representative individually with a computerized final exam. The meeting revealed that computerized interaction can greatly improve both individual and group learning (15).

Olin Corporation

In 1981, an interactive instructional system (IBM's) was initiated to train the Chemical Group's new employees to process sales orders. Company officials reported that this computer based instruction system has significantly decreased the time required for customer service representatives to become productive. New customer service representatives now reach 80 percent efficiency in four to five weeks, which formerly took three to six months on the traditional system. Furthermore, productivity has improved with the use of the computer based training system. Other benefits of this new system were identified by company officials as: a) lowered costs since they "piggy back" on existing resources with program development and delivery as their only costs; b) decreased instructor's actual teaching time by about 75 percent, giving more time to develop new courses; c) its flexibility to include verbal instruction; d) new employees learn the same thing; and e) the quality of a course can be monitored from student responses to questions (22).

United Airlines

In January 1978, United Airlines began using an individualized, computer based training program for newly hired pilots. The Initial First Officer training program was delivered and managed by PLATO. It was designed for the second officer upgrading to first officer for the first time. After 15 months of operation, training time was reduced to 9 1/2 elapsed days, with a range of 4 to 15 days, compared to a conventionally presented course length of 28 days. Since the course was in an individualized, self-paced manner with virtual elimination

of instructor presentation of material, the instructor staff was reduced by three-fourths. First year savings realized were over $72,000 including the cost of the CBL hardware, and estimated future savings will be about $175,000 annually. Field reports indicated that the trainees were well trained and that they successfully met all job requirements (13).

U.S. Army Signal Center, Fort Gordon, GA

In 1981, the computer technology and video technology were used together in an experiment conducted in the 26Y10 tri-service course. The 26Y10, a satellite communications ground station equipment repair course was conducted in 36 weeks and 2 days in length. It provides enlisted personnel with skills, knowledge and techniques required to operate, troubleshoot, design and repair the digital communication subsystem and satellite communications ground terminal AN/FSC-78 and FSC-79. The course teaches 98 distinct tasks and the equipment cost is approximately $12 million. The experiment was conducted on one lesson which was a three-hour practical experience, on line test of AN/FSC-98(V), which costs approximately $40,000 and repair costs of "board replacement" ranging from $200 to $2,000. For the experiment, the typical costs of the videodisc/microcomputer equipment considered ranged from $2,700 - $5,800. Ketner (39) indicated that the major advantages of the system were economic and flexibility of the training process with at least equal training.

Western Bancorp

An organization with 22 banks located in 11 states, Western Bancorp has trained 6,800 tellers and 1,500 bank officers to use the bank's remote clearing system TIP (Teller Item Processing System). Simultaneously, the training was and is carried out with normal production operation of the system without conspicuously weakening the production environment. This cost effective application made revision of the educational programming almost instantaneous since the same system that did the work taught the tellers (63).

These illustrations have served as guides to other organizations considering computer based learning by identifying the applications which have the highest probability of achieving success in an initial effort.

Summary

Computers have been in existence for a long time, starting from the age of "counting bones" to the fourth generation computers. Computers as we know today came into existence with the Hollerith's tabulating machine used for U.S. Census. Since then there has been different versions of computers, referred to as generations.

Because of the interest and the need for new methods of instruction, computers were introduced into instruction. This use of computers in instruction became prevalent and has been approached from different perspectives, 1) as an object of instruction, 2) as a manager of instruction, and 3) as a medium of instruction, etc.

Computers are general purpose machines capable of processing data at a very fast speed and with great accuracy. Computers possess no

inherent reasoning ability unless it has been pre-programmed, as in artificial intelligence. Computers are flexible, they can manipulate data in different forms, they can store data or information as well as process data electronically. Computers are appropriately referred to as the thinking man's machine.

Computer applications in a learning environment, pioneered by university research are referred to as computer-based education (CBE). As organizations began using computers in a broader sense, it was referred to as computer-based learning (CBL). CBL is the use of computers in managing and presenting a learning experience, and in most cases as an individiualized learning. This individualization potential gives the learners the capability of pursuing specific interests and applications as they see fit.

The presence of modern electronic gadgetry has created some revolutionary trends in the way training is done. Research has shown that CBL produces an equal or increased learning effectivness and reduces the learning time when compared with the traditional method. Research also shows that the cost of CBL is very competitive with the traditional methods.

The major feature of the CBL management capability is that it affords the learner enhanced flexibility, by diagnosing learner needs and providing remediation. Another feature of this technique is in terms of cost and energy savings. HRD professionals benefit from this because they can quickly update courses from a central location, they can store huge amounts of information to be used for course revision and evaluation. Another benefit HRD departments derive from

this technique is the reduced travel cost, the decrease in learning time and diagnoses.

There are many advantages associated with the CBL technique. Some of these advantages are: careful design, availability, reduction in time, and reduction in instructor staff, recordkeeping, immediate feedback, etc. The disadvantages are: high startup costs, requires specialized staff, sophisticated technical staff, takes up computer resources, long lead time, overly structured learning materials.

There are different methods of CBE delivery systems. These are: 1) Centralized network is a time sharing arrangement, 2) Dedicated network is connected to a Central Processing Unit and is used for a particular task; 3) Stand-Alone System functions independently and is not connected to a central communication line.

When selecting CBL delivery systems it is essential that the appropriate system be acquired to ensure effective and efficient instructional delivery. Some of the points to be considered in selecting a CBL delivery system are as follows: 1) number of learners, and their background; 2) training goals and objectives; 3) training time/schedule for completion.

In order to ensure successful establishment of a CBL project there are many points to consider in terms of software and training outcome. Some of the points to be considered are: 1) investing in quality courseware, 2) securing extensive vendor support, 3) accurate assessment of the system's future growth potential, 4) provision of names and addresses of contact technicians, 5) training away from work stations, 6) ensuring better retention, and 7) involving learners in some aspect of the design and development work.

As society shifts from an industrial to an informational structure there will be a need to keep skills and knowledge current. An increasing number of trainers will be aware of this need. Therefore, there will be a need to effectively design CBL courseware.

The cost of CBE systems vary with type, capability, improvements, and manufacturer. The price range of mainframe CBE systems is between $17,000 and $1,000,000 dollars. The price of a minicomptuer CBE system varies between $6,000 and $25,000 and $30,000 to $80,000, while microcomputers CBE systems are in the range of $1,000 and $3,000 dollars. Off-the-Shelf CBE software packages range between $250 and $500 dollars. The total cost per CBE station, (including cost of installation, maintenance, peripherals, programmers, and specialists, etc.) will range between $6,000.00 and $15,000.

Many organizations are now establishing CBE systems in their organizations for staff training and development. Some of the organizations who are using CBE techniques for staff training and development include 1) Caisse Natoinale of Credit Agricole, 2) Comshare Incorporated, 3) Development Dimension International, 4) Mead Johnson Pharmaceutical Division, 5) Olin Corporation, 6) United Airlines, U.S. Army Signal Center at Fort Gordon, Georgia, and Western Bancorp.

Several of these organizations have indicated remarkable results from this method of training. It is believed that in the near future computers in training will become common place.

CHAPTER III

DESIGN AND METHODOLOGY

Introduction

This research study attempted to identify the criteria that should be used in successfully establishing computer-based training (CBT) projects in business and industry.

Description of the Population

It was determined that the population sampled for this research study should be experts in computers in training technology, especially as it relates to computer-based training in business and industry.

In an effort to identify the experts in CBT, this author generated a listing of eight (8) individuals who were cited in brochures, handbooks, journals, and manuals on CBT. Through a telephone contact process some of these individuals indicated the need for this type of study, but recommended that this author contact the organizers of conferences, seminars, and workshops on CBT for a listing of their annual speakers. A listing of the initial eight individuals and the conferences, seminars, and workshops with their

organizers may be found in appendix A and B respectively. After contacting the six (6) organizers of CBT conferences seminars and workshops, a listing of 145 speakers was generated. The population frame for this research study was composed of university and college professors, training and development directors/managers, course developers, instructional designers, corporate managers for education and instructional delivery, multi-media experts, and other professionals dealing with computers in instructional delivery. All of the respondents to this research study were engaged in some form of CBT programs, and lived in different parts of the United States of America (U.S.A.).

Selection of Study Participants

Individual respondents were identified using first and second screening criteria. The preliminary sample selection process was limited to those who are active in CBT, and have made presentations in conferences, seminars, workshops, and/or who have written books, articles, in CBT.

The secondary sample selection process was done using a three-point-two-must screening criterion. The three-point-two-must screening criterion is as follows:

1. Peer nomination;
2. Presentation in conferences, seminars, workshops, and/or written books, articles, etc. on CBT programs; and
3. Self nomination.

In order to qualify as an expert in this secondary sample selection procoess, the individual had to score at least two points made up as follows:

1. One point must be from the first three-point-two-must screening criterion: peer nomination, and
2. One point from either of the second or third three-point-two-must screening criterion: presentation or self nomination.

Instrumentation

The research instrument for the first round questionnaire was designed by the principal investigator, and was approved by the thesis advisor and one of the members of the doctoral committee. Before the instrument was mailed to all the experts, five (5) of the experts who were still going to participate in the research study were sent the first round research instrument in order to determine their reaction to the wording of the questionnaire. They were provided an extra sheet of paper for comments and/or additional information. After one week all the five modified pilot experts had responded to the research instrument without suggesting a change to the instrument, but with valuable comments to help in analyzing the first round responses, and in designing the second round questionnaire, respectively.

The first round questionnaire consisted of one page and a cover letter. There was one question broken into two parts. The questionnaire was preceded by a series of instructions for the completion of the questionnaire. A blank sheet was provided for the

first round responses. The first round correspondence may be found in Appendix F.

The opinions of each of the experts as analyzed into minor task item groups by the principal investigator, were check-marked, and the numerical notations indicating the total number of times each particular minor task item group was mentioned in the first round was placed adjacent to the individual minor task item group. The second round questionnaire was designed such that the experts would indicate the minor task item groups that fall under each of the major headings identified in the second round of questioning.

The second round questionnaire was formulated using the data gathered and analyzed in the first round questioning as part of the second round questionnaire. The responses from the first round were tabulated into twenty-eight (28) minor task item groups, incorporating all the opinions expressed in the first round as part of the second round questionnaire. The tabulated listings of the opinions gathered and analyzed into twenty-eight (28) minor task item groups in the first round were not presented in rank order form as some of the experts did not see a need to rank order the elements identified.

In the design of the second round questionnaire, the principal investigator exercised a considerable degree of interpretation of the opinions expressed in the first round of questioning to facilitate data groupings. This was done to prevent the second round questioning from becoming excessively voluminous and complicated. Interpretation of the expressed opinions was done carefully and kept to an absolute minimum.

The second round questioning consisted of eight pages, including a response sheet, a blank sheet for comments/additional information, and a cover letter. The questions were preceded by a series of instructions and examples for the completion of the questionnaire. A copy of the second round correspondence may be found in Appendix G.

Data Collection and Analysis

The data was collected in a series of two rounds of questioning administered by mail. Analysis of the data was accomplished by using the responses gathered in the first and second round of questioning to generate listings, in serial number order, and by the frequency of occurrence of each of the opinions expressed by the experts regarding the minor and the major task items respectively. In addition to analyzing the responses, the response rate in each of the mailed out correspondence was grouped, counted and reported.

Summary

This research study used a modified Delphi technique to gather data. Initially, active professionals who have made presentations in conferences, seminars, workshops, and/or who have written books, articles, etc. on CBT were identified. After applying the three-point-two-must selection criterion, forty-five (45) experts were chosen for this study. However, only thirty-seven (37) accepted the invitation to participate.

The Delphi technique was carried through round two during which the experts were asked to identify respectively the necessary elements

and major tasks necessary for successful establishment of CBT projects in business and industry.

Before the first round questionnaire was mailed out, five (5) of the experts identified for this research study were sent the first round research instrument as a pilot test. Their responses did not indicate that the instrument needed any refinement, so the instrument was sent out for round one responses. The second round questionnaire was also designed and sent to the first round respondents using the data generated and analyzed in the first round as statistical feedback and as part of the second round questioning.

CHAPTER IV

ANALYSIS OF THE DATA

Introduction

The purpose of this chapter was to present the data collected in the preliminary sample selection process, secondary sample selection process, round one, and round two of questioning; and to indicate the response rate for these rounds.

