

COMPUTER ASSISTED INSTRUCTION IN
HEALTH PROFESSIONS EDUCATION:
GUIDELINES FOR UTILIZATION

Dissertation for the Degree of Ph. D.
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ABSTRACT

COMPUTER ASSISTED INSTRUCTION IN HEALTH PROFESSIONS EDUCATION: GUIDELINES FOR UTILIZATION

By

John Paul Casbergue

The problem investigated in this study was to identify the most critical factors which facilitate or inhibit the development of CAI in health professions educational programs. Once these critical factors were identified, they were used to prepare a set of guidelines for health professions administrators and educators who are responsible for considering or planning for the utilization of CAI.

As a first step, the study developed a methodology which combined a modification of the Nominal Group Process method of problem identification with principles of survey research and questionnaire design.

The study was conducted in three phases. The first phase of the study consisted of the identification and prioritization of the critical factors influencing the development of CAI as perceived by CAI-experienced administrators, faculty and technical staff in three

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medical education programs that have pioneered the development of CAI in health professions education. These institutions were The University of Illinois Medical Center, Massachusetts General Hospital with Harvard University, and The Ohio State University. Separate problem identification meetings were held at each institution with the CAI planning and development faculty and staff.

The second phase of this study consisted of a mail survey to the 108 deans or directors of the institutional members of the Association of Schools of Allied Health Professions (now the American Society of Allied Health Professions) and the CAI-experienced health professions personnel from the three medical education institutions. They were asked to rate their perceived degree of cruciality of 28 factors identified in Phase I of the study.

In the third phase of the study, the data obtained from the first two phases were utilized to prepare a set of guidelines for the utilization of CAI. These guidelines were validated with CAI-experienced and inexperienced health professions administrators and faculty members.

It was concluded that there are common crucial factors across health professions educational institutions that influence the development of CAI. Among the most critical factors facilitating the development of CAI were the need for top level administrative support and

commitment to the use of CAI; the need for the faculty to be convinced of the learning benefits of CAI; and access to a reliable computer facility or system. Among the most critical factors inhibiting the development of CAI were the high initial investment required for the development of CAI; the lack of institutional administrative structure to support and develop CAI; and the lack of recognition among the faculty as to how to utilize CAI as an integral part of the curriculum.

Further, it was concluded that there is a high rate of agreement ($r_s = 0.8213$) among CAI-experienced and CAI-inexperienced health professions administrators and faculties on facilitating factors. However, there was almost no agreement ($r_s = 0.0909$) between the experienced and inexperienced personnel on inhibiting factors. One of the broad generalizations which seemed warranted from this study is that inexperienced health professions administrators may put the emphasis on the less important factors and not adequately address the factors reported as most critical by the CAI-experienced personnel.

The guidelines and over 200 factors identified as influential in the development of CAI by the CAI-experienced group provide numerous considerations for administrators contemplating the utilization of CAI.

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By

John Paul Casbergue

A DISSERTATION

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DOCTOR OF PHILOSOPHY

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1974

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1974

Dedication
to
My wife, Eugenia,
and our three children
Paul, Maria and Lisa

They provided the encouragement,
support, love, patience and understanding
that enabled me to complete this study.

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CHAPTER I

BACKGROUND

The demands for health care and health manpower are outstripping the ability of educational institutions to meet these demands with traditional educational approaches and methods (Keller, 1965). These demands, coupled with the changing roles of the health professions, and the varied learning styles of students, are creating a growing sense of the need for better educational methods. Medical education is being challenged as never before (Stewart, 1968). Educators are seeking to modify their approaches to instruction in order to improve the effectiveness of teaching and learning systems. Jason states:

Patterns and techniques of instruction which had been hallowed by decades of use are being modified and even jettisoned and the search is on for new instructional modalities which hold the promise of getting more done in less time (1968, p. 37).

Thus, the need to educate and to provide continuing education for the large numbers of people in the specialized disciplines required for the delivery of modern health services mandate the development and use of newer instructional techniques (Herskovitz and

Skolnick, 1972, p. 85). Health professions educators and administrators should be aware of the capabilities of the computer and the potential of computer assisted instruction (CAI) when seeking new techniques for improving their educational programs. The computer is becoming an increasingly significant and available tool for instruction. Hammond states:

There appears to be widespread agreement that computers have the capacity to facilitate individualized instruction and that their flexibility permits a variety of instructional strategies. Many believe that the computer has the potential to enhance the productivity of the individual teacher and improve the quality of the learning process (1972, p. 1005).

Universities are beginning to develop courses with the computer as an integral part of their instructional systems. "In the United States within a relatively short span of fifteen years, nearly all the universities and more than a third of the four-year colleges provide computing services for research and instruction (Molnar, 1972, p. 7)."

In the health professions educational programs, progress toward improving instructional effectiveness through the use of the computer and computer assisted instruction is just beginning. In a recent survey of 561 health sciences* institutions (Brigham, 1973a), over a

* Health sciences include the health professions and also dentistry, pharmacology, public health and veterinary medicine.

third stated that they were using or planning to use computerized instruction in their curriculum.

In most cases, however, this represented a small experimental teaching unit (developed by an enthusiastic faculty member) and used in a few courses. Of all the reported computerized teaching material developed in medicine, 44% was developed at a single institution and 74% of the total came from only three institutions (Brigham, 1973b, p. 186).

The apparent lack of acceptance of CAI as an educational tool in health professions education, in spite of its potential, is usually attributed to several factors. The factors most often cited are the high investment cost of CAI instructional systems, institutional resistance to change and the lack of available CAI course material. These factors, however, are only alluded to in the literature. The literature reveals a lack of empirically based evidence concerning the influence of these and other factors on the development and use of CAI in health professions education. Surely, an awareness of these factors would enable educators and administrators to plan more effectively for, and make educational decisions regarding, the use of CAI as an instructional medium (Anastasio, 1972, p. 1). Such decisions could include (1) the consideration of CAI; (2) the development and implementation of a CAI system; or (3) the utilization of CAI materials and/or systems developed at other institutions.

To assess the need for such factors in developing or utilizing CAI in health professions education, this researcher surveyed by questionnaire (Appendix C) the institutional members attending the national meeting of the Association of Schools of Allied Health Professions (ASAHP) in Houston, Texas on November 14, 1972, to determine whether identification of factors influencing the development of CAI would be helpful to educators and administrators in allied health professions programs. Of the 74 official delegates (usually the dean or director of each school) representing the 96 institutions (ASAHP membership as of November, 1972), 74 (100%) responded in the affirmative to the questionnaire. The researcher therefore felt that this response further indicated there is a need for more research relating to the factors that influence the development and utilization of computers in health professions education.

Goals of the Study

The goals of this study are: (1) to identify the critical factors which facilitate or inhibit the development and utilization of CAI in health professions education as perceived by current, experienced users of CAI in medical education and (2) to develop a set of guidelines for health professions administrators and faculty to use in planning for the utilization of CAI as an instructional medium.

It is suggested by the researcher that guidelines for planning as well as a better understanding and insight into the crucial factors associated with effective planning and utilization of CAI may provide educators with the confidence needed to consider CAI objectively as an instructional medium. Thus, the guidelines developed in the study should be helpful in facilitating planning and increasing effectiveness in the utilization of CAI in health professions education through better informed administrators and faculty. Such guidelines should also aid in reducing the negative effects of a poorly planned or improperly introduced innovation.

Limitations of the Study

The study will rely on the CAI-experienced health professions educational personnel (of which there are relatively few) for identification of crucial factors influencing the development of CAI. It will not include CAI users in elementary and secondary schools and the nonmedical areas of higher education. Second, the study will not provide an empirically tested method for decision making. Third, the study will not provide an evaluation of the effectiveness of CAI as an instructional medium, nor information on types of available hardware and software or the specific costs of installing CAI systems.

Definition of Terms

For the purposes of this study, certain terms common to the subject or methodology are defined as follows:

Allied Health Personnel.--The term "allied health personnel" includes those personnel who support and work with physicians, dentists, and nurses in the areas of patient care, public health, health research, and environmental health. Such workers function at professional, technical, or supportive levels to complement and supplement the activities of other health professionals (Allied Health Education Programs in Senior Colleges, 1971, Washington, D.C., U.S. Government Printing Office, 1973).

Association of Schools of Allied Health Professions (ASAHP).--This Association, established in 1967, consists of approximately 120 health professions educational institutions (circa January, 1974). In 1974 it was renamed the American Society for Allied Health Professionals (ASAHP). The prior name will be used throughout this report as the study was instituted and completed prior to the renaming of the organization.

Computer Assisted Instruction (CAI).--Computer assisted instruction (CAI) in this study refers

specifically to uses of the computer as a medium of instruction. It includes the tutorial, inquiry or dialogue, simulation, and problem-solving modes of instruction.

Crucial Factors.--Crucial factors include attitudes, conditions or processes which are of varying levels of importance in influencing the development or utilization of CAI in either a facilitating or inhibiting manner.

Development.--Development includes the process of considering, planning, designing, utilizing and/or evaluating CAI.

Facilitating Factor.--This is a process or condition that positively influences CAI development.

General Education Programs.--These are elementary, secondary, or college level programs other than health professions educational programs.

Guideline.--An action or function set forth as a guide to utilization of CAI based on the results of this study.

Health Professions Educational Programs.--These are college or university based programs which educate physicians, dentists, nurses and allied health personnel.

Inhibiting Factor.--This is a process, condition, or obstacle that negatively influences CAI development.

Perceived Cruciality.--The degree of importance or criticality assigned to a crucial factor.

Utilization.--The use of CAI materials that may have been developed, adapted or adopted from internal or external resources.

Order of Presentation

The literature relevant to the development of CAI and related research studies is reviewed in Chapter II. Included are studies of the development of CAI in general education and the factors influencing this development. The use and acceptance of CAI in health professions education are also reviewed. In Chapter III, the methodology of the study is described. The methodology involved three phases. Phase One consisted of group meetings at three medical education institutions with CAI-experienced personnel to identify critical factors in the development and utilization of CAI. Phase Two consisted of a mail survey to the three medical institutions and the institutional members of ASAHP to assess the perceived importance of the critical factors identified in Phase One. Phase Three included analysis of data from Phase One and

Two and the preparation and validation of guidelines for the utilization of CAI. Chapter IV presents the results and discussion of Phases One, Two and Three. In Chapter V, the study is summarized, the major conclusions are presented and recommendations for further research provided. Guidelines for the utilization of CAI are found in Appendix A.

CHAPTER II

RELATED RESEARCH

This chapter will review studies related to the following three areas:

- (1) Studies of factors facilitating the development of CAI in general education;
- (2) Studies of factors inhibiting the development of CAI in general education;
- (3) Studies of applications of CAI and of factors influencing the development of CAI in health professions education.

These areas were chosen to identify research on the factors that have influenced the development of CAI and to provide insight for health professions educators considering CAI as an instructional medium. Also, in order to limit the review of research to current materials in a rapidly changing technology, major reliance is upon materials published since 1968. Materials published earlier were reviewed and are referenced only if of special significance.

Studies of Factors Facilitating the Development
of CAI in General Education

The literature emphasizes, generally without the benefit of empirical evidence, that teachers and administrators are apprehensive toward CAI (Marolin, 1967; Cullinan, 1968; Testerman, 1973). Tuttle (1970) provides an expansive review of computer-based instruction. Three empirical studies by Christopher, 1969; Robardey, 1971; and Hess and Tenezakis, 1973, that examined the role of attitudes of teachers, school administrators and students as well as other factors that influence the acceptance of CAI as an instructional medium are discussed.

Tuttle (1970) conducted an extensive descriptive study of the historical development of computer capabilities as an educational medium from 1958 to 1968. Among his conclusions are two that are seen by this researcher as potentially influencing the acceptance of CAI. They are:

1. The teacher's role shifts "from purveyor of information and record-keeping to specialist in educational management, diagnostics, prescriptive procedure, etc. [p. 380]."
2. The student's role shifts from passive to active involvement in the educative process, and toward increasing control of teaching-learning activities [p. 381].