Sample Selection Process

Preliminary Sample Selection Process

At this stage, the initial screening of the potential experts for this modified Delphi research study was carried out. This first screening yielded a total of 145 professionals who are active in CBT, and these individuals made up the first group of potential experts for this research study.

These 145 individuals who met this first screening criterion were the experts for the secondary sample selection process, and they were sent a mailing asking them to identify ten (10) or more experts who are active in CBT projects in business and industry. However, twenty-one (21) of the mailings were returned as undeliverable. The response received from this first group of potential experts was tremendous. Five weeks after mailing the first letter, the respondents had

nominated 100 experts in CBT projects. Before the seventh week of the mailing, a reminder was sent to those experts who had not responded at that time. By the ninth week another 85 experts were nominated. Complete addresses for 125 potential experts were obtained and these individuals became the new experts for the secondary sample selection process. One potential expert asked to be dropped from the list of 125 names due to personal reasons.

Table I shows the response rate for the preliminary sample selection process to identify potential experts for the research study.

TABLE I

RESPONSE RATE FOR PRELIMINARY SAMPLE SELECTION PROCESS

Number Sent Out	Number Responded	Number Identified	Percentage Response
124	109	185	87.90

After applying the second selection criterion -- three-point-two-must screening criterion -- only forty-five (45) individuals qualified for the modified CBT Delphi research study.

Table II shows the three-point-two-must screening criterion used in the selection of the experts who were qualified to be invited to participate in the modified Delphi research study.

TABLE II

THREE-POINT-TWO-MUST EXPERTS' SCREENING CRITERION

Part A -- Expert Identified
Part B -- Points From Peer Nomination
Part C -- Points From Presentation, etc.
Part D -- Points From Self Nomination
Part E -- Total Points
Part F -- Selected (*)/Not Selected ( )

Table III shows the number and the percentage of the potential experts who qualified for the modified CBT Delphi research study, after apply the three-point-two-must screening criterion.

TABLE III

TOTALS AND PERCENTAGE FROM THE SCREENING OF EXPERTS

Total No. of Experts Screened	Total Points From Peers	Total Points from Presentation etc.	Total Points From Self	Total Points Earned	Total No. of Experts Selected	Total Percentage Selected Against Screened
125	210	77	43	330	45	36.00

Secondary Sample Selection Process

For this round, the forty-five (45) experts who met the three-point-two-must screening criterion were sent a mailing including a post card with which to indicate their willingness to participate in the modified CBT Delphi research study. One of the mailings was returned as undeliverable leaving a total of forty-four (44). A short description of the Delphi Technique was provided in the cover letter,

informing the individuals of the implications of accepting participation in this research study.

Thirty-seven (37) individuals indicated their willingness to participate in the research study. A listing of the thirty-seven (37) individuals who accepted participation and became the experts for this research study may be found in Appendix E. Table VI shows the response rate for the secondary sample selection.

TABLE IV

RESPONSE RATE FOR SECONDARY SAMPLE SELECTION PROCESS

Number Sent Out	Number Responded	Percentage Response
44	37	84.09

MAIN ROUNDS

Round One Data

In this round the experts were asked to identify and rank order the elements they would consider significant for successfully establishing computer-based training projects in business and industry. The first round correspondence may be found in Appendix F.

The question for the first round questioning was divided into two parts as follows:

1. Please identify and/of list the elements, steps, processes, and/or tasks that you would consider significant in

successfully establishing CBT projects in business and industry.

2. After you have completed (1) above, please rank order the listings in order of significance.

After two weeks of mailing the the first round questionnaire two (2) mailings were returned as undeliverable due to change in address, but eighteen (18) of the experts for the study had responded to the first round research instrument. After three weeks of mailing the first round questionnaire, a reminder was sent to the experts who had not responded at that time. By the fifth week another ten (10) experts had responded to the research instrument, bringing the total number of experts who had responded to the first round questioning to twenty-eight (28). At this time the second round questionnaire was formulated using the information gathered in the first round as part of the second round questionnaire.

In the first round it should be noted that the totals among the various minor task item groups vary greatly because not all participants identified all the elements within a minor task item group. Again, not all participants rank ordered their responses because they felt that it was not necessary since some of the elements within each minor task item group may be by-passed depending on situations. It should also be noted that a degree of interpretation was exercised by the principal investigator to facilitate data groupings.

In the analysis of the first round responses, part (1) was the focus of attention as part (2) was not strictly adhered to by all the experts, because some of the respondents felt it did not make a

difference to rank order the elements. Every time a particular opinion was expressed it was given a point to obtain a frequency count of all the expressed opinions. The opinions that were similar in meaning and in content were grouped together and an item count taken to arrive at the frequency count for the first round responses of twenty-eight (28) minor task item groups made up of the elements identified. Table V shows the response rate for the first round questioning.

TABLE V

RESPONSE RATE FOR FIRST ROUND DATA

Number Sent Out	Number Responded	Percentage Response
35	28	80.00

Table VI shows the frequency of responses for each of the twenty-eight (28) analyzed minor task item groups. The numerical notations adjacent to each of the minor task item group indicates the total points accumulated for that particular minor task item group.

Table VII shows a listing of the comments most frequently made through the first round questioning.

TABLE VI

FREQUENCY OF RESPONSES FOR EACH
MINOR TASK ITEM GROUP

Item Serial No.	Item	Item Frequency
1	Perform training needs assessment in terms of: Needs not satisfied due to time, talent, budget constraints; and needs being satisfied inappropriately due to untimeliness, low talent, etc. Establish need for Computer-Based Training (CBT) in terms of: fiscal, training, and personnel requirements (One of these must exist for a CBT project to be worth initiating). -- Fiscal, to reduce training time, increase throughput, etc.; Training, for shortage of instructors, difficult to train, dangerous to use real equipment, etc.; Personnel, for course with large/wide variety of audience (Audience with different levels of familiarity with subject of training, is widely dispersed in location and in time (Geographic vs. One Site), and with varied duration of training usefulness).	18
2	Gather data to support use of CBT over conventional/traditional training, especially in terms of: Instructional benefits, Learner Attitude benefits, and Overall (long term) cost benefits. Educate all levels of management, especially upper management, on the benefits, limitations, and cost of CBT to enable upper management to be far sighted enough to absorb the high front-end costs now in exchange for dramatic savings in the future. Ensure that everyone concerned understands what is being produced. State clearly the written goals and the objectives of CBT project. Establish organizational readiness for change in terms of: Computer Technology in Training and Terminology. Establish the place of CBT project within organizational framework.	11

TABLE VI

(Continued)

Item Serial No.	Item	Item Frequency
3	Present reasonable problem to upper management with CBT as solution. Use research findings to support your ideas through human resource strategic planning, state of training needs, CBT issues, etc. Secure upper management support and commitment with well documented needs and data. Reveal realistic goals, expectations (of what CBT will buy the organization relative to the costs), dollar cost, hardware, human resource allocations, time, etc., to produce desired results. Count on upper management blessing for training department to proceed to prevent their "pull out" before there is adequate time for results. Sell traditional trainers, trainees, and their managers on the effectiveness and the efficiency of CBT approach.	16
4	Carefully plan and consider the establishment of CBT project on a small scale first by producing a short course (pilot/prototype) which can be reviewed/evaluated and revised (content and grammatical issues, etc.) and tested on the actual people who will be u sing it, with real product, in the setting it will be used (dangerous or expensive operations is necessary for practice), in-house, by subject matter experts (SME's) and management. It is very important to start small, proceed slowly, learn, tool-up for larger CBT effort gradually with the experience gained from the first try. Review, modify, and secure upper management approval as you go along by keeping them informed of progress made and the levels of success.	11

TABLE VI

(Continued)

Item Serial No.	Item	Item Frequency
5	Ensure the success of first CBT effort. Utilize extensive review by all levels of the organization. Carefully selected outside vendor knowledgeable in selected system may be used to help develop "show case" first CBT effort. Find ways to promote the success of first CBT attempt and publicize this success throughout the organization. Practice public relations, keep lines of communications open, and speak the language of management because you cannot cost justify product if no one uses it. Cost/benefit is enhanced the more product is used.	7
6	Immediate feedback on trainee progress is necessary. Evaluate tests. Utilize interactive testing with users of CBT. Adopt evaluation plan for formative, summative, and post summative stages. Continually evaluate and revise courseware, etc., as you go along; and the final product against overall plan. Survey trainees' attitude toward CBT and conduct item analysis. Monitor learner progress, collect learner comments, provide feedback on progress, and provide remediation. Measure increase in learner skills because achieving a measured level of mastery is essential. Instructional consistency is required for mastery. Present above data to upper management to help strengthen their support and commitment to larger CBT effort.	9

TABLE VI

(Continued)

Item Serial No.	Item	Item Frequency
7	Obtain strong, knowledgeable, creative, energetic, flexible, etc., leader for CBT project. The leader should know what style of learning/training (tutorial, simulation, etc.) would work best, and to report to the training manager. Obtain local expertise in screen design, instructional design, intelligent answer judging, human factors in computing systems, etc., that can create effective CBT program. Obtain Programmer technically oriented and familiar with CBT applications and Central Processing Unit (CPU) system environment (not just one with high level Authoring system expertise).	12
8	Establish goals to be achieved with CBT project and determine business objectives for CBT project because clear understanding and agreement on objectives of CBT project should be matched/tied to organizational goals and objectives and measured periodically, focusing on business problems/needs, and addressed in terms of revenue, margin, and service, etc.	8
9	Augment desired CBT design approach with rigorous instructional design and development methodologies, developed after researching through demonstrations and readings. Determine and ensure that instructional concepts supporting CBT effort will be consistent with organizational philosophies and strategies, in terms of corporate philosophy, adult learners, learning theories, fear of computers, etc.	3
10	Identify available funding for hardware, software, planning, design, and development, etc., and plan a reasonable budget in light of expectations. Do not pad budget but work harder, because budgetary restrictions must be adhered to, especially in initial stages of establishing CBT project.	11

TABLE VI

(Continued)

Item Serial No.	Item	Item Frequency
11	Extensively research and carefully select a programming language compiler or intelligent/high quality Authoring System tool (example: CDC's PCD 3) that allows simulation, embedded training, separate knowledge base from user interface, etc. Know that CBT of the 70's (drill and practice, multiple choice questions, inflexible answer judging, little adaptation to trainee individuality, etc.) is rapidly becoming obsolete; and being replaced with embedded training and intelligent tutoring system models.	8
12	Analyze hardware relative to organization's needs and constraints, and select hardware (micro, mini, mainframe, or a combination) that is widely available throughout the organization and/or off-the-shelf (example: IBM XT or AT). Secure necessary hardware support for development and testing, as well as for implementation. Choose a CBT system that best meets instructional delivery needs, materials development, and future training needs.	11
13	Evaluate current courses. Design appropriate courses (CBT and non-CBT). Identify courses/discipline well suited for CBT project. Determine whether there are existing/available materials that cover the training situation, structure of CBT course, evaluation guidelines, etc. Determine costs/benefit trade-off between CBT and alternatives. Organize course materials as they would be presented; and select the best approach.	10

TABLE VI

(Continued)

Item Serial No.	Item	Item Frequency
14	Develop plan/schedule for implementing and managing each phase of CBT project. Review plan/schedule periodically in terms of the elements, learning center (suitable space for class), pilot test, internal sell, etc., at specified intervals. Design curriculum tracks, construct tests, establish "test out" criteria, and ensure that training staff are monitoring the progress of trainees. Secure required Computer-Managed Instruction (CMI) tool and ensure fast response time with instructionally sound and interesting course.	10
15	Use outside Vendor/Expertise only after careful research and selection process, and cost justify the use of outside help to upper management who should perceive them as critical elements for successful CBT project.	5
16	Develop and establish standards for CBT course design and development, as well as for software and interfaces, to help protect CBT investments for longer terms; and to ensure upper management willingness to make larger CBT investments necessary to give CBT project a fair try. Document CBT project efforts (writing, editing, etc. support), and build documentation into CBT plan/schedule. Secure and document agreement on target product development staff support, commitment for reviews, communication on changes to product, possible future products, and the future direction of CBT.	7
17	Perform cost effectiveness calculation by need to be satisfied. Design cost models and cost/benefit analysis for any specific CBT effort to help give direction toward the goals of the project. Keep instructional designers and programmers on track because cost models must be painstakingly accurate and brutally honest.	12