Although Tuttle made no prediction of any positive or negative influence, he recommended these areas be studied further to identify the effects on roles and relationships of students in learning. Further, he recommended that

studies be made to identify the problems that are encountered when CAI is implemented as a means of providing information to guide administrators in their decision making.

Christopher (1969) found from his literature review three obstacles which commonly occur in the use of computers in instruction. They are:

1. the fledgling state of the art of computer assisted instruction;
2. the necessary financial commitment required by the medium and;
3. the resistant attitudes among professional educators toward the use of mechanically controlled instruction (1969, p. 2).

He described most programs as being in developmental stages and attributed the lack of progress both to the inadequacy or lack of sufficient compatible and tested software and to the reluctance of educators to commit their resources to CAI systems which may soon be modified. But despite the decrease in the cost of utilizing computers, due to improved technology, he felt that incompatibility of hardware and software as well as competition among manufacturers were delaying the willingness for educators to make the investment required by CAI.

Christopher also stated that resistant attitudes of educators is more likely due to the magnitude of changes that CAI may cause than to the computer itself;

and he referred to the fear, apprehension, and attitudes among educators which prohibit the "intelligent investigation" of the capabilities of CAI.

As part of the same study, Christopher conducted an empirical investigation to determine if school administrators' attitudes could be affected by "an acceptable computer assisted instruction experience." He found that (1) a structured experience with CAI did cause attitudes to become more favorable toward CAI; (2) the experience caused a decreased apprehension toward CAI among school administrators; and (3) administrators who were knowledgeable of computer applications in education possessed a more favorable attitude toward CAI.

Another of the three studies examining factors influencing the development of CAI was conducted by Robardey (1971). He examined the relationships between attitude, knowledge, and other variables regarding CAI among 256 teachers and principals in one Michigan county. After an extensive survey directed at determining attitudes toward CAI, he suggested that "exposure to the computer and computer assisted instruction tends to foster a positive attitude toward this mode of instruction [p. 34]." On the basis of survey results, he concluded that there is a positive, statistically significant, relationship between knowledge and attitude in respect to CAI.

The third of the three studies included in this section was by Hess and Tenezakis (1973) who sought to examine the long-term effects of CAI on educational institutions and particularly on the role of the teacher and the attitudes of students toward CAI. This was accomplished by comparing attitudes of 189 seventh- to ninth-grade students toward CAI and other sources of information and instruction such as classroom lecture or reading. Hess and Tenezakis reported that in the eyes of both CAI and non-CAI students the computer had a more favorable image than the teacher and textbooks. It appeared that these favorable student attitudes were related to some predicted role changes of teachers and opportunities for more personal and creative instructional contact with students.

In summary, there is some evidence to support the position that knowledge of, and a positive experience with CAI will cause administrators, students and teachers to have a more positive attitude toward CAI as an instructional medium. The studies by Christopher and Robardey suggest that educational leaders within an institution who are contemplating the use of CAI should initially plan to acquaint administrators, faculty, and students about CAI through various activities such as internal or external educational workshops and provide experiences with CAI. Hess and Tenezakis' study further demonstrates

the need, as suggested by Tuttle, to recognize the implications of technological developments upon individuals and educational institutions.

Studies of Factors Inhibiting the Development
of CAI in General Education

Two empirical studies by Luskin (1970) and Anastasio (1972) sought to identify the factors that inhibit or negatively influence the development of CAI.

As evidenced in the previous studies, attitudes are a significant factor to consider in planning for CAI. Awareness of obstacles to the introduction of an educational innovation is likewise helpful to educational planners. Luskin (1970) sought to identify and to examine the obstacles to development of CAI particularly as they relate to junior colleges (Luskin included all instructional uses of computers in his definition of CAI). He conducted a series of 127 individual interviews from which he identified 22 obstacles to CAI which he then included in a survey instrument. The survey instrument was administered to 75 of the same personnel interviewed which included educators with expertise in CAI, junior college administrators, and representatives of hardware/software companies active in CAI. This survey was conducted for two reasons: (1) to classify the 22 factors (obstacles) obtained from the interviews as critical inhibitors, considerable inhibitors, or minor

inhibitors and (2) to determine when in the future these obstacles would be resolved. Of the 22 obstacles considered crucial inhibitors to CAI development, seven emerged as critical. They were:

(1) availability of individuals with appropriate component skills; (2) sufficient local funds; (3) sufficient funds for research and development; (4) attitude of faculty; (5) lack of incentives to stimulate preparation of educational software; (6) poor documentation of educational software; and (7) the existence of a communication gap between educators and representatives of industry.

Ten obstacles were reported as considerable inhibitors:

(1) high cost; (2) lack of definition of required skills; (3) lack of definition of appropriate personnel combinations; (4) inability to share developed software; (5) poor distribution mechanisms; (6) the traditional nature of education; (7) inadequate copyright laws; (8) attitude of administrators; (9) general availability of audio-visual devices; and (10) general availability of appropriate terminal devices.

Five obstacles were reported as minor:

(1) ability to choose between instructional strategies; (2) attitude of the public; (3) lack of sufficiently powerful author languages; (4) ability to measure educational effectiveness; and (5) attitude of students [p. xiv].

Luskin concluded, "The shortage of individuals with appropriate component skills is the most critical obstacle appearing in the findings of the study [p. xiv]," and that the idea of CAI may eventually win acceptance in education but it may be as late as 1988 in general education (p. xv).

A more recent study by Anastasio (1972) was undertaken to identify the obstacles to the widespread

use of computers in the instructional process and to outline strategies for overcoming the difficulties. Anastasio defined the term CAI to include all aspects of computer use in an instructional context. The study methodology utilized the Delphi technique with 30 participants from the areas of curriculum development, educational research, educational administration, law, computer science, and computer hardware and software production. Anastasio classified the inhibiting factors from the Delphi questionnaires as having the following dimensions:

1. The lack of "good readily available" CAI materials was cited as the most critical inhibiting factor.
2. The lack of demonstration capability of "high quality use" and economic feasibility of CAI.
3. The failure to recognize that CAI requires an extensive reorganization of course materials and pedagogy in order to be utilized effectively [p. 31].
4. CAI requires a high capital investment even when good cost effectiveness can be achieved in the long run [p. 41].
5. The use of CAI will require a change in the established patterns of instruction and a restructuring of the traditional role of the teacher [p. 35].
6. The design of more appropriate hardware and software systems is moderately inhibiting in the development of CAI.

In summary, the Luskin and Anastasio studies emphasize the problems inherent in introducing and developing applications of CAI in general education.

They provide the most comprehensive, empirically derived lists of obstacles to the development of CAI found in the literature. As such, they are helpful in specifying the factors and expanding the knowledge of and about the critical and less critical factors. Therefore the studies are considered quite useful to educational planners as they consider CAI. Yet, there is no reasonable way for these findings to be generalized to health professions education without further research. In the next section, the literature on research on factors influencing the development of CAI in health professions education will be reviewed.

Studies of Applications of CAI and of Factors
Influencing the Development of CAI in
Health Professions Education

In 1967, four publications directly relating CAI to health professions education appeared in the literature (Stoluwrow, 1967; Geertsma, 1967; Fonkalsrud, 1967; Starkweather, 1967). Stoluwrow states:

The health sciences and professions seemed an excellent place to start, not only because of the cost of instruction and the critical personnel shortages, but also because of the problems attendant upon the education and training of the various members of this community of specialists (1970, p. 3).

In contrast, Skolnick states:

This concept (CAI) has always been and still is full of promise, but the promise has been very slow to be fulfilled. The difficulties have

not primarily related to hardware. . . . The problem instead has been one of software, of the instructional materials and the computer program to control the new medium (McTernan, 1972, p. 43).

Four references have recently appeared in the literature which provide a more optimistic perspective and further insight into the state of the art of CAI in the education of health professionals.

In the first study, Griesen (1971) attributed the growth and positive acceptance of CAI in medical education at The Ohio State University to the fact that faculty were involved in developing concepts about CAI and its use in teaching and learning rather than just being involved in the details of computer coding. The involvement of students in education and medicine in the planning stages was another factor that contributed to the favorable response to CAI [p. 54].

Griesen also examined medical student preferences and performance in an independent study mode (in which CAI was a significant medium of instruction) versus traditional group instruction. He reported:

1. Students who elect independent study and enroll in such a curriculum display more positive reactions to their school environment at the completion of their programs than do students who complete a group instruction curriculum [p. 154].
2. Students who enroll in an independent study curriculum possess certain personality characteristics that differ from those choosing a group instruction curriculum [p. 153].

Brigham, in a Guide to Computer Assisted Instruction in the Health Sciences (1973a), provides a listing of specific current applications of CAI and a comprehensive bibliography of the CAI literature directly related to health sciences education. Brigham lists each of the 362 courses offered in 109 of the 561 schools responding to the survey. It should be noted that many of these institutions offer only one or two courses while some offer a large number. For example, The Ohio State University has 81 CAI courses in the College of Medicine; University of Kansas School of Medicine has 20; and Harvard Medical School has 38. But the number of institutions employing CAI is increasing rather rapidly. Of the 561 institutions reporting, 78 reported they were using CAI as an instructional medium; 116 anticipate using CAI; and 367 do not anticipate using CAI. Furthermore, the Lister Hill Biomedical Communications Center CAI Experimental Network (Lister Hill Network) now offers CAI to health professions educational institutions without CAI capability through a national network (Brigham, 1973a).

The rapidly increasing number of CAI users and the appearance of several articles regarding CAI in health professions education indicates CAI is an increasingly integral part of many related health professions educational programs (Ingersoll, 1974; Meyer & Beaton, 1974; Brigham & Kamp, 1974). Furthermore, a perusal of the

literature indicates that questions regarding the adoption of CAI are more of "when" and "how" rather than "if" (Hickey, 1968, p. 7).

Another reference is provided by Bitzer and Bitzer (1973) who, in an experimental study in nursing education, utilized CAI to present simulated patients to student nurses and commonly encountered questions or problems. They found that students taught by CAI learned the same materials as well or better than the control group taught by conventional classroom methods and that they learned them in one-third to one-half the time. They also stressed that CAI must be accepted by both students and instructors if it is to be of practical use. This finding is supportive of Robardey's observation in general education that acceptance of CAI is influenced by the way it is introduced and by teachers' and students' preconceived attitudes [pp. 6-7]. Bitzer and Bitzer's attitudinal studies revealed that 54% of the nursing students initially had difficulty in concentrating on the lesson because of attention needed to operate the terminal equipment. However, shifts in attitude were found by students' acceptance of CAI for learning difficult material as they became familiar with the terminals. Thus, Bitzer and Bitzer stated:

By the end of their courses, over 50 percent of students typically rate PLATO (the CAI system) as the "best," "easiest," and "most preferred"

medium over lecture, textbook or movie; while from 0 to 15 percent rate PLATO as "worst" or "hardest" to learn from. Instructor evaluation of the material was almost uniformly favorable [p. 201].

Gaston's (1972) study related students' attitudes toward CAI and their achievement in dental school tests and on the Dental National Board Examinations (DNB). He found that students who were favorably disposed toward CAI, as measured on an attitude scale, (1) achieved higher grades in the courses when CAI was used as adjunct material and (2) received higher grades in the first two years of dental school. However, he reported that the favorably disposed students who scored higher during the last two years of dental school had a lower entering grade point average than did other students. Thus, CAI was perceived by the faculty as a helpful learning resource to these students.

In summary, the literature on CAI in the health professions is mainly reports of surveys, specific activities or experiences with CAI or the viewpoints of educational leaders. Empirical studies are more recently being reported and initiated. Stolurrow and others have described the appropriateness of recognizing and exploiting the potential of CAI to assist in meeting health and educational needs. CAI's feasibility for increasing rates of learning is now being demonstrated. Yet, there is little in the literature to guide health

professions administrators or faculty in planning or decision making regarding the development and utilization of CAI as an instructional medium. However, an optimistic projection of CAI's future roles in university-based and continuing education programs for health professionals indicate an exciting opportunity for the future.