TABLE VI

(Continued)

Item Serial No.	Item	Item Frequency
18	Join professional organizations, especially those that are CBT oriented (example: ADCIS) and read professional journals.	1
19	Obtain suitable delivery system that is best for the situation in terms of the demand in the subject matter for production (training aid, hardware considerations, color, graphics, movement, values, shared delivery, compatibility, interactive video, sound, suitable CBT terminology for audience, operating software considerations, etc.), and the expectation of the audience for the production values. If hardware is available go ahead with CBT effort, else, secure capital equipment approval for hardware purchase.	11
20	Form a committee on software selection, including the training manager, CBT coordinator, data center manager, etc. to seek out good quality CBT software package, authoring language/system, etc. If software meets need purchase software and install it (a team building/productivity enhancing process).	11
21	Obtain qualified training instructors and train them as appropriate to take over CBT project through a technology transfer plan. Use a cadre of skilled trainers willing to learn enough data processing (DP) skills to author courseware. Train authors in each department and provide technical and training support to authors, with minimal threat to turf, especially the established trainers. Explain trainers role in CBT environment.	10

TABLE VI

(Continued)

Item Serial No.	Item	Item Frequency
22	Establish course learning and performance criteria (method of measuring whether CBT goals are being met) and the project place in the training and operations system. Provide CBT project result in terms of increased demand for computer resources if end-users are trained to use the computer. Provide on-going performance data to different levels of management. To local management for course completion by trainee; to training management for percent trained by job title; and to upper management for overall cost/savings of the CBT project.	4
23	Establish whether courses are to be developed in-house and/or purchased off the shelf. If courses are to be developed in-house, determine the maturity of the organization in recognizing the cost and time it takes to develop courseware, and prepare a comprehensive course development plan, one that everyone can work toward, that tells how to begin and how to end.	4
24	Create interactive video disks, Computer-Assisted Instruction (CAI) lessons, etc. Develop storyboard, flowchart, screen template, scripts (as appropriate), program logic (program design, element flowchart, from specifics), and complete courseware programming. Produce enough programs to make an impact and use people who did not program courseware to debug it. Install completed courseware on site and provide a 90-day warranty for "big fixes."	6

TABLE VI

(Continued)

Item Serial No.	Item	Item Frequency
25	Perform a detailed task analysis of available, proven CBT system appropriate to needs, and identify limitations of each CBT system. Skills training is required as opposed to performance or concepts training. Basic set of training requirements should exist for the subject that would not require an instructor (let CBT cover the basics and the instructor handle the advanced training in a workshop environment). The subject matter for training should be computer and/or data processing oriented (not necessarily teaching about computers but an application that runs on a computer).	7
26	Ensure that other companies in the same business verify that use of CBT has been successful in fulfilling training needs of a similar nature in a cost efficient manner. Ensure that CBT effort and/or product can be marketed to other organizations if need be, to recover initial cost of investment (training tool will accompany or be sold to a client as part of an application software package).	2
27	Timeframe for training should be flexible. Trainees need to practice repeatedly. Training should be delivered as needed because individualized instruction is required. Allow adequate time (no hard delivery date). Bring CBT project in ON TIME, and under budget to ensure upper management continued backing, involvement, and financial support.	4

TABLE VI

(Continued)

Item Serial No.	Item	Item Frequency
28	Establish full-time CBT staff and courseware department (marketing, training and standards unit). A technical person for CBT system expertise and standards, an administrative person for administrative duties, designers, programmers, graphic specialists, SME's, etc. Develop long term CBT strategy that is fully integrated with new business systems and end-user computer training. Action plan should address needs in terms of technical, financial, and political feasibility. Ensure maintainability of CBT project, and never develop a course that would not be maintained.	9

TABLE VII

COMMENTS UP TO ROUND ONE

Serial No.	Comments
1.	This is an area of great concern to me and I'm eager to find some research study done on it.
2.	Your project sounds very intersting.
3.	Will I know the other participants.
4.	All these steps are significant in the process: there is no way to rank order them.
5.	Most of the stuff out there is junk.
6.	Authoring Languages may be killing Computer-Based Training (CBT).
7.	Inadequate tools: people are trying to do too much with too little.
8.	Vendors of authoring languages make ridiculous claims about what their systems do, and how easy their systems are to use.
9.	We need standardized hardware/software interfaces that will not be obsolete tomorrow: to protect investsment in longer terms.
10.	If we had more "success stories" ... more training managers would give CBT a serious look.
11.	We need to get industry to look at a few good CBT programs.

Round Two Data

In this (second) round the experts were further asked to identify the major task headings, phases, and/or stages that they would favor in successfully establishing CBT projects in business and industry, and also to list in rank order, each of the minor task item groups established in the first round that fall under each of the major task headings identified in this (second) round.

Formulation of the second round questionnaire took two weeks, at which time the second round questioning was mailed out. The second round questionnaire was mailed to a population of twenty-eight (28) experts who were given a ten-day period to respond and mail back the questionnaire to the principal investigator. A self addressed stamped envelope was provided for the return of the responses. The second round correspondence may be found in Appendix G.

The second round questionnaire was divided into two parts as follows:

a. Identify and/or list, in rank order, the major task headings, phases, and/or stages that you would consider significant in successfully establishing CBT projects in business and industry (starting from the time of conception to the management of successfully established CBT projects in business and industry). Refer to Example (A) below.

b. After completing (a) above, as in Example (A) below, and focusing on the item analysis of the criteria established in the first round (attached), please list (by item serial number, and in rank order) the order/step the items should follow/be performed within each of the major task headings,

phases, and/or stages you identified in this second round, under (a) above. Refer to Example (A) below.

EXAMPLE A

I. Feasibility Studies of CBT Project } Rank Ordered Major Task Heading
(a) 1 (b) 2 (c) 3 (d)... (e)... (f)... (g)... (h)... (i)...

II. Planning & Selection of CBT Delivery System
(a) 8 (b) 10 (c) 12 (d) 11 (e) 7 (f) 4 (g)... (h)... (i)...}
Items within major task heading. In rank order/steps to be followed.

III. Implementation & Management of CBT Project
(a) 5 (b) 6 (c)... (d)... (e)... (f)... (g)... (h)... (i)...

After ten (10) days had elapsed, fifteen (15) of the experts had responded to the second round questioning. After two weeks had elapsed, a reminder was sent to the experts who had not responded to the research instrument at that time, and this produced another nine (9) responses, bringing the total responses in the second round to twenty-four (24). By the third week of mailing the second round questionnaire data from twenty-four (24) responses was analyzed and tabulated.

After analyzing and tabulating the second round responses it was found that a consensus had been reached. Therefore, subsequent rounds were not required.

Table VIII shows the response rate for the second round questioning.

TABLE VIII

RESPONSE RATE FOR THE SECOND ROUND DATA

Number Sent Out	Number Responded	Percentage Response
28	24	84.61

Table IX shows the frequency of responses for the major task headings, phases, and/or stages identified in the second round.

Table X shows a listing of the CBT criteria (minor task item groups within the major task headings) established through round two of questioning. The frequency with which each major and minor tasks occurred was also reported.

Based on the comments made by some of the experts, in some cases, some of the elements were rearranged into other minor task item groups.

Table XI shows a listing of the comments frequently made in the second round questioning.

TABLE IX

FREQUENCY OF RESPONSES FOR THE MAJOR TASK HEADINGS ESTABLISHED IN THE SECOND ROUND QUESTIONING

Major Task Serial No.	Major Task Heading	Major Task Frequency
1	Detailed Task and Training Needs Analysis	15
2	Computer-Based Training (CBT) Project Feasibility Investigation	18
3	Goal Setting and Objective Clarification	15
4	Assemblage of Full-Time CBT Staff and Courseware Department	14
5	CBT Project Planning and Development	19
6	CBT Project Sale and Publicity	17
7	CBT Project Delivery System Planning and Selection	21
8	CBT Courseware Production Planning and Development	20
9	CBT Project Evaluation and Revision I: Formative	14
10	CBT Project Establishment and Implementation	17
11	CBT Project Evaluation and Revision II: Summative	13
12	CBT Project Major and Long-Term Commitment and Maintenance	14

TABLE X

LISTING OF CRITERIA (MINOR TASK ITEM GROUPS WITHIN MAJOR TASK HEADINGS) FOR SUCCESSFUL ESTABLISHMENT OF CBT IN BUSINESS AND INDUSTRY

Major Task Serial No.	Minor Task Serial No.	Major Task Headings and Minor Task Items Within Each Major Task Heading	Item Frequency	Major Task Frequency
1		DETAILED TASK AND TRAINING NEEDS ANALYSIS		15
	1	Perform training needs assessment in terms of: Needs not satisfied due to time, talent, budget con straints; and needs being satisfied inappropriately due to untimeliness, low talent, etc. Establish need for Computer-Based Training (CBT) in terms of: fiscal, training, and personnel requirements (One of these must exist for a CBT project to be worth initiating). -- Fiscal, to reduce training time, increase throughtput, etc.; Training, for shortage of instructors, difficult to train, dangerous to use real equipment, etc.; Personnel, for course with large/wide variety of audience (Audience with different levels of familiarity with subject of training, is widely dispersed in location and in time (Geographic vs. One Site), and with varied duration of training usefulness).	18	

TABLE X

(Continued)

Major Task Serial No.	Minor Task Serial No.	Major Task Headings and Minor Task Items Within Each Major Task Heading	Item Frequency	Major Task Frequency
2		COMPUTER-BASED TRAINING (CBT) PROJECT FEASIBILITY INVESTIGATION		18
	2	Gather data to support use of CBT over conventional/ traditional training, especially in terms of: Instructional benefits, Learner Attitude benefits, and Overall (long term) cost benefits. Educate all levels of management, especially upper management, on the benefits, limitations, and cost of CBT to enable upper management, on the benefits, limitations, and cost of CBT to enable upper management to be far sighted enough to absorb the high front-end costs now in exchange for dramatic savings in the future. Ensure that everyone concerned understands what is being produced. State clearly the written goals and the objectives of CBT project. Establish organizational readiness for change in terms of: Computer Technology in Training and Terminology. Establish the place of CBT project within organizational framework.	11	

TABLE X

(Continued)

Major Task Serial No.	Minor Task Serial No.	Major Task Headings and Minor Task Items Within Each Major Task Heading	Item Frequency	Major Task Frequency
	26	Ensure that other companies in the same business verify that use of CBT has been successful in fulfilling training needs of a similar nature inn a cost efficient manner. Ensure that CBT effort and/or product can be marketed to other organizations if need be, to recover initial cost of investment (training tool will accompany or be sold to a client as part of an application software package).	7	
3		GOAL SETTING AND OBJECTIVE CLARIFICATION		15
	8	Establish goals to be achieved with CBT project and determine business objectives for CBT project because clear understanding and agreement on objectives of CBT project should be matched/tied to organizational goals and objectives and measured periodically, focusing on business problems/needs, and addressed in terms of revenue, margin, and service, etc.	8	

TABLE X

(Continued)

Major Task Serial No.	Minor Task Serial No.	Major Task Headings and Minor Task Items Within Each Major Task Heading	Item Frequency	Major Task Frequency
4		ASSEMBLAGE OF FULL-TIME CBT STAFF AND COURSEWARE DEPARTMENT		14
	28	Establish full-time CBT staff and courseware department marketing, training and standards unit. A technical person CBT system expertise and standards, and administrative duties, designers, programers, graphic specialists, SME's, etc.	9	
	21	Obtain strong, knowledgeable, creative, energetic, flexible, etc., leader for CBT project. The leader should know what style of learning/training (tutorial, simulation, etc.) would work best, and to report to the training manager. Obtain local expertise in screen design, instructional design, intelligent answer judging, human factors in computing systems, etc., that can create effective CBT program. Obtain programmer technically oriented and familiar with	10	

TABLE X

(Continued)

Major Task Serial No.	Minor Task Serial No.	Major Task Headings and Minor Task Items Within Each Major Task Heading	Item Frequency	Major Task Frequency
		CBT applications and Central Processing Unit (CPU) system environment (not just one with high level authoring system expertise).		
	7	Obtain qualified training instructors and train them as appropriate to take over CBT project through a technology transfer plan. Use a cadre of skilled trainers willing to learn enought data processing (DP) skills to author courseware. Train authors in each department and provide technical and training support to authors, with minimal threat to turf, especiallly the established trainers. Explain trainers role in CBT environment.	12	