Generalizations from the Review of the Literature

The following generalizations have emerged from this review of the literature:

1. Technological developments such as CAI have implications for changes in roles and relationships of teachers and students as well as instructional design.
2. The acceptance of CAI by teachers and school administrators is strongly related to their knowledge of how CAI can be utilized in instruction.
3. Educational planners must recognize that there are cognitive and noncognitive variables which impinge on individuals' achievement in and attitude toward independent study modes such as CAI.
4. CAI is a feasible instructional medium to consider in health professions education in terms

of learning effectiveness, increasing numbers of students that can be served and the limited numbers of faculty and educational programs presently available.

5. There is a limited amount of empirical evidence defining the factors inhibiting the development of CAI in general education but no empirically based studies were found that sought to identify factors that facilitate the development of CAI.

Implications of Literature Review for This Study

This dissertation is directed at identifying critical factors which influence development of CAI and preparation of guidelines for the utilization of CAI in health professions education. The review of literature was most helpful in defining the approach of this study.

Studies by Christopher (1969) and Robardey (1971) revealed that there were positive relationships between the knowledge of and experience with CAI, and the attitudes of school administrators and teachers. These studies were helpful in raising questions as to the effects of factors other than attitude toward CAI and its adoption as an instructional medium.

Tuttle (1970) recognized the need to identify Problems in CAI planning as an aid to later planning and decision-making. Luskin (1970) and Anastasio (1972)

sought to identify inhibiting factors in general education but neither sought to identify those factors that are crucial in influencing CAI development in a positive or facilitating fashion.

The lack of any such studies in health professions education led the researcher to seek to identify both facilitating and inhibiting factors that are crucial in the development of CAI in health professions education. Tuttle stressed the need to identify problems so that administrators might be more effective by having such information and this assisted the researcher in defining the need for guidelines for the utilization of CAI as a part of this study.

Because the published literature on the factors affecting the development of CAI was too limited, particularly in health professions education, a new methodology was formulated to prepare guidelines for the utilization of CAI.

CHAPTER III

METHOD OF CONDUCTING THE STUDY

A methodology was utilized in which critical factors influencing the development of CAI were identified by CAI-experienced personnel in three medical education (ME) programs. The cruciality of these factors was then determined by both CAI-experienced and nonexperienced health professions personnel. The results and analyses of the above data were then used in preparation of a set of guidelines to aid educators in the development and utilization of CAI in health professions educational programs.

Overview of the Methodology

Phase I

The first phase of the study consisted of the identification and prioritization of the critical factors influencing the development of CAI as perceived by CAI-experienced administrators, faculty and technical staff in three medical education programs through the use of the nominal group process.

Phase II

The second phase of the study consisted of a mail survey to determine the perceived cruciality of the factors obtained in the Phase I among allied health professions educators and a rating of these factors by the ME groups. The extent of application of CAI in allied health professions educational programs was also surveyed.

Phase III

The third phase of the study was directed at preparing a set of guidelines for the utilization of CAI. The guidelines were derived from data gathered in Phases I and II, the analyses of these data, a discussion of the crucial factors identified and knowledge from related research studies that were discussed in Chapter II.

Phase I

Phase I consisted of a series of nominal group process meetings (Delbecq, 1971, & Van de Ven, 1972) with the members of the CAI development groups of each of the three medical education institutions providing ongoing programs to the Lister Hill CAI Experimental Network. These institutions are the University of Illinois Medical Center, The Ohio State University and Massachusetts General Hospital in Boston. These three institutions have the longest record of experience among the health professions institutions in CAI

development. They developed the majority of CAI programs in use by the 55 health professions institutions that were using the Lister Hill Network in 1973 when this study began.

Selection of the Phase I Participants for the Study

The researcher, with the aid of Dr. Harold Wooster, Director of the Lister Hill CAI Experimental Network, contacted the directors of the CAI program at each of the three medical institutions which provide CAI programs to the Network. The goals of the study were described and the institution's participation in the study was requested. The director of each program was asked to select no more than eight members of the CAI program development group to participate in the nominal group process meeting. (Appendix D lists the personnel from the medical education institutions who participated in the study.)

The Nominal Group Process

The nominal group process produces a prioritized listing of critical factors as ranked by the group members. Delbecq and Van de Ven have described the process as "problem" oriented. This study sought to identify factors, i.e. important variables that influence CAI in a positive or negative sense, not "problems." However,

personal communication with Delbecq confirmed this interpretation of the process as within his meaning of "problem." This method was chosen as an exploratory research tool to obtain objective and subjective responses that would be more difficult to obtain, particularly in a prioritized fashion, from interviews or questionnaires.

The Nominal Group Process as Used in This Study

Participants were presented with a Task Statement Form and were asked to "List the subjective and objective factors you have experienced, perceived or anticipate as an administrator or faculty member in planning for the use of CAI in health professions education." (The form used is found in Appendix E.) The process was first conducted for identifying facilitating factors and after a coffee break a second session was conducted for identifying inhibiting factors at each of the three institutions. Following each session, the participants' listings were consolidated for discussion. Then each participant selected and ranked the ten problems which he or she perceived as most important. (The highest ranked factor of ten factors is given ten points; the second highest, nine points, etc.) The factors were then ranked by total number of points assigned. The results were discussed and then each participant reconsidered his or her rankings and completed a second ranking. The final ranks in

this process are determined by the total points received by the ranked factors. In the final ranking step, the participants also distribute 100 points among the ten ranked factors to rate his or her perception of each factor's importance.

The distribution of 100 points among the ten factors is a modification of the process described by Delbecq and Van de Ven. They suggest having participants assign 100 points to the highest ranked problem and values between zero and 100 to the other nine ranked problems. This appeared to the researcher as an opportunity to "load" the importance that a factor might have even though the total rank points determine the final priority (a discussion of this issue is in the next section).

After all sessions were held in the three medical education institutions, the lists of factors were compared and a combination of the five highest ranked facilitating factors and the five highest ranked inhibiting factors from each institution were combined into respective lists (duplications were removed). Limiting the lists to the five highest ranked critical facilitating factors and the five highest ranked inhibiting factors by each institution was done to limit the total number of variables to be rated on the mail survey

instrument in Phase II. A composite listing of all factors is presented in Appendix F.

Comments on the Nominal Group Process

It is noted by the researcher that the ranking in the nominal group process is a step designed to provide a prioritized list and also to provide a method of determining results so that the group's areas of agreement can be indicated in a short period of time. A card sorting system and the rank-point assignment technique allows the participants to rank and also rate the items in a short period of time.

The researcher communicated with Dr. Andre L. Delbecq (March, 1973), the developer of the nominal group process, concerning the use of ranking as the final order of priority. In subsequent correspondence, Dr. Delbecq stated:

There is a great deal of debate in management science concerning the value of rank ordering versus ratings and their reliability. It's my feeling that unless one is dealing with refined areas of technical judgment that rankings are more insightful. I am not enough of a decision scientist to defend this position, but Professor Edwin Bartee has developed a long mathematical defense of the value of rankings as opposed to ratings where the issues are still exploratory (Delbecq, 1974).

In regard to the researcher's concerns about the weighting (rating) step, Delbecq stated further:

Your (the researcher's) comment concerning the possibility of individuals "loading" on one or more factors with ratings is perfectly correct.

The technique (of total rank points only) that you used is quite appropriate and your comments represent one of the weaknesses of that type of rating scale (Delbecq, 1974).

Furthermore, the researcher (after conducting this process with numerous groups who were not a part of this study) has noted that participants carefully deliberate over the first and second ranking steps. But when weighting points are assigned after the second ranking, they are done very quickly and with much less deliberation. This suggests further that the ranking step might be more reflective of the perceived importance of factors ranked. With Delbecq's comments and personal experience with the process, the researcher considers total rank points as the best evidence available for determining ranks for the final priority listing.

Phase II

In Phase II, a questionnaire developed by the researcher was mailed to the three medical education institutions (ME Groups) and to the deans and directors of the 108 institutions of the Association of Schools of Allied Health Professions (ASAHP Group). In the design of the questionnaire, the choice of whether to use a rating scale versus a ranking scale was made after consultation with Dr. Andrew Porter, Director of Office of Research Consultation, Michigan State University (April, 1973). The decision was based on the difficulty a person

encounters on ranking a large number of variables on a survey instrument (28 factors in this study) versus the relative ease for a respondent to rate each factor on a five-point scale.* A rank could then be determined based on the mean ratings of the respondents of each factor. The consultant further stated that this procedure would be more likely to obtain a more reliable reflection of the rater's true perception of the cruciality on each factor. In addition, the consultant suggested a rating procedure, as a by-product, would increase the probability that the survey instrument itself would even be completed.

The questionnaire was designed to:

- (1) Obtain a cruciality rating of each factor by the CAI experienced ME groups and by the administrators and educators in the ASAHF group;
- (2) Obtain data on the extent of utilization of CAI in allied health professions educational programs.

The questionnaire (Appendix G) consisted of two lists of randomly sequenced factors: one containing the factors facilitating development of CAI; the other containing the factors inhibiting development of CAI. A scale for rating perceived cruciality was provided. The

*This is a contrast to the nominal group process where group members in using a card sort method rank items rather easily. Further, Delbecq reports that the dynamics of the group process also motivate the individual to carefully assign his rankings.

format of the rating scale on the questionnaire is shown in Figure 3-1. Respondents checked the perceived degree of cruciality for each factor.

DEGREE OF CRUCIALITY				
Not a Factor	Minor	Considerable	Critical	I Cannot Rate

Fig. 3-1.--Format of Cruciality Rating Scale for Factors.

The ordinal values assigned were 4.0 for "Critical," 3.0 for "Considerable," 2.0 for "Minor," and 1.0 for "Not a Factor." "I Cannot Rate" was recorded as a "0" for frequency count only. The researcher utilized this category to provide a means for the rater to identify when he or she was inadequately informed on the item being rated and could choose not to rate the item. This had two purposes: (1) to identify the number of raters with this perceived lack of knowledge, and (2) to remove this rating when, during data analysis, the mean response would be calculated (the computer program adjusts the N accordingly) so that mean ratings would not be skewed by

a "0" rating. The mean ratings and frequency distribution of ratings for each factor are summarized in Tables B-3 and B-4 of Appendix B.

Phase III

In Phase III the results of Phases I and II in which critical factors were identified were analyzed. A rank order of cruciality was established by a listing of descending mean ratings for each list.

In addition, although no hypotheses had been stated in the study on the degree of agreement in perceptions of CAI-experienced and nonexperienced health professions personnel, a Spearman rank order correlation coefficient was calculated using the derived ranks of the ME group and the ASAHP group to determine whether or not there was a tendency for the ME and ASAHP groups to respond in the same way to the critical facilitating and inhibiting factors.

Utilizing the list of critical factors and analyses, the researcher grouped these factors into seven categories. This categorization and development of the discussion section of the study assisted the researcher in focusing the critical factors into a manageable number to prepare guidelines. A set of planning guidelines for the utilization of CAI in health professions education was then developed. The initial guidelines were presented to ten health

professions educators and administrators and after their suggestions as to semantic changes were incorporated and content validity confirmed, a later version was formally tested in November, 1973, with 15 members of ASAHP representing programs presently using or anticipating the use of CAI. They were evaluated against two criteria:

1. Is the language used in the guidelines understandable and acceptable to health professions administrators and faculty members?
2. Are the guidelines perceived as useful by administrators and faculty members?

The validation form is included in Appendix H.

A final evaluation of the guidelines was made during a presentation in February, 1974, at the National Library of Medicine. Attending were 25 persons including the Director of the Library, the Director and staff of the Lister Hill CAI Experimental Network, representatives from the Association of American Medical Colleges and ASAHP, and users and potential users of CAI in health professions education.

Summary

The first phase of this study consisted of critical factor identification sessions at three medical education institutions experienced in CAI. The nominal group process was utilized in this phase. A survey instrument

was developed utilizing the results of Phase I and field tested with allied health and medical education faculty and administrators.

The second phase consisted of a mail survey to determine the perceived cruciality of the factors identified in the first phase in the CAI-experienced group and the allied health professions educational programs and to determine the extent of application and experience in CAI in allied health programs. The instrument was mailed to the ME Group and to the deans and directors of the 108 institutions which were institutional members of the ASAHP.

The third phase included an analysis and discussion of the data obtained in the previous phases and the preparation and validation of a set of guidelines for the development of CAI in health professions.

CHAPTER IV

RESULTS AND DISCUSSION

The facilitating and inhibiting factors influencing the development and utilization of CAI which were identified at the three medical education institutions and those factors rated for perceived cruciality are presented and discussed. The use, and anticipated use, of CAI in allied health education is also summarized. The chapter concludes with a comparison of the findings of this study with the findings of other related studies.

Results of Phase I

The Phase I nominal group process identified the most critical factors (those facilitating and those inhibiting) influencing the development and utilization of CAI in medical education at the three institutions providing CAI programs to the Lister Hill Network. Over 200 factors were generated by the three groups. A composite list of all factors listed in the nominal group meetings are included in Appendix F. The lists of the ten highest priority facilitating factors and ten

highest priority inhibiting factors from each group are presented in Tables 4-1 through 4-3.

It is interesting to note that there are some high priority factors that are listed by all three ME institutions and several that are listed by only one ME institution. For example, "high costs of CAI" appears as a critical inhibiting factor among all three ME institutions but "Funding for CAI based on task analysis" is mentioned by only one ME institution. This suggests to the researcher that there may be factors that can be generalized across institutions but that some may be institution-specific. This is an area of inquiry suggested for further research.

Results of Phase II

Thirteen questionnaires were received from the three medical education (ME) participants (the same number that participated in the nominal group meetings). One hundred and eight questionnaires were sent to the ASAHP member schools: 103 were returned (a response rate of 95%) of which 90 (83%) were usable and included in the ASAHP group. Thirteen ASAHP questionnaires were incomplete, consequently they were not included.

Use of CAI in Allied Health Education

A total of four ASAHP institutions reported use of CAI for more than one year. These institutions used

Table 4-1

University of Illinois Medical Center, Critical
Factors in the Development of CAI
N = 3

Facilitating Factors			Inhibiting Factors		
Rank	Rank Points *	Factor	Rank	Rank Points	Factor
1	20	Top administrative support	1	26	Administrative structure restricted promotion of CAI
2.5	19	Top level health professions administrator is liaison between CAI staff and faculty	2	23	No on-going faculty-CAI staff organization exists
2.5	19	Operational computer facility available	3	16	CAI programs do not relate to existing curricula of users
4	17	Funding for CAI based on task analysis	4	13	High costs with little documented results
5	15	Joint faculty and CAI staff production and evaluation of software	5	11	Incompatibility of CAI material with educational goals
6	13	CAI is an integral part of the curriculum	6.5	10	Lack of understanding of CAI by faculty and students
7.5	10	Easy student access to terminals	6.5	10	Central computer facility is not a part of total educational program
7.5	10	Direction of CAI defined by the curricula	8	9	High operational costs
9	6	Continuous production and evaluation of CAI materials	9	7	Competition between CAI groups to promote own brand of programs
10	5	Establishment of written priorities and objectives	10	7	Cost for development of software in terms of time and resources

*cf. Chapter II, final ranking points determine final rank per published procedures.

Table 4-2

Massachusetts General Hospital with Harvard University
Critical Factors in the Development of CAI
N = 4

Facilitating Factors			Inhibiting Factors		
Rank	Rank Points	Factor	Rank	Rank Points	Factor
1	40	Adequate funds for personnel, hardware and software	1	39	High initial investment
2	31	Validated documented CAI programs available	2	30	Lack of institutional framework
3.5	29	Competent faculty and technical staff available	3	26	Lack of perceived need by faculty
3.5	29	Availability of CAI network	4	25	Inadequate evaluation mechanism for cost benefit and cost analysis
5	17	Commitment to CAI as an educational tool	5	15	Transmission problems
6	16	Reliable CAI network with guaranteed access to users	6	14	Lack of money to develop content
7	10	Availability of support personnel	7	13	Lack of validation of CAI program
8	9	CAI terminals in institutions are highly accessible to users	8	10	Nontransferability of CAI programs
9	8	Appropriate educational orientation to faculty and others	9	8	Lack of faculty commitment to schedule students for CAI
10	7	Trial use of CAI system before institutional commitment	10	7	Lack of clearly defined objectives for CAI programs

Table 4-3

The Ohio State University, Critical Factors in the
Development of CAI
N = 6

Facilitating Factors			Inhibiting Factors		
Rank	Rank Points	Factor	Rank	Rank Points	Factor
1	40	Top level administrative support	1	48	High investment costs
2.5	32	Adequate budget for implementation and development	2	34	Time investment for planning and development period
2.5	32	Qualified director of CAI	3	33	Lack of administrative support
4	23	Stable and reliable computer facility available	4	32	Faculty do not perceive proper use of CAI
5	21	Independent study curriculum in progress	5	31	Lack of adequate software
6	19	Qualified technical staff available	6	25	Cost benefits unknown
7	13	Students' interest and support of use of CAI	7	24	Unknown effectiveness of CAI instruction
8	12	Abundance of courseware	8	21	Inadequate computer compatability
9	11	Time saving for faculty	9	18	Requires large support staff
10	10	Authoring recognized as a publishing endeavor	10	15	Lack of recognition and reward system for faculty

CAI as part of their educational program. One institution used CAI only for experimental purposes.

Prior to rating the factors, the ASAHP group was asked two questions regarding the anticipated use and appropriateness of CAI for health professions education. The questions and responses are in Table 4-4.

Results of Phase III

Preparation of Guidelines

The guidelines presented in Appendix A were prepared after an analysis of the cruciality ratings by the ME and ASAHP groups of the facilitating and inhibiting factors included in the mail survey instrument. The mean ratings for each item were converted to a rank-ordered listing and the data for each group and other data from the questionnaire are summarized in Appendix B. In reviewing these data while preparing guidelines, a considerable variation was noted in the rankings of individual inhibiting factors of the ME group and of the ASAHP groups. For example, in Table B-2 in Appendix B, the medical education group lists "Cost benefits are unknown" as the least crucial of the 12 inhibiting factors rated and the ASAHP group rates this as the third most crucial factor. Another comparison reveals the medical education group's second most crucial factor is the "Lack of institutional framework for development

Table 4-4
Responses by ASHP Group on Anticipated Use and Appropriateness of
CAI in Education of Health Professionals

1. Do you anticipate that your health professions educational program will be using CAI as an integral part of your educational program in the next five years?

	Frequency	Percentage
Yes:	64	(71%)
No:	22	(25%)
No Response:	$\frac{4}{90}$	$\frac{(4\%)}{100\%}$

2. CAI is an appropriate instructional strategy to consider in the education of health professionals.

<u>Responses from ASHP Institutional Members (N=90)</u>				
	<u>Strongly Agree</u>	<u>Agree</u>	<u>Indifferent</u>	<u>Disagree</u>
Frequency of Responses	32	52	4	1
Percentage	36%	58%	4%	1%
				<u>No Response</u>
				1
				<u>Strongly Disagree</u>
				0
				0%
				1%

of CAI" and the ASHP group rates it as the least crucial inhibiting factor of those rated.

These observed differences led to analyzing the items using the Spearman rank order correlation coefficient (Seigel, 1956, p. 204). The following correlations between the ME group and the ASHP group were found:

Facilitating Factors	$r_s = 0.8213$
Inhibiting Factors	$r_s = 0.0909$

These two statistics indicate that both groups tend to rate the facilitating factors in the same way since the correlation is large and positive. Whereas, there is relatively little agreement on the inhibiting factors which have a correlation which is close to zero.*

In the development of guidelines, it becomes important not only to address those factors which are prioritized differently between the groups but also to emphasize those factors which are ranked the same between the groups. The reason for this is not to lose sight of important or highly crucial factors for CAI development merely because they do not differ between the two groups. For example, in Table B-2 in Appendix B, both groups rated "High initial investment for people, time and hardware" as the most crucial inhibiting factor in the study. This underscores the important nature of this

*0.0909 is not statistically different from zero.

factor. Therefore, not to include it or comment on it in the discussion would be a serious error since any list of recommendations for the development of CAI guidelines must include this factor.

Also, it is important to note that prioritizing within each group can lead to a misinterpretation of the data. It should be stressed that all the factors in the facilitating column and inhibiting column (Tables B-1 and B-2, Appendix B) are crucial by virtue of how these factors were originally determined (see Chapter II). Therefore, the reader should interpret each factor as necessary in the guidelines and further research can indicate which subset of these factors, if any, can serve as a sufficient core for adopting CAI.

A final point of discussion refers back to the high correlation of perceptions of facilitating factors and the low correlation on inhibiting factors. It could be suggested that since the inexperienced ASHP group perceived the facilitating factors in the same way as the experienced ME groups, that guidelines for naive health professions educators need only address the inhibiting factors, where reported perceptions differ. Thus, why bother the administrator with something he already "knows"? It must be noted that the crucial factors were identified by the CAI-experienced ME groups and then the factors were presented in an instrument

to the inexperienced group for a review and rating. The naive raters thus had the opportunity to consider a factor presented to them; they were not asked to derive the factors and then rate them. Thus, one cannot say with certainty that the high correlation on facilitating factors means that the inexperienced group would perceive or even generate these same facilitating factors if they were not suggested to them. Indeed, the low correlation on the inhibiting factors suggests the inexperienced administrators may put the emphasis on the wrong factors and not deal with the more critical factors as specified by the experienced people. This point supports, in the researcher's view, the need for guidelines incorporating both facilitating and inhibiting factors. This was further supported during the guideline validation process. The inexperienced health professions educators who reviewed the prototype guidelines included such comments as: "Yes, very helpful"; (the guidelines) raise questions we should attend to and identify the necessary support and "Yes, particularly (useful) in communicating these CAI considerations to other faculty and administrators."

The guidelines themselves are presented in Appendix A.

In the next section, a discussion of categorized factors is presented for the facilitating factors and inhibiting factors on which the guidelines are based.

Discussion of Critical Factors*

A discussion of the factors influencing CAI is included in this section and will be discussed in logical categories. There will be overlap on statements of interrelated factors where appropriate. The seven categories are (1) Attitudes (includes recognition and reward); (2) Economics; (3) Learning and Instruction; (4) Organization and Administration; (5) Personnel; (6) Software; (7) Technology.

Attitudes

Factors identified in this category include the need for faculty and student commitment to CAI and a system of recognition and reward for motivating faculty to undertake the necessary development effort in order to utilize CAI more effectively. Over 94% of the raters stated that faculty commitment to CAI was among the most crucial factors in the development of CAI. Such commitment is a critical element in (1) the objective consideration of CAI as an instructional medium, (3) the appropriate use of the medium, and (3) the determining factors

*The data from which these analyses are made are summarized in Appendix B.

in student acceptance of CAI as an effective learning medium. For, as described in the literature by Tuttle (1970), CAI will not only change the faculty member's way of teaching; it will affect his familiar way of relating to students, his relationship with peers, and his work setting. Therefore, plans to consider and diffuse an innovation such as CAI should give careful consideration to the factors of faculty commitment and how this might be accomplished.

Further, the ME groups said during their discussions that this aspect of attitude and commitment to diffusion of the innovation, CAI, if desired as an instructional medium, is one that can be considered and dealt with at the earliest stages. It does not require the capital investment, the most critical inhibitor reported, for hardware or technical staff. But it does require a planned approach to involve faculty, likely selected on the basis of openness, status, and leadership (as change agents or opinion leaders) in considering or planning for CAI. Considering the early state of the art of CAI in health profession education and the presently limited amount of software, the educational preparation of administrators and faculty may be the most promising opportunity to bring about objective consideration of CAI or other technologically based instructional media.