TABLE X

(Continued)

Major Task Serial No.	Minor Task Serial No.	Major Task Headings and Minor Task Items Within Each Major Task Heading	Item Frequency	Major Task Frequency
5		CBT PROJECT PLANNING AND DEVELOPMENT		19
	13	Evaluate current courses. Design appropriate courses (CBT and non-CBT). Identify courses/discipline well suited for CBT project. Determine whether there are existing/available materials that cover the training situation, structure of CBT course, evaluation guidelines, etc. Determine costs/benefit trade-off between CBT and alternatives. Organize course materials as they would be presented; and select the best approach.	10	
	17	Perform cost effectiveness calculation by need to be satisfied. Design cost models and cost/benefit analysis for any specific CBT effort to help give direction toward the goals of the project. Keep instructional designers and programmers on track because cost models must be painstakingly accurate and brutally honest.	12	

TABLE X

(Continued)

Major Task Serial No.	Minor Task Serial No.	Major Task Headings and Minor Task Items Within Each Major Task Heading	Item Frequency	Major Task Frequency
6		CBT PROJECT SALE AND PUBLICITY		17
	3	Present reasonable problem to upper management with CBT as solution. Use research findings to support your ideas through human resource strategic planning, state of training needs, CBT issues, etc. Secure upper management support and commitment with well documented needs and data. Reveal realistic goals, expectations (of what CBT will buy the organization relative to the costs) dollar cost, hardware, human resource allocations, time, etc., to produce desired results. Count on upper management blessing for training department to proceed to prevent their "pull out" before there is adequate time for results. Sell traditional trainers, trainees, and their managers on the effectiveness and the efficiency of CBT approach.	16	

TABLE X

(Continued)

Major Task Serial No.	Minor Task Serial No.	Major Task Headings and Minor Task Items Within Each Major Task Heading	Item Frequency	Major Task Frequency
7		CBT PROJECT DELIVERY SYSTEM PLANNING AND SELECTION		21
	10	Identify available funding for hardware, software, planning, design, and development, etc., and plan a reasonable budget in light of expectations. Do not pad budget but work harder, because budgetary restrictions must be adhered to, especially in initial stages of establishing CBT project.	11	
	12	Extensively research and carefully select a programming language compiler or intelligent/high quality authoring system tool (example: CDC's PCD 3) that allows simulation, embedded training, separate knowledge based from user interface, etc. Know that CBT of the 70's (drill and practice, multiple choice questions, inflexible answer judging, little adaptation to trainee	11	

TABLE X

(Continued)

Major Task Serial No.	Minor Task Serial No.	Major Task Headings and Minor Task Items Within Each Major Task Heading	Item Frequency	Major Task Frequency
		individuality, etc.) is rapidly becoming obsolete; and being replaced with embedded training and intelligent tutoring system models.		
	12	Analyze hardware relative to organization's needs and constraints, and select hardware (micro, mini, mainframe, or a combination) that is widely available throughout the organization and/or off-the-shelf (example: IBM XT or AT). Secure necessary hardware support for development and testing, as well as for implementation. Choose a CBT system that best meets instructional delivery needs, materials development, and future training needs.	11	

TABLE X

(Continued)

Major Task Serial No.	Minor Task Serial No.	Major Task Headings and Minor Task Items Within Each Major Task Heading	Item Frequency	Major Task Frequency
	25	Perform a detailed task analysis of available, proven CBT system appropriate to needs, and indentify limitations of each CBT system. Skills training is required as opposed to performance or concepts training. Basic set of training requirements should exist for the subject that would not require an instructor (let CBT cover the basics and the instructor handle the advanced training in a workshop environment). The subject matter for training should be computer and/or data processing oriented (not necessarily teaching about computers but an application that runs on a computer).	7	

TABLE X

(Continued)

Major Task Serial No.	Minor Task Serial No.	Major Task Headings and Minor Task Items Within Each Major Task Heading	Item Frequency	Major Task Frequency
	19	Obtain suitable delivery that is best for the situation in terms of the demand in the subject matter for production (training aid, hardware considerations, color, graphics, movement, values, shared delivery, compatibility, interactive video, sound, suitable CBT terminology for audience, operating software considerations, etc.), and the expectation of the audience for the production values. If hardware is available go ahead with CBT effort, else, secure capital equipment approval for hardware purchase.	11	
8		CBT COURSEWARE PRODUCTION PLANNING AND DEVELOPMENT		20
	4	Carefully plan and consider the establishment of CBT project on a small scale first by producing a short course (pilot/prototype)	11	

TABLE X

(Continued)

Major Task Serial No.	Minor Task Serial No.	Major Task Headings and Minor Task Items Within Each Major Task Heading	Item Frequency	Major Task Frequency
		which can be reviewed/evaluated and revised (content and grammatical issues, etc.) and tested on the actual people who will be using it, with real product, in the setting it will be used (dangerous or expensive operations is necessary for practice), in-house, by subject matter experts (SME's) and management. It is very important to start small, proceed slowly, learn, tool-up for larger CBT effort gradually with the experience gained from the first try. Review, modify, and secure upper management approval as you go along by keeping them informed of progress made and the levels of success.		
	9	Augment desired CBT design with rigorous instructional design and development methodologies, developed after researching through demonstrations and readings. Determine and ensure that	3	

TABLE X

(Continued)

Major Task Serial No.	Minor Task Serial No.	Major Task Headings and Minor Task Items Within Each Major Task Heading	Item Frequency	Major Task Frequency
		instructional concepts supporting CBT effort will be consistent with organizational philosophies and strategies, in terms of corporate philosophy, adult learners, learning theories, fear of computers, etc.		
	23	Establish whether courses are to be developed in-house and/or purchased off the shelf. If courses are to be develped in-house, determine the maturity of the organization in recognizing the cost and time it takes to develop courseware, and prepare a comprehensive course development plan, one that everyone can work toward, that tells how to begin and how to end.	4	

TABLE X

(Continued)

Major Task Serial No.	Minor Task Serial No.	Major Task Headings and Minor Task Items Within Each Major Task Heading	Item Frequency	Major Task Frequency
	24	Create interactive video disks, Computer-Assisted Instruction (CAI) lessons, etc. Develop storyboard, flowchart, screen template, scripts (as appropriate), program logic (program design, element flowchart, from specifics), and complete courseware programming. Produce enough programs to make an impact and use people who did not program courseware to debug it. Install completed courseware on site and provide a 90-day warranty for "big fixes."	6	
	15	Use outside Vendor/Expertise only after careful research and selection process, and cost justify the use of outside help to upper management who should perceive them as critical elements for successful CBT project.	5	

TABLE X

(Continued)

Major Task Serial No.	Minor Task Serial No.	Major Task Headings and Minor Task Items Within Each Major Task Heading	Item Frequency	Major Task Frequency
	16	Develop and establish standards for CBT course design and development, as well as for software and interfaces, to help protect CBT investments for longer terms; and to ensure upper management willingness to make larger CBT investments necessary to give CBT project a fair try. Document CBT project efforts (writing, editing, etc. support), and build documentation into CBT plan/schedule. Secure and document agreement on target product development staff support, commitment for reviews, communication on changes to product, possible future products, and the future direction of CBT.	7	

TABLE X

(Continued)

Major Task Serial No.	Minor Task Serial No.	Major Task Headings and Minor Task Items Within Each Major Task Heading	Item Frequency	Major Task Frequency
	22	Establish course learning and performance criteria (method of measuring whether CBT goals are being met) and the project place in the training and operations system. Provide CBT project result in terms of increased demand for computer resources if end-users are trained to use the computer. Provide on-going performance data to different levels of management. To local management for course completion by trainee; to training management for percent trained by job title; and to upper management for overall cost/savings of the CBT project.	4	

TABLE X

(Continued)

Major Task Serial No.	Minor Task Serial No.	Major Task Headings and Minor Task Items Within Each Major Task Heading	Item Frequency	Major Task Frequency
9		CBT PROJECT EVALUATION AND REVISION I: FORMATIVE		14
	6	Immediate feedback on trainee progress is necessary. Evaluate tests. Utilize interactive testing with users of CBT. Adopt evaluation plan for formative, summative, and post summative stages. Continually evaluate and revise courseware, etc., as you go along; and the final product against overall plan. Survey trainees' attitude toward CBT and conduct item analysis. Monitor learner progress, collect learner comments, provide feedback on progress, and provide remediation. Measure increase in learner skills because achieving a measured level of mastery is essential. Instructional consistency is required for mastery. Present above data to upper management to help strengthen their support and commitment to larger CBT effort.	9	

TABLE X

(Continued)

Major Task Serial No.	Minor Task Serial No.	Major Task Headings and Minor Task Items Within Each Major Task Heading	Item Frequency	Major Task Frequency
10		CBT PROJECT ESTABLISHIMENT AND IMPLEMENTATION		17
	20	Form a committee on software selection, including the training manager, CBT coordinator, data center manager, etc. to seek out good quality CBT software package, authoring language/system, etc. If software meets need purchase software and install it (a team building/productivity enhancing process).	11	
	5	Ensure the success of first CBT effort. Utilize extensive review by all levels of the organization. Carefully selected outside vendor knowledgeable in selected system may be used to help develop "show case" first CBT effort. Find ways to promote the success of first CBT attempt and publicize this success throughout the organization. Practice public relations,	7	

TABLE X

(Continued)

Major Task Serial No.	Minor Task Serial No.	Major Task Headings and Minor Task Items Within Each Major Task Heading	Item Frequency	Major Task Frequency
		keep lines of communications open, and speak the language of management because you cannot cost justify product if no one uses it. Cost/benefit is enhanced the more product is used.		
	14	Develop plan/schedule for implementing and managing each phase of CBT project. Review plan/schedule periodically in terms of the elements, learning center (suitable space for class), pilot test, internal sell, etc., at specified intervals. Design curriculum tracks, construct tests, establish "test out" criteria, and ensure that training staff are monitoring the progress of trainees. Secure required Computer-Managed Instruction (CMI) tool and ensure fast response time with instructionally sound and interesting course.	10	

TABLE X

(Continued)

Major Task Serial No.	Minor Task Serial No.	Major Task Headings and Minor Task Items Within Each Major Task Heading	Item Frequency	Major Task Frequency
	27	Timeframe for training should be flexible. Trainees need to practice repeatedly. Training should be delivered as needed because individualized instruction is required.	4	
11		CBT PROJECT EVALUATION AND REVISION II: SUMMATIVE		13
	6	Immediate feedback on trainee progress is necessary. Evaluate tests. Utilize interactive testing with users of CBT. Adopt evaluation plan for formative, summative, and post summative stages. Continually evaluate and revise courseware, etc., as you go along; and the final product against overall plan. Survey trainees' attitude toward CBT and conduct item analysis. Monitor learner progress, collect learner comments, provide feedback on progress, and provide remediation. Measure increase in learner skills because achieving a measured level of mastery is	9	

TABLE X

(Continued)

Major Task Serial No.	Minor Task Serial No.	Major Task Headings and Minor Task Items Within Each Major Task Heading	Item Frequency	Major Task Frequency
		essential. Instructional consistency is required for mastery. Present above data to upper management to help strengthen their support and commitment to larger CBT effort.		
12		CBT PROJECT MAJOR AND LONG-TERM COMMITMENT AND MAINTENANCE		14
	18	Develop long term CBT strategy that is fully integrated with new business systems and end-user computer training. Action plan should address needs in terms of technical, financial, and political feasibility. Ensure maintainability of CBT project, and never develop a course that would not be maintained. Allow adequate time (no hard delivery date). Bring CBT project in ON TIME, and under budget to ensure upper management continued backing, involvement, and financial support. Join professional organizations, especially those that are CBT oriented (example: ADCIS) and read professional journals.	7	

TABLE XI

COMMENTS FROM ROUND TWO

Serial No.	Comments
1.	Instruction a bit unclear; use of examples very helpful.
2.	There should be no distinction between CBT design and Instructional design.
3.	Staff developing CBT should be included in choosing software.
4.	Evaluation step should be included in production planning.
5.	Technology transfer plan should include ingredients for developing qualified CBT author so that end-product is successful.
6.	Items generated in study are good ideas for successful CBT, but not necessarily steps in the process.