The aspects of recognition and reward were reported as important factors in maintaining a positive attitude and commitment toward CAI. Recognition within the institution as well as monetary and professional recognition were referred to in written comments on the survey instrument and verbal comments during the ME group meetings. Financial incentives were reported as desirable but faculty release time for development was also reported as important. But there is presently little institutional recognition of the knowledge and time commitment for CAI materials development. Recognition of CAI development efforts by a faculty member's peers and external professional groups was also found to be crucial in the ME institutions as was the need to consider the authoring of CAI materials as a publishing endeavor--an historical source of evidence of academic achievement.

In summary, the commitment of faculty and students to value and support CAI is considered a critical element in its development. This study indicated that passive acceptance of CAI will not lead to effective utilization of CAI as an integral part of the instructional systems even with financial support. In addition, there must be systems for recognition and reward of development efforts. Financial support and reward systems are needed, but

internal and external professional recognition of faculty authoring and development of CAI will increase the likelihood of continued faculty commitment to CAI.

Economics

The primary concern of both experienced and potential users of CAI was the high initial investment costs. As referenced earlier, cost effectiveness was not as critical an issue as seen by the ME group but was still important because the investment costs are a significant barrier, particularly when coupled with other activities competing for funds. But, this study revealed that experienced CAI users in medical education did not rate the inadequacies of measures of cost effectiveness and unknown cost benefits as critical as did the ASAHP group. Verbal comments by the ME users during the nominal group process meetings indicated that increased motivation and effectiveness, and increased learning rates of students were factors that had to be considered in establishing cost effectiveness. This perspective of cost-effectiveness and learning-effectiveness is particularly relevant to health professions educational programs because as described in Chapter I, increasing demands for health manpower, an increasing number of students, and a limited number of faculty and educational programs are emphasizing the need for improved effectiveness in existing teaching and learning systems. When weighing

the relative advantages of CAI, the health professions administrator must recognize the economic as well as social-organizational implications. However, due to rapid changes in technology and computer-related costs, he or she should not disregard CAI as an instructional medium because of present costs or concerns of cost effectiveness. Again, the researcher found that "Cost benefits are unknown" was the least inhibiting factor of those rated by the ME groups. But systematic analyses of the cost and learning effectiveness of present instructional methods, projections of the impact of CAI and other innovations on the educational program, and related development activities should still be a part of any effort to develop or utilize CAI on a widescale basis.

Learning and Instruction

The lack of integration of CAI into the health professions educational programs and the lack of understanding of the alternative forms of CAI were reported (by over 65% of the raters) as crucial factors that are directly related to the faculty's understanding of and commitment to CAI as a medium of instruction. These and related factors indicate the need for faculty education and understanding of CAI as an instructional medium rather than merely a technological innovation and this would include an understanding of the need for an

instructional system to be redesigned and restructured if CAI is to be used effectively. There must also be a movement from teaching-oriented pedagogy to learning-oriented approaches. In this respect, the acceptance of individualized instruction as a learning mode was rated by over 80% of both groups as a critical or considerable factor in the development of CAI.

There was also agreement among the groups that CAI would be most effective as an integral part of curricula (70% rated critical or considerable). However, verbal and written comments also support the use of CAI for remedial learning and as an optional resource for students if integration into the curriculum was not yet feasible. The somewhat limited number and types of CAI courses available make this a feasible alternative.

In summary, faculty knowledge of the instructional alternatives provided by CAI and an understanding of how to integrate CAI with other instructional modalities remain as crucial factors in the development of CAI. These factors and faculty attitudes toward CAI, which affect student acceptance of CAI, again demonstrate the need for educational planners to provide educational opportunities and demonstration as means for interested faculty to learn about and "try-out" CAI as an instructional medium before undertaking a long-range development effort.

Organization and Administration

In the perception of over 91% of the ME and ASAHF groups, the development and implementation of CAI on more than an experimental basis will require top-level administrative support and commitment to CAI in order to provide the necessary support and organizational structure. Other crucial factors were the establishment of a central office to lead, coordinate, and facilitate the development of CAI materials and the establishment of an organizational mechanism whereby faculty and CAI technical staff can work together in the development of these materials. Discussion in the ME groups suggested that this need for faculty and CAI technical staff to work together is apparently more important as CAI is being planned and implemented. Once faculty and staff understand their responsibilities, there is a decreased need for joint efforts in developing CAI programs. But continuing joint efforts were suggested for long-range planning, review of new developments, and formative and summative evaluation. Also, joint efforts were seen as helpful in keeping CAI available primarily for instructional purposes rather than solely for research and/or administrative purposes.

In summary, top-level administrative support of and commitment to CAI is necessary for its development and implementation. Cost factors and developments in

CAI technology will influence administrative decision-making; but once there is a decision to develop and implement CAI, support must be provided for educational programs for faculty, for leadership, for instructional and technical staff, and for computer-system capabilities.

Personnel

Three personnel factors emerged as crucial for the development of CAI in the ME nominal group process meetings:

- (1) a highly qualified director of CAI must be available;
- (2) a top-level health professions educator should be available to serve as liaison between CAI staff and faculty; and
- (3) faculty knowledgeable in computers and health care and an experienced CAI technical staff must be available.

There was agreement that the recruitment of a competent staff is an important element for effective diffusion of CAI. The ME groups reported most success in developing and utilizing CAI materials when the faculty did not have to become experts in the technical aspects of CAI as well as being content experts. And even in those schools where CAI is made available through a network, the availability of a technically competent

person(s) to assist faculty and students in using hardware or software was reported in discussions as highly desirable in overcoming the frustration that can occur with errors in input (or output), unanticipated disconnections, or systems failures.

Software

The availability of a large number of appropriately documented and validated CAI programs had a derived rank of three as a facilitating factor by the ME groups, but the factors more representative of the current state of development were the inhibiting factors. These are:

- (1) There is a lack of adequate software;
- (2) Available CAI programs do not relate to the curricula of most health professions educational programs.

The lack of adequate software had a derived rank of seven as an inhibiting factor by the ME group and second by the ASAHP group. It cannot be stated with any high degree of certainty, but this may be a dissemination problem as well as an actual lack of courses. The literature revealed that there are approximately 85 courses available through the Lister Hill Network. The discussions indicated that though these may be primarily for physician education, many of the programs are in the basic sciences, i.e. histology, gross

anatomy, physiological chemistry and physiology. At least part of these are potentially adaptable for health professions educational programs such as dietetics, nursing, occupational or physical therapy, or other programs. Moreover, the multitude of programs present a variety of instructional strategies available through CAI. This capability would be most helpful for demonstration or experimental applications by potential users of CAI.

The factors related to software reflect the adolescent age of CAI. The past difficulties attributed to weakness and/or complexity of programming languages are less important due to strengthening of programming capability and the use of CAI personnel to carry out the technical programming of a CAI course designed by faculty. However, the lack of programs per se will remain a problem until there is an expanded number of faculty or other content specialists involved in program design and development for the varied needs of the health professions educational programs.

Technology

The availability of a reliable computer, on-premises or by network, has a rank of first and second most critical facilitating factor by the ME and ASAHP groups respectively. The existence of a national CAI

network was perceived as slightly less crucial. The only inhibiting factor in this category was "Transmission problems cause frustration and loss of interest."

Access to a CAI system is, of course, a requisite for the operational and instructional use of CAI. The development or establishing a computer system, if not available through a network, or within an institution, can be a time-consuming and often discouraging activity. The developing technology is reducing the difficulties, but the establishment of any computer system is still a cause of concern for potential users. Experienced CAI users stressed the need for "tolerance" and "patience," and one law often referred to in this respect was "Things take longer than they do."

The primary inhibiting factor of frustration due to system failure or transmission problems is a serious one that cannot be negated simply by alluding to the early state of the art. However, experienced users emphasized that faculty and students could accept occasional problems and delays if there were an adequate orientation to this aspect of CAI and user understanding of what kinds of problems occur and why. It is for this reason that failure of the CAI or support systems during demonstrations to potential users is a major concern to those trying to introduce CAI.

Summary

Each phase of the study and associated findings were presented as they related to the identification of critical factors which facilitate or inhibit the development and utilization of CAI.

The factors were discussed in terms of (1) attitudes, (2) economics, (3) learning and instruction, (4) organization and administration, (5) personnel, (6) software, and (7) technology.

The guidelines that were developed from these factors, the discussion of these factors and past research studies, are presented in Appendix A.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER RESEARCH

This chapter will summarize the purpose and methodology of the study, present the conclusions, and make recommendations for further research.

Summary

This study had two goals (1) to identify the critical factors which facilitate or inhibit the development of CAI in health professions educational programs and (2) to develop guidelines for health professions administrators and faculty to use in planning for the utilization of CAI. The health professions educational program populations included in the study were (1) the three medical education (ME) institutions providing CAI programs nationally through the Lister Hill Biomedical Communications Center CAI Experimental Network and (2) the 108 institutions in the Association of Schools of Allied Health Professions (ASAHP).

The CAI-experienced education groups provided, through the nominal group process, a prioritized list

of the crucial factors influencing the development and implementation of CAI. Utilizing this list of crucial factors, a questionnaire was developed to (1) identify the current state of adoption of CAI in allied health educational programs and to (2) determine the perceptions of the cruciality of factors influencing adoption of CAI of the three CAI-experienced medical education programs and ASAHP institutions. The ASAHP group reported that they (71% of those responding) expect to be utilizing CAI as an integral part of their educational program within five years, and 94% agreed that CAI is an appropriate instructional strategy to consider in the education of health professionals.

Conclusions

There are two sets of conclusions in this study. The first relates to the critical factors which facilitate or inhibit the development or utilization of CAI in health professions education--the first goal of this study. These conclusions were useful in deriving the guidelines for the utilization of CAI in health professions education--the second goal of the study. The guidelines are presented in Appendix A.

The second set of conclusions is drawn from the identification and examination of critical factors influencing the development of CAI. These conclusions

provide insight into the differing perceptions of crucial factors depending on (1) the level of CAI experience of the health professions educator and (2) the perceptions of those from areas other than health professions education.

Conclusions Regarding Crucial Factors

1. THE HIGH FINANCIAL INVESTMENT REQUIRED FOR THE DEVELOPMENT OF CAI IS A PRIMARY INHIBITING FACTOR TO THOSE CONSIDERING THE USE OF CAI. These costs and the lack of evidence of documented cost-effectiveness are seen by some allied health professions educators as so prohibitive that they will not consider CAI.
2. A RELIABLE COMPUTER SYSTEM MUST BE AVAILABLE OR ACCESSIBLE FOR THE CONSIDERATION OR DEVELOPMENT OF CAI. Further, there is a need for continued development of relevant CAI software that meet the needs of the multitude of health professions curricula.
3. THERE MUST BE AN INSTITUTIONAL COMMITMENT TO THE DEVELOPMENT AND UTILIZATION OF CAI. In addition, an institutional framework or organizational structure that supports such utilization must be established. This includes recruitment and/or

development of a competent team of faculty and technical staff that can plan, coordinate and assist in evaluating any development or utilization efforts. These are critical organizational factors for any health professions educational programs contemplating the utilization of CAI.

4. THERE MUST BE EDUCATIONAL PROGRAMS FOR FACULTY, ADMINISTRATORS AND TECHNICAL PERSONNEL. Educational planners must recognize the need for faculty and administrators' awareness, knowledge and interest in CAI, prior to introducing an innovation such as CAI.
5. FACULTY MUST UNDERSTAND HOW TO INTEGRATE CAI WITH OTHER INSTRUCTIONAL MODALITIES. Furthermore, they should be aware of the various instructional strategies available through CAI. Faculty experience with learner-oriented pedagogy was found to be a facilitating factor in the acceptance of CAI as a part of health professions curricula.

Conclusions Regarding Differing Perceptions of Factors Influencing the Development of CAI

1. There is only partial overlap in both the highest priority facilitating and inhibiting factors cited by the three medical education institutions

with CAI experience. This leads the researcher to conclude that there are some institution-specific factors influencing the development of CAI.

2. CAI-experienced and inexperienced health professions educators tend to agree on perceptions of crucial facilitating factors and fail to agree on several crucial inhibiting factors.
3. The most critical inhibiting factors identified in this study are different, in part, than those reported by Anastasio and Luskin. The "lack of institutional framework for development of CAI" (rank of second most critical factor by the CAI-experienced education groups) and lack of reference to the need for "top-level administrative support" and commitment to CAI as an instructional medium are two examples. The CAI experienced medical educators view these as highly critical yet these factors are only alluded to indirectly by Luskin and not reported by those who participated in the Anastasio study. Thus, there are particular factors that are perceived differently in health professions educational institutions than those reported in studies of inhibiting factors in general education.

Recommendations for Further Research

This study has identified a number of areas which are appropriate to consider for further research. In the view of this researcher, studies in the following five areas would expand present understanding of the processes involved in: the decisions to adopt or reject CAI; the planning, development and/or utilization of CAI; and the factors influencing the development of CAI.

1. The finding that there was high agreement among CAI-experienced users and CAI-nonexperienced health professions educators on facilitating factors and a low level of agreement on inhibiting factors suggests a fruitful area of research. Further study could test the hypothesis that CAI-experienced and nonexperienced health professions personnel perceive critical factors in the same way. This study provides some evidence in this respect but the hypothesis warrants testing under controlled conditions. Similar hypotheses could be tested regarding present users of the Lister Hill Network to ascertain why some health professions educational institutions are finding high acceptance and utilization of CAI and other institutions low or lack of acceptance of the same CAI programs.

2. This study utilized the three medical education institutions who were among the most experienced in the use of CAI in health professions education as of 1973. The study developed a methodology which combined a modification of the nominal group process with principles of survey research and questionnaire design. This methodology was found to be useful in collecting data on critical factors influencing the development of CAI. This methodology could be used with other health professions educational institutions (or other types of educational systems) who are presently gaining experience in developing or utilizing CAI as a part of their instructional systems. Such an effort would expand the generalizability of the factors and/or reflect the changes that will occur in planning and decision making; software and hardware and other technological developments; in educational programs for faculty and administrators; and other such developments.
3. Further research should be conducted to determine if some factors or guidelines may be institution-specific. The lists of factors for the three CAI-experienced medical education institutions have some overlap and some unique factors. Questions can be raised as to if and why they are idiosyncratic to an institution.

4. The need for education of faculty and administrators to prepare them for CAI development and utilization was reflected in the literature and identified as crucial in this study. Alternative instructional systems need to be defined, designed and evaluated for the varying levels and needs of administrators and faculty. Such instructional systems should be designed based on researched needs, learning preferences, and performance data rather than the present method of collecting a group of experts from various educational programs and areas of industry together to lecture to interested administrators or faculty. Computer programming has often been a focus of such workshops in the past. Yet this study showed that most progress was attained when faculty were not involved in the tedious details of computer programming or coding of data.

Research and participation in development of instructional systems is, in the researcher's opinion, a responsibility and opportunity for those involved in instructional development.

5. A need exists to survey the instructional goals and problems of the medical and allied health professions educational programs to identify where and how CAI might be utilized as an

alternative instructional medium. Particular consideration should be given to the use of simulation and problem-solving experiences that might be alternatives to present clinically based experiences which are expensive in terms of time, availability, patient comfort, and financial costs. However, it is questionable whether such a survey can include those institutions with little or no knowledge of CAI.

APPENDICES

APPENDIX A

**GUIDELINES FOR THE UTILIZATION OF COMPUTER
ASSISTED INSTRUCTION IN HEALTH PRO-
FESSIONS EDUCATIONAL PROGRAMS**

APPENDIX A

GUIDELINES FOR THE UTILIZATION OF COMPUTER ASSISTED INSTRUCTION IN HEALTH PRO- FESSIONS EDUCATIONAL PROGRAMS

This paper presents a set of guidelines for administrators in health professions educational programs who are considering the use of Computer Assisted Instruction (CAI). The guidelines were developed from a study that identified the factors that were crucial to the development of CAI in medical education at the University of Illinois Medical Center, Massachusetts General Hospital and The Ohio State University. These institutions are pioneers in the development and use of CAI and they have identified the factors that facilitate or inhibit the growth and development of CAI as an instructional medium. These factors have been developed into a set of guidelines for educational planning.

The guidelines can be looked upon as actions necessary for the utilization of CAI. The items listed under each guideline are specific factors or considerations that elaborate on the action(s) stated in the guideline. These guidelines should be helpful in assisting the educational administrator in posing the question: Is this institution ready to commit its resources to the development or utilization of CAI?

GUIDELINES

GUIDELINE I. THE HIGH INITIAL INVESTMENT COSTS OF CAI MUST BE WEIGHED AGAINST THE POTENTIAL GAINS IN LEARNING EFFECTIVENESS, RATE OF LEARNING, AND OVERALL COST EFFECTIVENESS OF THE TOTAL CURRICULUM.

- A. Studies have reported increased learning effectiveness and reductions of time for learning via CAI, when compared to traditional methods of instruction.
- B. The costs of development of health professions instructional materials can be reduced through shared network systems.
- C. Instructional programs (software) can be developed for multiple purpose use with advance planning--thereby reducing overall development costs.
- D. When high initial investment costs are amortized over large numbers of students and/or long periods of time, the cost per unit of instruction compares favorably with other modes of instruction in health professions curricula.

- E. The availability of the Lister Hill Center CAI Experimental Network provides an opportunity for many health professions educational programs to utilize CAI without significant investment.

GUIDELINE II. RELIABLE COMPUTER FACILITIES AND SERVICES MUST BE MADE AVAILABLE.

- A. Access to reliable institutional facilities or access to computer facilities by telephone network (where several institutions share CAI materials) is a requisite. The crucial factor is the reliability of the system. Frequent breakdowns, delays or limited access are frustrating to users.
- B. There must be a recognition by faculty and students that CAI is in its technological adolescence and that there will be occasional system delays or failures. Recognition and acceptance of the state of the art will facilitate satisfaction in spite of occasional interruptions.
- C. The availability of computer networks is altering requirements for hardware, software and staff. The Lister Hill Center CAI Experimental Network provides an established base of CAI materials and opportunities for further development to many health professions educational programs.

GUIDELINE III. THE INSTITUTION MUST MAKE A COMMITMENT TO THE DEVELOPMENT AND UTILIZATION OF CAI.

- A. Top-level administrative support and commitment to CAI as an instructional medium are required for continued development, utilization and effective evaluation. Such support and commitment must be clearly communicated to other administrators and faculty.
- B. Support by the institution must include facilities, space, and staff as well as recognition and reward systems for faculty. Further, support must be provided for faculty to attend educational workshops or programs and to purchase appropriate reference materials. Access to resource personnel is also an effective means of demonstrating institutional commitment to CAI development.
- C. There must be an institutionalized system of professional reward and recognition of faculty involved in CAI development. Release time for faculty members has proven to be an effective means of indicating the importance of CAI to the institution.

GUIDELINE IV. THE FACULTY MUST MAKE A COMMITMENT TO USE OF CAI.

- A. There must be at least part of the faculty who value and are committed to the use of CAI as an instructional medium. This may initially be one or two faculty innovators or opinion leaders who can demonstrate to others the utility and potential for CAI in health professions education.
- B. Faculty members who are part of the on-going instructional program must be actively involved in the planning and development of CAI.
- C. CAI has been successfully developed and integrated into curricula where the faculty were given educational orientation to individualized learning and CAI. Educational workshops and other educational support must be provided and/or supported by the institution.
- D. CAI can be more readily integrated into curricula which already utilize individualized instructional modes. There are specific examples where computer-based simulations and problem-solving exercises have also proven excellent for group instruction. In this context, CAI can respond to the needs of an individual even though in a group setting.
- E. The availability of a CAI demonstration unit is a crucial element in developing awareness and interest in CAI. Faculty members and administrators need opportunities to test the capabilities of CAI and its relative advantage over other instructional media for various instructional problems.
- F. Student acceptance of CAI is dependent on acceptance and valuing by the faculty. CAI materials which have been identified as major components of a course are perceived as more valuable by students than any "optional course materials."

GUIDELINE V. THE UTILIZATION OF CAI IS FACILITATED BY DEVELOPMENT OF COLLABORATIVE EFFORTS BETWEEN FACULTY AND CAI TECHNICAL STAFF.

- A. Traditionally, faculty work as individuals in the development of instructional materials. In developing CAI programs, however, few faculty possess the technical knowledge and skills required for computerization. The production of CAI materials is best accomplished when technical staff participate in the design and development of programs--a collaborative relationship. The faculty prescribes the context, sets the objectives, and designs the instructional strategy; the technical staff works with the faculty member in these activities and then takes over the technical aspects of preparing and testing the CAI programs.

- B. Rational growth and objective evaluation are facilitated by (1) a central office or committee composed of faculty knowledgeable of computers in education, and (2) a technical staff knowledgeable in CAI to guide and coordinate development.
- C. Educational institutions developing CAI should consider utilizing internal resources such as faculty or staff from the areas of educational psychology, evaluation, instructional development and computer science. Long-term team development relationships are necessary in addition to the occasional support and guidance provided by external consultants.

GUIDELINE VI. CAI MUST BE MADE AN INTEGRAL PART OF THE HEALTH PROFESSIONS CURRICULUM.

- A. CAI is more than the use of computer-based materials to augment conventional instruction. CAI is best utilized when integrated into the total curriculum. This will require an analysis of the alternative modes of instruction for established objectives and if CAI is appropriate, it is most effective if integrated with other instructional activities.
- B. To assure proper use of CAI, the faculty must recognize the alternative modes of instruction provided by CAI. These are: tutorial, drill and practice, problem solving and simulation.
- C. Utilization of CAI is best when designed to meet the instructional objectives for a given course or curriculum. However, for demonstration purposes and experimental use, CAI materials developed for other courses may be utilized.

GUIDELINE VII. EDUCATIONAL WORKSHOPS, PROGRAMS AND PROCESSES MUST BE PROVIDED TO PREPARE FACULTY, STUDENTS AND STAFF FOR CHANGE DUE TO THE UTILIZATION OF CAI.

- A. Educational planners must recognize that the development of CAI will affect roles, relationships and settings of teachers and students.
- B. When various modes of individualized instruction and independent learning are provided, the primary contact between teachers and students may be shifted to an individual or small group basis to resolve problems or discuss materials rather than in a lecture environment oriented toward presentation of content. The implications of such shifts in roles and relationships should be well considered in light of the knowledge of the roles of attitudes and the historical resistance to change.

- C. The change in roles, relationships and settings has implications for organizational structure as well as physical design of teaching and learning facilities to accommodate such changes.

APPENDIX B

SUMMARY DATA REGARDING CRUCIALITY OF FACTORS INCLUDED IN THE MAIL SURVEY INSTRUMENT

APPENDIX B

SUMMARY DATA REGARDING CRUCIALITY OF FACTORS INCLUDED IN THE MAIL SURVEY INSTRUMENT

Tables B-1 and B-2 provide the mean ratings and ranks of the ME and ASAHP groups for the sixteen facilitating factors (Table B-1) and the twelve inhibiting factors (Table B-2) included in the mail survey instrument. A Spearman rank order correlation coefficient was determined from the ranks on each table. These correlations were:

Facilitating Factors $r_s = 0.8213$

Inhibiting Factors $r_s = 0.0909$

Tables B-3 and B-4 present the summary data of the ME and ASAHP groups from the mail survey instrument. These data include: (1) the mean ratings, (2) the standard deviations and (3) frequency distribution of the cruciality ratings on an item-by-item basis. In addition, a statistical item-by-item comparison of the mean ratings by each group was performed utilizing the Kruskal Wallis method (Kerlinger, 1973, pp. 287-289). It was determined that there was no statistical difference between the mean ratings on 24 of the 28 factors included in the survey instrument. These differences are noted on tables B-3 and B-4. These tables are included as a finding of the study for the benefit of the reader.