Summary

Data generated from the first and the second round was analayzed and tabulated. The response rate in all the rounds was tremendous. In the first round, the elements identified by the experts were analyzed and tabulated into twenty-eight (28) minor task item groups. The frequency of responses for each minor task item group was reported as well as the choices made by the individual respondents.

In the second round, the major task headings identified with their corresponding minor task item groups were anlayzed and tabulated. After analysis, it was realized that consensus had emerged. Therefore, subsequent rounds were not required.

The major task headings identified were analyzed into 12 major task items as follows: 1) Detailed Task and Training Needs Analysis, 2) Computer-Based Training (CBT) Project Feasibility Investigation, 3) Goal Setting and Objective Clarification, 4) Assemblage of Full-Time CBT Staff and Courseware Department, 5) CBT Project Planning and Development, 6) CBT Project Sale and Publicity, 7) CBT Project Delivery System Planning and Selection, 8) CBT Courseware Production Planning and Development, 9) CBT Project Evaluation and Revision I: Formative, 10) CBT Project Establishment and Implementation, 11) CBT Project Evaluation and Revision II: Summative, and 12) CBT Project Major and Long-Term Commitment and Maintenance.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

Computer-based learning is a growing phenomenon with a great number of applications and implications for Human Resources Development (HRD). It is a modern, sophisticated, and technology-based tool that is not foreign; and does not involve magic or mystery. It can be used in situations where it will produce an overall outcome that is preferable to the outcome obtainable with conventional methods. (52). Instruction or learning with computers opens new ways for people to acquire job-related knowledge and skills which when increased give business and industry an added advantage. (22).

In reference to Reynolds, Anyanwu (5) points out that the application of the computer in learning provides a unique and powerful tool for technology transfer. Through computer-based learning, HRD professionals will be able to improve the quality of instruction, increase the productivity of employees, and expand the availability of training, education and development. Although computer-based learning is relatively expensive, the costs actually decreases -- continually -- when compared to the cost of labor over time. In the future CBL can be highly cost effective for manpower training and development (HRD) programs.

As we look into the future, there will be several challenges to be faced including the provision for increased effective instruction to an increasingly intelligent, independent, self-directed, more demanding, and bilingual population. When traditional methods of training become obsolete and instructional commitments with the old methods become uninteresting, new training technologies will have far reaching implications for both HRD programs and careers.

In furtherance of this notion, Anyanwu (6) referred to Butler's eight rules for dealing with the new training technologies in the 1980's as follows:

1. Rising costs make use of educational technologies inevitable.
   Cost of education per pupil rose 10 percent per year while cost of computer technology dropped at the rate of 25 percent per year over the past 25 years.

2. Beware of all bells and whistles.
   Needs and resources should be carefully scrutinized when considering new technologies so that when chosen, these new tools will remain effective long after their supposed obsolescence in the marketplace.

3. Cost savings will not come cheaply.
   New instructional media will require a wide range of support and back up services ranging from instructional research and material design to production, testing, housing and courseware distribution.

4. Effective courseware will be problem- not content-oriented. Educational media will be used to help stimulate personal confrontation with real problems which require use of values, responsibilities, social interaction and knowledge to reach workable solutions.

5. Resource allocations will emphasize technology and differentiated staffing.
   Future training budgets will shift to development of educational materials and shift to purchasing equipment from an emphasis on facilities and large pools of instructors. Two thirds of employees will be behind the scene course developers or on-the-scene paraprofessionals.

6. Think small when it comes to facilities.
   More and more instructors, administrators and students will telecommunicate to work. Educational facilities will be dominated by library-media telecommunications centers and only a fraction of the classrooms will be required.

7. Industry must be ready to establish its own college training programs.
   Companies will be forced to turn away from the marketplace and will look in-house to educate and upgrade existing employees.

8. Share programs whenever possible.
   Schools, universities and industrial training and development programs will establish networks and consortiums to help reach the low per capita costs needed to justify large instructional design and production costs. Sharing courseware in general subject areas will be common.

With the workforce becoming increasingly sophisticated, more and more employers will be providing education for their employees, as a very cost effective employee benefit, to learn job-related skills and enhance employee quality of life. Accordingly, Anyanwu (3) referred to Weiss as saying that education, training and career development will lose their separate indentities and become parts of an integrated, comprehensive system. As we are in the midst of a revolution in an unprecendented power of human knowledge and technology, HRD's role will be to assist organizations to understand these trends and use them as opportunities. Therefore, HRD should take advantage of the challenges and the potentials available in this new technology to improve the conditions of the workplace and the people in it.

The clarity with which responses were given was generally good. However, some interpretation of the opinions expressed by the experts was necessary. To increase the response rate to the questioning, the principal investigator and the thesis advisor determined that

succinct instructions and/or examples would increase the response rate. This would reduce misinterpretation of the research instrument.

A response rate of 87.90 percent was achieved in the preliminary sample selection process, which represented 185 potential experts in CBT for the modified Delphi research study. In the secondary sample selection process the response rate was 84.09, and this represented thirty-seven (37) experts in CBT for the modified Delphi research study.

In the first round questioning, the response rate was 80.0 percent, representing twenty-eight (28) experts responding to the first round research instrument. The first round responses produced several elements as part of the criteria for successful establishment of CBT projects in business and industry. These elements were analyzed and ordered into twenty-eight (28) minor task item groups. After analyzing the responses from the first round, the items were sent back to the experts with the frequency for each minor task item group and the choices made by each individual expert reported. These analyzed minor task item groups constituted part (b) of the second round questioning.

Listed below are the major highlights of the criteria (minor task item groups) established in the first round of questioning.

1. Establishment of needs for training;
2. Data gathering;
3. Presentation of data to management, especially upper management;
4. Planning a pilot CBT course;
5. Insuring the success of a pilot CBT course;

6. Feedback on the first the CBT course;
7. Staffing and creating a CBT department including the necessary units;
8. Setting goals of the CBT project;
9. Funding the CBT project;
10. Hardware/software acquisition;
11. Developing the plan/ schedule for CBT project course development;
12. Developing standards and documention for the CBT project;
13. Planning for technology transfer;
14. Establishing course learning/performance criteria;
15. Timely execution of the CBT project plan; and
16. Establishing long range commitment and maintenance of the CBT project.

It should be mentioned that the above highlights were not listed in rank order form. For more details see Table VIII.

The second round questioning yielded a response rate of 84.61 percent, which represented twenty-four (24) experts responding to the second round research instrument. The first part of the second round questionnaire required the experts to identify the major task headings they consider necessary in successfully establishing CBT projects in business and industry. Their reponses, after ananlysis, produced 12 major task headings. The highlights of the 12 major task headings were as follows:

1. Analyzing Tasks and Training needs;
2. Investigating the Feasibility of CBT Project;

3. Clarification of Objectives and setting Goals of CBT Project;
4. Obtaining Full-Time CBT Staff and Establishing Courseware Department;
5. Planning and Developing CBT Project Strategies;
6. Selling and Publicizing CBT Project in Organization;
7. Planning and Selecting CBT Project Delivery System;
8. Planning and Developing CBT Courseware;
9. Evaluating CBT Project Accomplishment and First CBT Course;
10. Establishing and Implementing CBT Strategies;
11. Evaluating CBT Project before Major Commitment; and
12. Making Major Commitment and Maintenance Plans for CBT Project.

The above major task headings (phases) for successful establishment of the CBT project were presented in order of priority as established in the research study. For more details see table IX.

The second part of this round required the experts to group the twenty-eight (28) minor task item groups established in the first round and to identify the groupings that fall under each of the major task headings identified in this (second) round. The groupings as specified by the experts responding to this second round instrument may be found in Table X. As was done in the first round, statistical feedback of the frequency with which each of the major task headings were identified was reported. This represented the number of times each major task heading was cited to occupy the position it now holds (see serial numbering).

The highlights of the criteria (minor task item groups within each major task heading) were as follows:

1. Analyze Task and Training Needs.
    a. Task analysis and training needs identification.
2. Investigate CBT Project Feasibility.
    a. Gather data to support CBT project.
    b. Cross-check with other CBT oriented organizations.
3. Objective Clarification and Goal Setting.
    a. Establish achievable goals.
4. Establish Full-Time CBT Staff and Department.
    a. Create units.
    b. Obtain effective and efficient CBT project leader.
    c. Train qualified trainers for technological change
5. Plan and Develop CBT Project Strategies.
    a. Evaluate current courses and design appropriate CBT and non-CBT courses.
    b. Calculate cost and design cost models.
6. Sell and Publicize CBT Project in Organization.
    a. Present CBT as solution to problem for management review.
    b. Sell CBT solution to all in organization.
7. Plan and Select CBT Delivery System.
    a. Identify funding and secure appropriate CBT delivery system.
    b. Select intelligent/high quality authoring system.
8. Plan and Develop CBT Courseware.
    a. Develop CBT pilot.
    b. Use adequate instructional design and development

methods.

c. Use outside expertise (if need be) to develop first course.

d. Establish courseware development standard and documentation.

e. Establish CBT Course Learning/Performance Criteria.

9. Evaluate CBT Project Accomplishment and Revise (If Need Be).

a. Obtain feedback on CBT project performance.

b. Revise course/project (if needed).

10. Establish and Implement CBT strategies.

a. Form committee to secure CBT software.

b. Insure success of pilot course before full scale implementation.

c. Develop plan/schedule for future CBT efforts.

11. Re-evaluate CBT Project Performance and Revise (if need be).

a. Obtain feedback on CBT project performance.

b. Revise course/project (if needed).

c. Recommend continuation of the CBT effort if the pilot project was successful.

12. Make Major Commitment to CBT Project and Insure On-going Maintenance of CBT Project.

a. Develop long-range plans for CBT project.

b. Allow adequate time for project delivery.

For more details see Table X.

After tabulating the frequencies for each of the major task headings with the corresponding minor task item groups, it was observed that consensus had already emerged after the second round

questioning. In consultation with the principal investigator's thesis adviser, it was determined that consensus had been reached and thus subsequent rounds were not required.

Conclusions

The conclusions reached in this study were based on the analysis and the interpretations of the expert opinions of the respondents to this modified Delphi research study and may not be generalizable to other experts on CBT in business and industry.

Based on the frequency of the data generated and analyzed through round two of questioning, the following conclusions were reached:

a. There is a need for establishing a standard procedure to be followed in successfully establishing CBT projects in business and industry;

b. There should be adequate information generated in order to justify the establishment of CBT projects in business and industry;

c. All levels of management, especially upper management, must be properly informed and educated on the need for, and the benefits of establishing CBT projects in business and industry;

d. There should be adequate time allowed for the planning, development, and implementation of CBT projects in business and industry;

e. There should be standardized procedures regarding CBT system's hardware and software documentation and selection

to facilitate decisions concerning CBT project establishment;

f. There is a need for more effective CBT programs to boost CBT project credibility, as very few of the CBT system software packages in the market today live up to expectations;

g. There is a need for starting a CBT effort on a small scale first and to "tool-up" for larger efforts after the success of the smaller effort;

h. There should be a thorough evaluation and necessary revisions in the establishment of CBT projects in business and industry;

i. There is a need for approaching CBT establishment in phases;

j. There is a need to insure that a considerable measure of success is reached in one phase before embarking on the next subsequent phase, else, an ineffective CBT end-product may be produced;

k. There is a need to include CBT project staff in the selection of the system software;

l. There is a need to adequately plan the technological transfer program so as to include "ingredients" that will assure obtaining efficient and effective CBT authors and end products;

m. There is a need for periodic evaluation and revision of the end product to insure that overall goals and objectives of the CBT effort are being met; and

n. There is a need for adequate planning concerning future implementation and maintenance of the CBT effort.

Generally, it was evident that many CBT experts who responded to this modified Delphi research study favored a systematic method of approaching CBT project establishment, since the success of any particular effort depends to a large extent on the successful implementation of the previous effort.

Implications of these Research Findings

After administering the two rounds of the modified Delphi reaearch instrument, the following implications are inferred. There is a need for increased effective:

1. instruction;
2. training needs assessment;
3. attainable goals for CBT establishment;
4. CBT project planning and development;
5. "sale and publicity" for the CBT project;
6. CBT delivery system planning and selection;
7. user-oriented courseware systems;
8. procedures for formative, summative, and post summative evaluation of CBT effort;
9. committed CBT maintenance staff; and
10. research in training technologies, and especially computer-based training.

Recommendations

It is recommended that Human Resources Development (HRD) and other professional groups who are thinking about introducing CBT techniques in various organizations try as much as possible to gather enough data about CBT projects and the effectiveness of the various CBT systems in the market before embarking on a CBT effort.

It is not out of place to point out that many HRD professionals would be under increased pressure to conform to the norms obtainable in other CBT oriented business and industrial organizations. Bearing this in mind, and the fact that there has been a rapid shift from an industrial to an informational society, it is further recommended that HRD professionals should acquire a basic knowledge of, and be current in some aspects of computer-based learning techniques in order to keep current in this changing world.

Furthermore, it is recommended that similar research studies be conducted that will sample the opinions of other CBT experts who did not participate in this research study, to act as the validation for any model that may be developed around the findings of this research study. It is also recommended that the research results be implemented in the field under a controlled environment to test the research model.

After careful analysis of the results of this research study it was found that several models for successful establishment of CBT projects in business and industry could be developed based on the major task headings and the minor task item groups established in the two rounds of this modified Delphi research study.

A model that can be developed from the findings of this research study may be found in Figure 1. Figure 1 is a flowchart model of the criteria (12 major task items/headings) established in this modified Delphi research study for successfully establishing CBT in business and industry. The minor task item groups were not included in the model but should be part of the decision at each stage of the model.

Although these are consecutive major task items necessary for successful establishment of CBT in business and industry, in some cases it may be necessary to skip a preceding major or minor task depending on individual situations. However, it is recommended that each major or minor task item group be considered before proceeding to the next stage. It is further recommended that organizations considering the establishment of CBT should use this or any other model developed from these research findings or a similar model as a decision making tool to help in successfully establishing viable CBT projects.

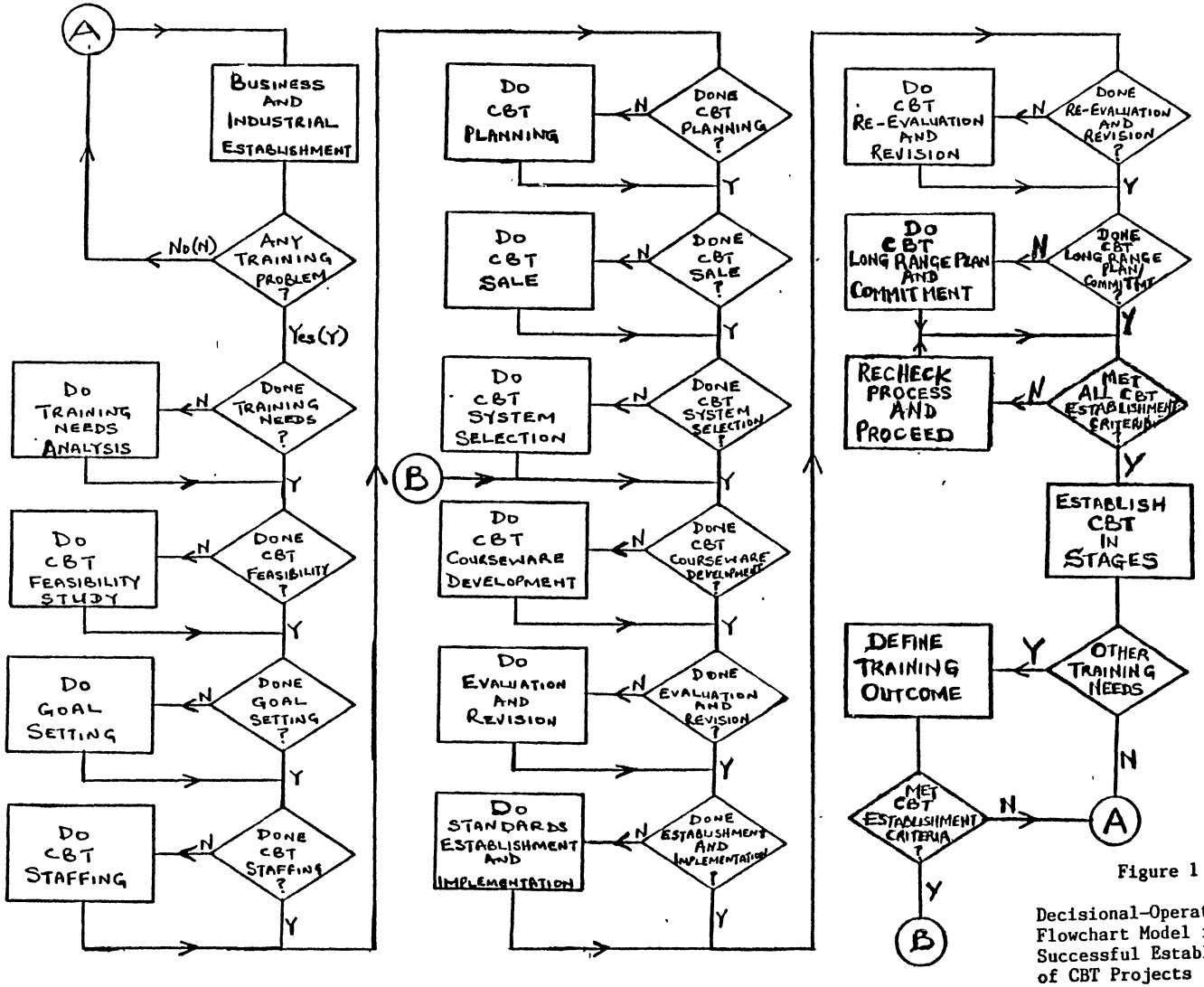

Figure 1

Decisional-Operational Flowchart Model for Successful Establishment of CBT Projects

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APPENDIXES

APPENDIX A

LISTING OF THE FIRST CONTACT EXPERTS

LISTING OF THE FIRST CONTACT EXPERTS

Serial No.	Name
1	Sheldon Fisher
2	Dr. Greg Kearsley
3	Tom D. Conkright
4	Dr. Paul Selden
5	Dr. Francis X. Mahoney
6	David Ayala
7	Nancy Weingarten
8	Lydia Garoian

APPENDIX B

LISTING OF ORGANIZERS OF CBT

CONFERENCES/SEMINARS/WORKSHOPS

LISTING OF CONFERENCE/SEMINARS/WORKSHOPS

AND THEIR ORGANIZERS

Serial No.	Conference/Seminar/Workshop	Organizer
1	1983 CBT Conference, Chicago, Illinois	Data Training
2	1984 CBT Conference, Dallas, Texas	Data Training
3	3rd Annual Conference on Interactive Instructional Delivery, Orlando, Florida	Society for Applied Learning Technology
4	41st National Conference and Exposition (HRD Means Business) CBT Unit, Anaheim, California	American Society for Training and Development
5	1984 CBT Conference, Wisconsin Center	University of Wisconsin Department of Engineering and Applied Science
6	1984 - Workshop on Designing Computer-Based Training	Univeristy of Michigan, School of Business

APPENDIX C

PRELIMINARY SAMPLE SELECTION CORRESPONDENCE

OSU

Oklahoma State University

SCHOOL OF OCCUPATIONAL AND ADULT EDUCATION

STILLWATER, OKLAHOMA 74078
CLASSROOM BUILDING 406
(405) 624-6275

May 24, 1985

Dear Friend/Colleague:

I am a graduate student in the School of Occupational and Adult Education with a program emphasis in the area of Human Resource Development. I am currently working on my dissertation to complete requirements for the doctoral degree. Within the field of Human Resource Development a significant area of interest exists concerning the identification of criteria to be used in justifying the establishment of computer-based training projects in business and industry. The study I will be conducting will use a modified Delphi Technique which draws heavily on the collective thinking of experts in the field.

You have been selected from a list of professionals who are active in the field of computer-based training and who have spoken at conferences, seminars, workshops, etc., and/or written books, journal articles, etc. on the subject.

I would like to invite your participation in identifying ten or more active professionals whom you would refer to as experts in computer-based training. A final selection of professionals who will participate in the succeeding rounds of this study will be made based on these responses. You will receive a summary copy of the final report.

Please mail your response in the enclosed self addressed stamped envelope at your earliest possible convenience. Thank you very much for your assistance.

Sincerely,

Fitzpatrick Anyanwu
Doctoral Candidate
School of Occupational
and Adult Education
Oklahoma State University

H. Gene Smith, Assoc. Prof.
School of Occupational and
Adult Education and Manager,
Systems Design and Computer
Services
Oklahoma State University

From: Include your name if you wish

_____

_____

_____

_____

Please list in the space below the names of your expert nominees.

Name of Expert	Address(if known)	Tel. No.(if known)

Thank you for your cooperation. Please return the list in the enclosed self-addressed stamped envelope to:

Fitzpatrick U. Anyanwu
320 South Benjamin
Stillwater, OK 74074

Oklahoma State University

SCHOOL OF OCCUPATIONAL AND ADULT EDUCATION
Systems Design and Computer Services

STILLWATER, OK 74074
1500 W SEVENTH STREET
(405) 624-6768

July 3, 1985

Dear Friend/Colleague:

We are writing you regarding the questionnaire you received in the mail two weeks ago, concerning the identification and/or the nomination of experts in computer-based training. If you have already responded we are most appreciative. If you have not yet responded we want to reemphasize our interest in your participation and encourage your response in the postage paid envelope enclosed with the questionnaire.

We appreciate your willingness to share your opinion in helping to select the final experts who will participate in the succeeding rounds of this study. Thank you.

Sincerely,

Fitzpatrick Anyanwu
Doctoral Candidate
School of Occupational
and Adult Education
Oklahoma State University

H. Gene Smith, Assoc. Prof.
School of Occupational and
Adult Education and Manager,
Systems Design and Computer
Services
Oklahoma State University

APPENDIX D

SECONDARY SAMPLE SELECTION CORRESPONDENCE

Oklahoma State University

SCHOOL OF OCCUPATIONAL AND ADULT EDUCATION
Systems Design and Computer Services

STILLWATER, OK 74074
1500 W. SEVENTH STREET
(405) 624-6768

July 25, 1985

Dear Friend/Colleague:

Through a mail/telephone contact process with experts in the field of Computer Based Training you have been identified as one of the more frequently referenced individuals in the field. I would now like to request your participation as a panel member in a Delphi research process which will identify criteria to be used for successfully establishing Computer Based Training projects in business and industry.

This research has been cleared through the Doctoral Degree Committee of the Oklahoma State University School of Occupational and Adult Education, Human Resources Development Unit. Through a series of three or more rounds of questionnaires, your opinion will be solicited and an effort will be made to gain a measure of consensus on what emerge as central themes.

Your input to this research will be extremely significant. You will be cited as a major contributor to the study and will receive a copy of the summary results of the research. Please indicate your willingness to participate on the enclosed postage-paid post card. Your time and effort is greatly appreciated.

Sincerely,

Fitzpatrick U. Anyanwu
Doctoral Candidate
School of Occupational
and Adult Education
Oklahoma State University

H. Gene Smith, Assoc. Prof.
School of Occupational and
Adult Education and Manager,
Systems Design and Computer
Services
Oklahoma State University

APPENDIX E

LISTING OF EXPERTS FOR THIS RESEARCH STUDY

Listing of Experts Who Participated in the

Modified Delphi Research Study

Ser. No.	Name	Ser. No.	Name
1	William R. Endsley	22	Dr. Lois Wilson
2	Robert J. Glazier	23	Dr. Franz Fauley
3	Dr. Paul Tenczar	24	Dr. Tim Spannaus
4	Dr. Francis X. Mahoney	25	Angus Reynolds
5	Dr. Gary R. McClain	26	William H. Sebrell
6	Dr. Edward A. Friedman	27	Gloria Gery
7	Dr. Jesse Heines	28	Mark Caruso
8	Travis Piper	29	Dr. Richard M. Lent
9	Tom D. Conkright	30	Dr. Esther Steinberg
10	Gary Brown	31	Carol Endriss
11	Carol Clark	32	Joseph J. Durzo
12	Anthony J. DePAOLIS	33	Bill Albin
13	John Jensen	34	Michael Lewis Flanders
14	Gary Baker	35	Dr. James L. Rogers
15	Dr. Diane Gayeski	36	Ron Zemke
16	Dr. Donald Shirer	37	Dr. Kathryn L. Alesandrini
17	Mary Stoddard		
18	Don Mitchell		
19	Jaunne Karlsrud		
20	Dr. Christopher Howey		
21	Roxy Westphal		

APPENDIX F

FIRST ROUND CORRESPONDENCE

Oklahoma State University

SCHOOL OF OCCUPATIONAL AND ADULT EDUCATION
Systems Design and Computer Services

STILLWATER, OK 74074
1500 W. SEVENTH STREET
(405) 624-6768

August 7, 1985

Dear Friend/Colleague:

We appreciate very much your willingness to participate in the Criteria for Computer Based Training research study as indicated on the post card you returned. We have chosen the Delphi technique, developed by Rand Corporation, to conduct this study. As you may already know, the Delphi technique is designed to produce a consensus judgement in inexact fields. The information gathered in this study will help us with the development of criteria to be used in successfully establishing Computer Based Training (CBT) projects in business and industry.