In addition, a comparison was made between the ratings of the four ASAHP institutions reporting more than one year of experience with CAI and those with no experience. There was no statistically significant difference between the mean ratings of the four members of the ASAHP group and the other ASAHP members so these data are included in the ASAHP group in all analyses.

Factors on which there were statistically significant differences between the cruciality mean ratings of the ME groups and the ASAHP group.

FACILITATING FACTORS

<u>Factor</u>	<u>ME Group Mean Rating</u>	<u>ASAHP Group Mean Rating</u>	<u>Kruskal-Wallis Score</u>
Faculty Commitment to CAI	3.31	3.63	3.963*
Individualized learning is an acceptable learning mode	2.85	3.23	4.481*
Faculty perceive CAI as means of saving time	2.33	2.89	5.238*

INHIBITING FACTOR

Lack of institutional framework for development of CAI	3.31	2.67	4.289*
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*Significant difference at .05 level

TABLE B-1
CRUCIAL FACILITATING FACTORS
RATED IN THE STUDY

FACILITATING FACTORS	ME GROUP		ASAHP GROUP	
	RANK	CRUCIALITY MEAN RATING*	RANK	CRUCIALITY MEAN RATING
Reliable Computer Facility Available	1	3.92	2	3.67
Adequate Funds Available	2	3.85	1	3.79
Availability of large number of appropriate CAI programs	3	3.62	6	3.45
Top level administrative support	4	3.54	5	3.54
Establishment of central office to lead, coordinate and develop CAI materials	5	3.46	8	3.24
Faculty Commitment to CAI	6	3.31	3	3.63
CAI is an integral part of curriculum	7	3.25	13	2.92
Faculty and CAI staff work together in planning and development of materials	8	3.23	4	3.57
Highly qualified director of CAI available	9	3.08	7	3.36
Funding for CAI based on task analysis	10.5	2.92	10	3.14
Students committed to and support CAI	10.5	2.92	12	2.94
Individualized learning is an accepted learning mode	13	2.85	9	3.23
Competent faculty and technical staff available	13	2.85	11	3.10
Existence of a national CAI network in health professions education	13	2.85	16	2.82
Top level health professions educator is liaison between CAI, staff and faculty	15	2.77	15	2.85
Faculty perceive CAI as means of saving time	16	2.33	14	2.89

*Cruciality Rating Scale Values:

Critical 4
Considerable 3
Minor 2

Not a factor 1
I Cannot Rate 0

TABLE B-2
CRUCIAL INHIBITING FACTORS
RATED IN THE STUDY

INHIBITING FACTORS	ME GROUP		ASAHP GROUP	
	RANK	CRUCIALITY MEAN RATING	RANK	CRUCIALITY MEAN RATING
High initial investment for people, time and hardware	1	3.54	1	3.63
Lack of institutional framework for development of CAI	2	3.31	12	2.67
Faculty do not recognize how to utilize CAI as an integral part of curriculum	3	3.23	4	3.02
Lack of perceived need for CAI by faculty	4.5	3.15	6	2.92
No on-going faculty and staff organization exists	4.5	3.15	9	2.82
There is a lack of top level administrative support	6.5	3.08	7.5	2.85
Lack of adequate software	6.5	3.08	2	3.12
Transmission problems cause frustration and loss of interest	8	3.00	11	2.72
Available CAI program do not relate to curricula of multitude of health professions education programs	9.5	2.92	7.5	2.85
Inadequate evaluation mechanisms for cost benefit and cost effectiveness analyses	9.5	2.92	5	2.99
Faculty do not recognize alternative forms of CAI (tutorial, problem solving, simulation, etc.)	11	2.83	10	2.78
Cost benefits are unknown	12	2.77	3	3.05

SUMMARY DATA REGARDING ITEM-BY-ITEM RATING OF CRUCIALITY OF FACILITATING FACTORS BY ME GROUPS AND ASAHP GROUP

ME Groups					ASAP Group					Kruskal Wallis Score
Factor+	Cruciality Mean	Standard Deviation	Frequency Distribution 0 1 2 3 4		Cruciality Mean	Standard Deviation	Frequency Distribution 0 1 2 3 4			
1	3.92	.28	0 0 0 1 12		3.67	.74	1 4 2 13 70	1.417		
2	3.85	.38	0 0 0 2 11		3.79	.41	3 0 0 18 69	0.197		
3	3.62	.51	0 0 0 5 8		3.45	.63	8 1 3 36 42	0.640		
4	3.54	.66	0 0 1 4 8		3.54	.68	1 1 6 26 56	0.006		
5	3.46	.52	0 0 0 7 6		3.24	.80	2 4 8 39 37	0.533		
6	3.31	.63	0 0 1 7 5		3.63	.59	2 1 2 26 59	3.963*		
7	3.25	.62	1 0 1 7 4		2.92	.71	11 2 17 45 15	2.205		
8	3.23	.73	0 0 2 6 5		3.57	.69	1 3 1 27 58	3.821		
9	3.08	.76	0 0 3 6 4		3.36	.71	3 1 9 35 42	1.818		
10	2.92	1.00	1 1 3 4 4		3.14	.72	12 2 9 43 24	0.489		
11	2.92	.49	0 0 2 10 1		2.94	.75	13 2 18 40 17	0.016		
12	2.85	.55	0 0 3 9 1		3.23	.80	3 4 8 39 36	4.481*		
13	2.85	.69	0 0 4 7 2		3.10	.78	3 3 13 43 28	1.764		
14	2.85	.69	0 0 4 7 2		2.82	.68	7 1 25 45 12	0.009		
15	2.77	.60	0 0 4 8 1		2.85	.79	3 2 28 38 19	0.125		
16	2.33	.65	1 1 6 5 0		2.89	.86	6 6 18 39 21	5.238*		
+Factor listed in order of Table B-1					*Significant difference at .05 level					

SUMMARY DATA REGARDING ITEM-BY-ITEM RATING OF CRUCIALITY OF INHIBITING FACTORS BY ME GROUPS AND ASAHF GROUP

ME Groups				ASAHP Group				Kruskal Wallis Score
Factor†	Cruciality Mean	Standard Deviation	Frequency Distribution 0 1 2 3 4	Cruciality Mean	Standard Deviation	Frequency Distribution 0 1 2 3 4		
1	3.54	.52	0 0 0 6 7	3.63	.51	0 0 1 30 55	0.435	
2	3.31	.48	0 0 0 9 4	2.67	1.03	12 15 13 33 17	4.289*	
3	3.23	.73	0 0 2 6 5	3.02	.83	4 5 13 43 25	0.594	
4	3.15	.55	0 0 1 9 3	2.92	.95	5 8 18 32 27	0.400	
5	3.15	.69	0 0 2 7 4	2.82	.99	0 10 17 30 23	0.982	
6	3.08	.67	1 0 2 7 3	2.85	1.04	0 11 17 26 27	0.260	
7	3.08	.67	1 0 2 7 3	3.12	.79	15 3 10 37 25	0.123	
8	3.00	.71	0 0 3 7 3	2.72	.98	26 8 18 22 16	0.781	
9	2.92	.79	1 0 4 5 3	2.85	.83	29 4 14 30 13	0.011	
10	2.92	.76	0 0 4 6 3	2.99	.81	0 3 17 37 22	0.153	
11	2.83	.72	1 0 4 6 2	2.78	.82	17 4 22 33 14	0.015	
12	2.77	.73	0 0 5 6 2	3.05	.72	17 1 14 38 20	1.893	
*Significant difference at .05 level								
†Factor listed in order of Table B-2								

APPENDIX C

PRE-STUDY SURVEY OF INTEREST IN CAI GUIDELINES AMONG ALLIED HEALTH PROFESSIONS EDUCATORS

APPENDIX C

MICHIGAN STATE UNIVERSITY EAST LANSING • MICHIGAN 48823

OFFICE OF MEDICAL EDUCATION RESEARCH AND DEVELOPMENT

FEE HALL EAST

November 14, 1972

TO: Members of Association of Schools of Allied Health Professions

FROM: John Casbergue, Member

SUBJECT: Planned study of the use of computer assisted instruction (CAI) in allied health professions education programs.

My intentions are to describe - if desired by members of ASAHP - current applications of CAI in allied health professions education programs and to identify factors that educators and administrators would find helpful in considering or planning the use of CAI.

Please respond to the following:

1. Do you feel that either of the following would be helpful to allied health professions administrators or educators?
 - a. A listing of CAI applications in allied health professions education programs ____, ____ (Please check one).
yes no
 - b. A descriptive listing of factors for considering, adopting or planning for the use of CAI ____, ____ (Please check one).
yes no
2. Would you be willing to complete a survey instrument regarding use or non-use of CAI at your institution? ____, ____ (Please check one).
yes no

Your Name

Position

Address

Please list name and position of person to whom survey instrument should be addressed if not to you.

Name	Position	Institution	Address
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Thank you.

APPENDIX D

LIST OF PARTICIPANTS FROM THE THREE MEDICAL EDUCATION INSTITUTIONS

APPENDIX D

LIST OF PARTICIPANTS FROM THE MEDICAL EDUCATION INSTITUTIONS

University of Illinois Medical Center
Center for Educational Development
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Mr. Gary G. Drennon
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Director

Ms. Barbara Farquhar
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Dr. Edward P. Hoffer
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Ms. Penny A. Prather
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Ms. Elaine Hawes
Instructor
Division of Medical Communications

Ms. Ruanne Pengov*
Director
Division of Computing Services

Dr. G. L. Trzebiatowski**
Assistant Dean

Dr. Armin Weinberg
CAI Project Director

*Participants in the Nominal Group Process Meetings Only
**Participants in Mail Survey Only

APPENDIX E

NOMINAL GROUP PROCESS

TASK STATEMENT FORM

NOMINAL GROUP TASK STATEMENT FORM

List the subjective and objective factors you have experienced, perceived, or anticipate as an administrator or faculty member in planning for the use of CAI in health professions education.

Subjective factors. (Personal feelings or emotions which were factors.)

Objective factors. (Organizational or environmental factors.)

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____

1. _____
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10. _____
11. _____
12. _____

APPENDIX F

A COMPOSITE LISTING OF ALL FACTORS IDENTIFIED AS INFLUENCING THE DEVELOPMENT OF CAI.

Facilitating Factors

Inhibiting Factors

FACILITATING FACTORS*

FACULTY COMMITMENT AND ATTITUDES

- (CAI perceived as) non-threatening mode of instruction
- Promotion of interdepartmental cooperation
- Student interest and support in use of CAI
- Uniqueness or newness (of CAI)
- Appropriate esprit de corps
- Generally innovative attitude
- Motivated and interested faculty
- Fortitude and humor in dealing with technical problems
- System non-threatening to users (working professionals)
- Open attitude (by faculty) toward innovation
- Commitment to CAI as effective (educational tool)

REWARD SYSTEM(S)

- Authoring recognized as publication endeavor
- Professional recognition of authors (within and external to institution)

EDUCATION FOR CAI

- Users (students and professionals) should have some previous orientation (education)
- Appropriate orientation to CAI (for faculty and others recognizing their individual background)

PERSONNEL

- Time saving for faculty
- Qualified technical staff
- Prior experience in CAI software
- Recruitment of aggressive and outgoing faculty to be first users
- Sufficient office and support staff (problems, responses for assistance and information)
- Availability of supporting personnel
- Personnel (technical, medical, educators) skilled in computer techniques

COMMUNICATION

- Constant feedback on the contribution of CAI in college programs to faculty, students and administrators
- CAI group have an understanding of expertise in group dynamics

*The factors are listed in logical categories and are generally as stated by group members from the three medical education institutions providing CAI programs through the Lister Hill CAI Experimental Network.