We need your cooperation and expert opinions to achieve the goals of this research study which has been approved through the Doctoral Degree Committee of the Oklahoma State University School of Occupational and Adult Education, Human Resources Department Unit. Through a series of three or more rounds of questionnaires, an effort will be made to gain a measure of consensus on what emerge as central themes.

In (this) the first round, it is desirable to allow total freedom concerning the directions of possible topics of concern. This round is directed toward accumulating a wide range of opinions about criteria for establishing successful CBT projects in business and industry, and for identifying issues that occur most frequently. In the second and succeeding round(s), you will be given a list of criteria identified in rank order and asked to give further opinion on rankings and subdivisions. A shift toward consensus is highly probable, and very essential for the study.

All responses on questionnaires are confidential and will be known only by the principal investigator. Only anonymous listings including your opinion and statistical feedback will be given to you. The same is true for the final report except for the listings of the participants contributing to the study. Anonymity is critical and an integral part of this technique. Individual responses will be destroyed after the final report is prepared.

Round one (attached) should, if at all possible, be mailed back by August 15, 1985. If this is not possible please mail back at your earliest convenience. Thank you very much for your assistance.

Fitzpatrick U. Anyanwu
Doctoral Candidate
School of Occupational and
Adult Education
Oklahoma State University

H. Gene Smith, Assoc. Professor and
Manager, Systems Design and Computer
Services, School of Occupational and
Adult Education
Oklahoma State University

QUESTIONNAIRE

ROUND ONE

This part of the questionnaire is concerned with information about the elements, steps, processes, and/or tasks that should be considered in establishing successful computer-based training projects in business and industry.

In this round, you should not concern yourself with groupings, subdivisions, and/or sub-headings. This round allows you total freedom concerning the directions of possible topics of concern, and is concerned with accumulating a wide range of opinions about criteria for successfully establishing computer-based training projects in business and industry.

(a) Please identify and/or list the elements, steps, processes , and/or tasks that you would consider significant in successfully establishing computer-based training projects in business and industry.

(b) After you have completed (a) above, please rank order the listings in order of significance.

Use the space below for your responses. Additional paper is enclosed should you require more space.

Please return the completed questionnaire in the enclosed self addressed stamped envelope. Thank you very much for your assistance.

Oklahoma State University

SCHOOL OF OCCUPATIONAL AND ADULT EDUCATION
Systems Design and Computer Services

STILLWATER, OK 74074
1500 W. SEVENTH STREET
(405) 624-6768

September 16, 1985

Dear Friend/Colleague:

We are writing you regarding the questionnaire you received in the mail some weeks ago, concerning the identification and/or the listing of elements, steps, and/or processes that you would consider significant in developing criteria for successful establishment of computer-based training(CBT) projects in business and industry.

If you have already responded we are most appreciative. If you have not yet responded we want to reemphasize our interest in your participation and encourage your response in the postage paid envelope enclosed with the questionnaire.

We appreciate your willingness to share your expert opinion in this first round, and in helping to achieve the goals of this research study which has been approved through the Doctoral Degree Committee of the Oklahoma State University School of Occupational and Adult Education, Human Resources Development Unit. Thank you.

Sincerely,

Fitzpatrick U. Anyanwu
Doctoral Candidate
School of Occupational and
Adult Education
Oklahoma State University

H. Gene Smith, Assoc. Prof.
and Manager, Systems Design
and Computer Services, School
of Occupational Adult
Education
Oklahoma State University

APPENDIX G

SECOND ROUND CORRESPONDENCE

Oklahoma State University

SCHOOL OF OCCUPATIONAL AND ADULT EDUCATION
Systems Design and Computer Services

STILLWATER, OK 74074
1500 W. SEVENTH STREET
(405) 624-6768

October 1, 1985

Dear Friend/Colleague:

Thank you very much for responding to the first round of our research study instrument for identifying the criteria for successfully establishing Computer-Based Training (CBT) projects in business and industry. Eighty percent of the questionnaires sent out by us have been returned with valued opinions and comments. Your informed responses indicated to us that you used your valued time to respond conscientiously to the questionnaire. Your further assistance is requested to help us focus more clearly on the collective opinions.

The following item analysis of each of the elements, steps, and/or processes established/identified in the first round was a concentrated attempt on our part to incorporate all of the expressed opinions. In the item analysis a degree of interpretation of the elements, steps, and/or processes was exercised by the Principal Investigator to facilitate analysis and subsequent data groupings or aggregations in this (second) round. Interpretation was done carefully and kept to an absolute minimum. However, if some specific response does not appear, the participant should be able to relate to an item in the analysis.

The comments option by respondents in the first round was so widely used that a comprehensive listing would be difficult. However, an effort was made to use the information in the comments to define some parameters to which you could respond in this (second) round.

The second round (attached) should, if at all possible, be mailed back by October 10th, 1985. If this is not possible please mail back at your earliest convenience. Thank you very much for your assistance.

Sincerely,

Fitzpatrick U. Anyanwu
Doctoral Candidate
School of Occupational and
Adult Education, Human
Resources Development Unit
Oklahoma State University

H. Gene Smith, Assoc. Prof.
and Manager, Systems Design
and Computer Services, School
of Occupational and Adult
Education
Oklahoma State University

QUESTIONNAIRE

ROUND TWO

This part of the questionnaire is concerned with the information you provided in the first round, and also the information about elements, steps, and/or processes (criteria) groupings or aggregations into major task headings, phases, and/or stages required for this second round.

In this (second) round, you should concern yourself with criteria groupings or aggregations, in rank order, into major task headings, phases, and/or stages. This round allows you total freedom of direction, focusing on the criteria listings of the item analysis (attached), and identifying and/or listing the items in the steps they should be followed/performed, under each of the major task headings, phases, and/or stages you establish in this (second) round.

Because of the disparity among participants in rank ordering the criteria established/identified in the first round, it was difficult to report the statistical feedback in rank order form; therefore, frequency count was adopted and used in reporting the statistical feedback.

Please respond to the following on the attached response sheet.

a. Identify and/or list in rank order the major task headings, phases, and/or stages that you would consider significant in a Computer-Based Training (CBT) project in business and industry (starting from the time of conception to the management of successfully established CBT project in business and industry). Refer to example (A) below.

b. After completing (a) above as in example (A) below and focusing on the item analysis of the criteria established/identified in the first round (attached), please list (by item serial number and in rank order) the order/steps the items should follow/be performed within each of the major task headings, phases, and/or stages identified in this second round under (a) above. Refer to example (A) below.

Use the attached, numbered response sheets for your responses. Please return the attached item analysis (criteria) established/identified in the first round with your responses as this will constitute a part of the summary report to be sent to you after the completion of this research study. Mail your responses and the item analysis by October 10, 1985, in the enclosed self addressed envelope. Thank you very much for your continued assistance.

EXAMPLE (A)

I. FEASIBILITY STUDIES OF CBT PROJECT } Rank Ordered Major Task Heading

(a) 1 (b) 2 (c) 3 (d) ... (e) ... (f) ... (g) ... (h) ... (i) ...

II. PLANNING & SELECTION OF CBT DELIVERY SYSTEM

(a) 8 (b) 10 (c) 12 (d) 11 (e) 7 (f) 4 (g) ... (h) ... (i) } Items within major task heading In rank order/ steps to be followed

III. IMPLEMENTATION & MANAGEMENT OF CBT PROJECT

(a) 5 (b) 6 (c) ... (d) ... (e) ... (f) ... (g) ... (h) ... (i) ...

and so on.

LISTING OF MAJOR TASK HEADINGS, PHASES, AND/OR STAGES FOR THE SECOND ROUND WITH ITEM ANALYSIS (CRITERIA) GROUPINGS OR AGGREGATIONS

I. _____

(a) (b) (c) (d) (e) (f) (g) (h) (i)

II. _____

(a) (b) (c) (d) (e) (f) (g) (h) (i)

III. _____

(a) (b) (c) (d) (e) (f) (g) (h) (i)

IV. _____

(a) (b) (c) (d) (e) (f) (g) (h) (i)

V. _____

(a) (b) (c) (d) (e) (f) (g) (h) (i)

VI. _____

(a) (b) (c) (d) (e) (f) (g) (h) (i)

VII. _____

(a) (b) (c) (d) (e) (f) (g) (h) (i)

VIII. _____

(a) (b) (c) (d) (e) (f) (g) (h) (i)

IX. _____

(a) (b) (c) (d) (e) (f) (g) (h) (i)

. _____

(a) (b) (c) (d) (e) (f) (g) (h) (i)

. _____

(a) (b) (c) (d) (e) (f) (g) (h) (i)

. _____

(a) (b) (c) (d) (e) (f) (g) (h) (i)

ROUND ONE STATISTICAL FEEDBACK

1 OF 5

ITEM ANALYSIS OF THE ELEMENTS, STEPS AND/OR PROCESSES ESTABLISHED/ IDENTIFIED IN ROUND ONE	YOUR RESPONSE FREQUENCY
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1. Do training needs assessment in terms of: Needs not satisfied due to time, talent, budget constraints; Needs being satisfied inappropriately due to untimeliness, low talent, etc. Establish need for Computer-Based Training (CBT) in terms of fiscal, training, and personnel requirements (One of these must exist for a CBT project to be worth initiating). Fiscal--to reduce training time, increase throughput, etc; Training--for shortage of instructors, difficult to train, dangerous to use real equipment, etc; Personnel--for course with large/wide variety of audience. Audience with different levels of familiarity with subject of training, is widely dispersed in location and in time (Geographic Vs. One Site), and with varied duration of training usefulness.	18
2. Gather data to support use of CBT over conventional/traditional classroom training (Instructional benefits, learner performance benefits, learner attitude benefits, and overall (long term) cost benefits Educate management (all levels) on the benefits, limitations, and cost of CBT (Availability of top management far sighted enough to absorb high front-end costs now in exchange for dramatic savings in the future). Ensure that everyone concerned understands what is being produced. State clear written goals and objectives for establishing and developing CBT project. Establish organizational readiness for change, computer technology in training, and terminology. Establish the place of CBT project within organizational framework.	11
3. Present reasonable problem to top management with CBT as solution. Use research findings to support your ideas through human resource strategic planning, state of training needs, CBT issues, etc. Secure top management support and commitment with well documented needs and data. Reveal realistic goals, expectations (of what CBT will buy the organization relative to the costs), dollar cost, hardware, human resource allocations, time, etc, to produce desired results. Count on top management blessing for training department to proceed to prevent their "pull out" before there is adequate time for results.	16
4. Carefully plan and consider the establishment of CBT effort on a small scale first. Produce short course (pilot/prototype) which can be reviewed/evaluated (content and grammatical issues, etc) and tested on people who will be using it, with real product, in the setting it will be used (dangerous or expensive operations is necessary for practice), in-house, by subject matter experts (SME's) and management. It is important to start small, proceed slowly, learn, tool up for larger CBT effort gradually and with experience gained from first try. Review, modify, and secure top management approval as you go along by keeping them informed of progress and levels of success.	11
5. Ensure success of first CBT effort. Utilize extensive review by all levels of the organization. Carefully selected outside vendor knowlegeable in selected system may be used to help develop "show case" first CBT course. Find ways to promote success of first CBT attempt.	7

I		Your Response Frequency
	Publicize this success throughout the organization. Practice public relations, keep lines of communications open, and speak the language of management (you cannot cost justify product if no one uses it). Cost/Benefit is enhanced the more product is used.	
	6. Immediate feedback on trainee/student progress is necessary. Evaluate tests. Utilize interactive testing with users of CBT. Adopt evaluation plan for formative, summative, and post summative stages. Continually evaluate and revise courseware, etc, as you go along; and the final product against overall plan. Survey trainee/student attitude toward CBT (critique). Conduct itemanalysis, monitor learner progress, collect learner comments, provide feedback on progress, and provide remediation. Measure increase in learner skills/knowledge because achieving a measured level of mastery is essential. Instructional consistency is required for mastery. Present above data to top management to help strengthen their support and commitment to larger CBT effort.	9
	7. Obtain strong, knowledgeable, creative, energetic, flexible, etc, leader for CBT effort. The leader should know what style of training (tutorial, simulation, etc,) would work best. The leader should report to the Training Manager. Obtain local expertise in screen design, instructional design, intelligent answer judging, human factors in computing systems, etc., that can create effective CBT program. Obtain Programmer technically oriented and familiar with CBT applications and Central Processing Unit (CPU) system environment (not just one with only high level Authoring system expertise).	12
	8. Establish goals to be achieved with CBT project and determine business objectives for CBT project by understanding why the organization is initiating CBT. Clear understanding anf agreement on objectives of CBT project should be matched/tied to organization and division goals and objectives (tie initial project to strategic plan for further implementation and use of CBT), and measured periodically, focusing on business problems/needs, and addressed in terms of revenue, margin, and service, etc.	8
	9. Augment desired CBT design approach with rigorous instructional design and development methodologies developed after researching through demonstrations and readings. Determine and ensure that instructional concepts supporting CBT project are consistent with organizational philosophies and strategies in terms of corporate philosophy, adult learners, learning theories, fear of computers, etc.	3
	10. Identify available funding for hardware, software, design and development, etc. Plan a reasonable budget in light of expectations. Do not pad budget, work harder, because budgetary restrictions must be adhered to, especially in initial stages of establishing CBT project.	11
	11. Extensively research and carefully select a programming language compiler or intelligent/high quality Authoring system tool (example: CDC's PCD 3) that allows simulation, embedded training, separate knowledge base from user interface, etc. Know that CBT of the 70's (drill and practice, multiple choice questions, inflexible answer judging, little adaptation to trainee individuality, etc) is rapidly becoming obsolete; and being replaced with the new embedded training and intelligent tutoring system models.	8

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	Your Response	Frequency
12. Analyze hardware relative to organization's needs and constraints. Select hardware (micro, mini, mainframe, or combination) that is widely available throughout the organization and/or off-the-shelf (example: IBM XT or AT). Secure necessary hardware support for development and testing as well as for implementation. Choose a CBT system that best meets your needs for instructional delivery, developing materials, and for future training.		11
13. Evaluate current courses. Design appropriate courses (CBT and Non CBT). Identify course/discipline well suited for CBT project. Determine whether there are existing/available materials that cover the training situation, structure of CBT course, evaluation guidelines, etc. Determine cost/benefit trade-off between CBT and alternatives. Organize course materials as they would be presented, and select the best approach. Ensure maintainability of CBT project and never develop a course you do not intend to maintain.		10
14. Instructional Management System Implementation Plan: Develop plan/schedule for implementing and managing each phase of CBT project. Review plan/schedule periodically (elements, learning center--suitable space for class--, pilot test, internal sell, etc., at specific intervals. Design curriculum tracks, construct tests, establish "test out" criteria, and ensure that training staff are monitoring progress of the large trainee/student body. Secure required Computer Managed Instruction (CMI) tool. Ensure fast computer response time and deliver instructionally sound and interesting course.		14
15. Use outside Vendor/Expertise only after careful research and selection process. Cost justify use of outside Vendor/Expertise to top management who should perceive them as critical elements in the success of CBT project.		5
16. Course Design, Development, and Course Content Must be Standardized and Documented: Develop and establish standards for CBT course design and development, as well as for software and interfaces to protect software investments for longer terms; and to ensure management willingness to make larger software development investments necessary to give CBT project a fair try. Ensure flexible course scheduling and course content uniformity (course content must be stable and clearly defined). Review target product carefully, because CBT development effort must be able to respond to changes in target product. Document CBT project (writing and editing support, etc.), and build documentation into CBT plan/schedule. Secure and document agreement on target product development staff support, commitment for reviews, communication on changes to product, possible future programs, and future direction of CBT (assuming that first CBT effort was successful).		7
17. Perform cost effectiveness calculation by need to be satisfied. Design cost models and cost/benefit analysis for specific CBT effort to help give direction to goals of the project. Keep Instructional Designers and Programmers on track because cost models must be painstakingly accurate and brutally honest. Determine that there is no other appropriate medium. Develop long term CBT strategy that is fully integrated with new business systems training and end-user computer training. Bring CBT project in ON TIME, and under budget to ensure top management continued backing, involvement, and financial support. Action plan should address needs in terms of technical, financial, and political feasibility.		12

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	YOUR RESPONSE FREQUENCY
18. Join professional organizations that are CBT oriented (example: ADCIS), read professional journals .	1
Obtain suitable media/delivery system that is best for the situation. The demand in the subject matter for "production" (training aid, hardware considerations, color, graphics, movement, values, shared delivery, compatibility, interactive video, sound, suitable CBT terminology for audience, operating software considerations, etc.), and the expectation of the audience for the production values. Secure a group: Training Manager, CBT Coordinator, Data Center Manager, etc, to seek out good quality CBT software package, Authoring language, Authoring system, etc. If software meets need purchase and install (a team building/productivity enhancing process). If hardware is available go ahead with CBT, else, secure capital equipment approval for hardware purchase.	11
19. Obtain qualified Training Instructors and train them to take over CBT project through a technology transfer plan. Use a cadre of skilled training professionals willing to learn enough data processing (DP) skills to Author Courseware. Train Authors in each department. Provide technical and training support to Authors (minimal threat to Turf, especially to established Trainers). Sell Traditional Trainers, Trainees, and their Managers on the effectiveness of CBT approach. Explain Trainers role in CBT environment.	10
20. Establish course learning and performance criteria (method of measuring whether CBT goals are met) and the project place in training and/or operations system. Provide CBT result in terms of increased demand for computer resources if end users are trained to use the computer. Provide on-going performance data to different levels of management: Local management--course completion by student; Training Management--percent trained by job title; Top Management--overall cost/savings of CBT project.	4
21. Establish whether courses are to be developed in-house and/or purchased off-the-shelf. If courses are developed in-house, establish the maturity of the organization in recognizing the cost and time it takes to develop courseware. Prepare a comprehensive course development plan (one that everyone can work toward) that tells how to begin and how to end.	4
22. Create interactive video disks, Computer-Assisted Instruction (CAI) lessons, etc. Develop storyboard, flowchart, screen template, scripts (as appropriate), and program logic (design program, element flowchart, frame specifics), and complete courseware programming. Be able to produce enough programs to make an impact. Use people who did not program course to debug courseware and install completed courseware on site. Provide a 90-day warranty for "big fixes".	6
23. Perform a detailed task analysis of available, proven CBT systems appropriate to needs, and identify limitations of each system. Skills training is required as opposed to performance or concepts training. Basic set of training requirements exist for the subject that would not require an Instructor (let CBT cover the basics and the Instructor handle the advanced training in a workshop environment). The subject matter for training should be computer or data processing oriented and not necessarily teaching about computers, but an application that runs on a computer (do not teach how to drive a car on the computer, use a car). Determine utility of off-the-shelf products. Select one CBT system for implementation.	7

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	YOUR RESPONSE	FREQUENCY
24. Ensure that other companies in the same business verify that use of CBT has been successful in filling training needs of a similar nature in a cost efficient manner. Ensure that CBT effort and/or product can be marketed to other organizations if need be, to recover initial cost of investment (training tool will accompany or be sold to a client as part of an application software package/system).		2
25. Timeframe for training should be flexible. Trainees/students need to practice repeatedly. Training should be delivered as needed because individualized instruction is required. Allow adequate time (no hard delivery date).		4
26. Identify available funding for hardware, software, planning, design, and development, etc., and plan a reasonable budget in light of expectations. Do not pad budget but work harder, because budgetary restrictions must be adhered to, especially in initial stages of establishing CBT project.		11
27. Form a committee on software selection, including the training manager, CBT coordinator, data center manager, etc. to seek out good quality CBT software package, authoring language/system, etc. If software meets need purchase software and install it (a team building/productivity enhancing process).		11
28. Establish full-time CBT staff and courseware department (marketing, training and standards unit). A technical person for CBT system expertise and standards, an administrative person for administrative duties, designers, programmers, graphic specialists, SME's, etc. Develop long term CBT strategy that is fully integrated with new business systems and end-user computer training. Action plan should address needs in terms of technical, financial, and political feasibility. Ensure maintainability of CBT project, and never develop a course that would not be maintained.		9

Oklahoma State University

SCHOOL OF OCCUPATIONAL AND ADULT EDUCATION
Systems Design and Computer Services

STILLWATER, OK 74074
1500 W. SEVENTH STREET
(405) 624-6768

October 15, 1985

Dear Friend/Colleague:

We are writing you regarding the questionnaire you received in the mail a week ago, concerning the identification and/or the listing of major headings, phases, and/or stages that you would consider significant in developing criteria for successful establishment of computer-based training projects(CBT) projects in business and industry; and the inclusion of the established criteria in round one under these headings.

If you have already responded we are most appreciative. If you have not yet responded we want to reemphasize our interest in your participation and encourage your response in the postage paid envelope enclosed with the questionnaire.

We appreciate your willingness to share your expert opinion in this second round, and in helping to achieve the goals of this research study which has been approved through the Doctoral Degree Committee of the Oklahoma State University School of Occupational and Adult Education, Human Resources Development Unit. Thank you.

Sincerely,

Fitzpatrick U. Anyanwu
Doctoral Candidate
School of Occupational and
Adult Education, Human
Resources Development Unit
Oklahoma State University

H. Gene Smith, Assoc. Prof.
and Manager, Systems Design
and Computer Services, School
of Occupational and Adult
Education
Oklahoma State University

VITA

Fitzpatrick U. Amanze-Anyanwu

Candidate for the Degree of

Doctor of Education

Thesis: IDENTIFICATION OF CRITERIA FOR SUCCESSFULLY ESTABLISHING COMPUTER-BASED TRAINING PROJECTS IN BUSINESS AND INDUSTRY

Major Field: Occupational and Adult Education

Minor Field: Human Resources Development with Computer-Based Training

Biographical Data:

Personal Data: Born in Ngali-Obibii Nguru, Aboh-Mbaise L.G.A., Imo State Nigeria, April 17, 1955, the son of Francis and Francisca Amanze Anyanwu, married to Bonnie Jean McClain, New York, June 5, 1985.

Education: Graduated from: Community Secondary School Amuzi-Mbaise, Nigeria, December 1972; School of Computer Technology London August 1977;North East London Polytechnic, England, July 1979; Institute of Data Processing Management, England, September 1979;Institute of Management Specialists, England, February 1980; Oklahoma State University, Stillwater, Oklahoma: Bachelor of Science Degree in Technical Education (Computer Data Processing Technology, December 1982; Master of Science Degree in Technical Education (Computer Data Processing Technology, December 1983. Completed requirements for Doctor of Education Degree in Occupational and Adult Education, Specialization: Human Resources Development with Computer-Based Training, Oklahoma State University, December 1985.

Professional Experience: Graduate Research Assistant, School of Occupational and Adult Education, Oklahoma State University, 1983-1984; Coordinating Director/Liaison Specialist, Staff Development/Personnel/Computer Services, Franko-Franko Enterprises, Nigeria, 1980-1982; Data Processing Programmer/Analyst/Supervisor, London, 1977-1979; Programmer/Trainer, National Youth Service Corps, Nigeria, 1980-1981.

Professional Affiliation: American Society for Training & Development; Oklahoma Microcomputer Education Association; British Computer Society; Institute of Data Processing Management; Institute of Management Specialists.