ORGANIZATIONAL STRUCTURE AND ADMINISTRATION

(CAI is a) management device
 Reports possible (for monitoring and evaluating)
 Qualified director
 Top administrative support (available)
 Defined CAI development group
 CAI staff and faculty prepare combined report on project periodically
 Written priorities and objectives reviewed after each report
 Medical faculty members (of high administration status) designated
 as liaison between CAI group and various schools
 Release faculty time
 Develop inhouse CAI teams consisting of faculty, content persons
 programmers and professional educators
 Presence of division or office of medical education. (A central educational
 office to facilitate educational development of CAI--to coordinate, lead,
 catalyze, engender and reward.
 High level enthusiastic leadership and support at using institution
 Imprimatur of authority (credible source)

ECONOMICS

Funding for CAI based on task analysis
 Common CAI funding available to support CAI group and medical faculty
 Ongoing cost effectiveness studies for administrators
 Delineation of operating budget and development budget
 Budget (available for implementation and development)
 Consistent moderately increasing funding
 Trial use before institutional commitment. (Does not require
 large capital outlay to try CAI)
 Network availability (reduction of cost)
 Money: Personnel, Computers, Terminal

PHYSICAL FACILITIES

Operational computer facility available
 Easy student access to terminals
 Stable and reliable computer facilities available
 Central facility in institution with high accessibility to users

CURRICULUM

Total integration of CAI into curriculum
 Direction defined by curriculum
 Ability (for CAI) to be component of learning packages (curriculum)
 Independent study curriculum in progress
 Tie-in available between CAI and ongoing curriculum
 Accommodates expanded enrollment

LEARNING

Interactive learning situation
 (CAI has student performance) diagnostic capability
 Student independence
 Program evaluation facilitated

LEARNING (cont.)

- Accommodates various learning rates or patterns
- Immediate feedback to student
- Private learning situation
- Improved learning
- Student progress measured
- (CAI) material should make learning fun

SOFTWARE

- CAI program design flexible
- Sharing of materials with other institutions
- Programs easily revised
- Abundance of courseware
- Ability for system modification (built into system)
- Validated, documented programs available

HARDWARE

- Stable and reliable computer equipment
- User oriented terminals
- Standardization of hardware and software materials

OPERATION OF SYSTEM

- Fieldworkers (available to work with faculty and student users)
- Program design flexibility
- Ongoing CAI-faculty production and evaluation of materials
- Reliable network with guaranteed access by user

INHIBITING FACTORS

FACULTY COMMITMENT AND ATTITUDES

Dehumanization via CAI

(Perception that) technology leads to dehumanization (Comment: contributor said this perception easy to deal with through discussion but most inhibiting until resolved)

Fear of change

Rapid technological change

Lack of personal contact for user (with system and people)

Negative reaction to automation

Medical profession grandiosity

M.D.'s mistrust of educators and (educators') methods

M.D.'s resistance (fear) of computers in medicine

Faculty fear loss of identity in professional role (on-campus) and in their professional organizations)

CAI groups feeling of loss of controls as faculty get involved

Negative faculty bias toward computer staff

Demoralization effect of faculty and administrative resistance

Fear of machine taking over teaching

Fear of medical faculty that CAI group is taking over teaching of medicine

Fear system will replace faculty

Fear of high student acceptance of CAI (Comment: faculty fear students positive response to CAI--see themselves being replaced)

Student and faculty response to anything less than perfection (Varying) attitudes among M.D.'s of CAI's usefulness and return on time invested (in development)

"Developmental Elitism" (Comment: snob effect of those perceived as experts--faculty and support staff)

Fear by M.D.'s of having lack of knowledge (content or judgment errors) exposed by CAI

M.D.'s fear of exposing lack of knowledge to "Central databank" (accessible to administrators, peers)

Fear of performance being known (to student and administrators) (Comment: faculty aware that errors will be made fear errors being known)

Fear of exposure of ignorance (about CAI)

Fear system will not be used (Comment: after developed at high costs)

Perception of flashy toy orientation

Attitudes toward rigidity of (CAI) programs

Demonstration (of CAI) failures (and subsequent negative effect on faculty, administrators and students)

REWARD SYSTEMS

- Lack of appreciation of faculty time investment
- Problems of ownership and copyright (of CAI materials)
- Recognition (reward for faculty) for effort
- Lack of institutional reward system for (CAI course) content development

EDUCATION FOR CAI

- Lack of cognition (understanding) about CAI by student and faculty
- Education of student user (in learning via CAI)
- Lack of instruction and instructional materials available to (teach) authors (about) CAI
- Ignorance of system capability
- Outsiders telling faculty how the computer can be used (results in demands that can not be met)
- Lack of understanding of limitations and abilities of computer
- Lack of knowledge of CAI by medical educators

PERSONNEL CONSIDERATIONS

- Requires (large) support staff
- Lack of available competent faculty for development
- Lack of competent technical personnel (Comment: refers to data processing staff-- not well informed on CAI as computer application (versus business accounting etc.) and role in instruction)
- Equipment orientation of CAI staff

COMMUNICATION AND DISTRIBUTION

- Language differences in terms of computer, educational personnel and content personnel
- Inadequate public relations
- Lack of appropriate fieldworkers (for disseminating CAI)
- Credibility of (CAI) provider
- Communication difficulties between providers and users
- Non-transferability of CAI materials (programs etc.)

ORGANIZATIONAL STRUCTURE

- Lack of institutional framework for implementing (CAI) at user institution (including personnel)
- Lack of control (policy for control)
- Lack of administrative support
- Lack of adequate leadership in CAI development
- Interorganizational conflict (Comment: refers to data processing staff, educational programmers, faculty and support staff)
- Inadequate organizational structure
- Lack of support or positive attitude toward CAI by support groups (EDP, media etc.)
- Responsibility for updating (of CAI instructional programs)
- Narrow base of (CAI) user support (Comment: too few areas involved, need broader base)
- Isolation of professional groups

ORGANIZATIONAL STRUCTURE (cont.)

Central computer facility not a part of total education program
 Competition between CAI groups to promote their own brand of programs
 No ongoing faculty--CAI staff organization
 Administrative structure in college of medicine restricts promotion of CAI
 Resentment of medical faculty toward the organization in which CAI
 is housed

ECONOMIC

Great cost with little documented results
 Cost for development of software in terms of time and resources
 Fear of uncontrolled computer investment
 Non-college sources of funding
 High ongoing cost
 Cost as compared by the faculty to other needs
 Competition for funds--CAI vs. other demands for resources (Comment:
 CAI is an "add-on" expense to other expenses)
 Cost benefits (unknown)
 Cost of development (of CAI)
 Money to develop content
 Initial investment--People's time, equipment
 Clinical investment cost
 Inadequate evaluation to determine cost-benefit and effectiveness

PHYSICAL FACILITIES

Inadequate physical facilities
 Inadequate number of terminals
 Inadequate number of computer ports (the computer can not serve
 enough terminals at one time)
 Inappropriate location of terminal (accessible to users)

CURRICULUM

Lack of systematic curriculum planning
 Lack of clearly defined objectives in CAI programs
 Poor communication of course content (to students, faculty and others)
 No opportunity for group interaction (for learning)
 Overuse (of CAI as instructional method) reduces student enthusiasm
 (Comment: students want varied learning modes)
 Lack of perceived need by medical educators
 Difficulty in changing teaching methods
 Lack of orientation (of CAI) toward learning (Comment: refers to
 preoccupation with teaching student versus assisting him/her in
 learning and also of use of CAI for learning other than evaluation
 or other)
 CAI programs do not relate to the existing curriculum of various schools
 Lack of faculty commitment to schedule students (for CAI)

CURRICULUM (cont.)

Integrating CAI into course vs. supplementing (role)
 Alternative methods (of instruction) more accessible
 Unclear definition of role of CAI in instructional process
 Inability to integrate CAI into total instructional process
 Incompatibility of materials with educational goals
 Faculty do not perceive proper CAI utilization (Comment: do not understand alternative forms available and how to integrate as a part of instruction rather than all or nothing)

LEARNING AND INSTRUCTIONAL DEMANDS OF CAI

Complexity of "good" courseware (Comment: referred to need for authors to be well informed on learning theory, reasoning and problem solving processes, alternative learning strategies etc.)
 Very inhibiting if faculty is required to program (the instructional material)
 Faculty frustration because of need for accuracy, detail (in preparing CAI materials) (Comment: not able to "play by ear", can not respond on their feet as they can in lecture or seminar. Must be all planned ahead)
 Difficulty for faculty to author effective CAI programs
Question format is "inhibiting", (Comment: perception that continuous asking for learner to respond to questions is more inhibiting than problem solving, simulation etc.)
 Lack of creativity (in present CAI programs)
 Improper use of CAI (Comment: as page turner, better or more appropriate media available etc.)
 CAI is perceived as same as programmed instruction
 Language deficiencies for faculty instructional needs
 Requires other media (as a part of CAI instructional materials)

SOFTWARE AND CONTENT OF CAI

Sloppy medical content of material
 Conflicts within professional groups on content and theory
 Disagreement among educators regarding program content and subject matter (includes varying view points or opinions)
 Differences in institutional techniques (differences in diagnostic procedure)
 Fear of content error due to system (Comment: referred to error by educational programmer - typing or other that would distort or invalidate intent of faculty - crucial for medical procedures and instruction to physicians using system for service or continuing education)
 Sloppy programming
 Computer's inability to respond to legitimate unanticipated (user) input
 Lack of (adequate) software-programs and courses
 Incompatibility of system and programming languages
 Unknown effectiveness (of CAI instruction)
 Lack of validation of CAI Programs

HARDWARE

- Inadequate computer capability
- (Computer) terminal characteristics
- Terminal slowness (and response lag)
- Networking problems
- Mechanical and programming failures
- Transmission problems
- Incompatibility of CAI equipment

PLANNING

- Inaccessibility to CAI planning by faculty
- Lack of easy involvement in implementation by faculty
- Time investment (Comment: referred to total planning and development period)
- Develop CAI vs. buy? (Purchase CAI materials from other developers and suppliers?)

DEVELOPMENT

- Lack of qualified faculty
- Premature involvement--system development takes too long for faculty
(Comment: faculty are involved early and eagerly await or participate in development-- are disillusioned by long development period)
- Rapid increase in demand for new materials as the program catches on
- Impatience with time for development efforts

IMPLEMENTATION

- (Lack of) vendors cooperation and coordination
- Service and repair (problems)
- Prime time scheduling (Comment: CAI most needed during normal working hours--other computer users competing)
- Unscheduled down time in system
- Lack of fast and appropriate feedback on CAI utilization

HUMAN FACTORS

- Propensity of faculty to lecture
- Feedback (mechanism) from student user to (developers of) "system"
- Difficulty of user input (typing problems)
- Hardware problems turn off many individuals (including breakdowns)
- Love of computer jargon; love of medical jargon

APPENDIX G

**MAIL SURVEY INSTRUMENT
AND LETTERS OF TRANSMITTAL**

OFFICE OF MEDICAL EDUCATION RESEARCH AND DEVELOPMENT
FEE HALL EAST

May 14, 1973

Dear _____:

Consideration of the potential impact and implications of computer assisted instruction (CAI) is a current topic of discussion among many health professions educational planners. I am conducting a study to identify the factors influencing the consideration or planning for the use of CAI in health professions education. This study comes as demands for health manpower are increasing and funds for education are increasingly limited. Alternative forms of instruction are being considered as well as means to increase the productivity of educational systems for health professionals.

The perceptions of the value of CAI range from very optimistic projections to extreme pessimism about CAI's ability or potential to assist in meeting educational needs. The literature reveals that few feel that the development of CAI will be simple or readily accepted. Attitudes and perceptions of administrators, faculty members and students are factors that influence the acceptance or rejection of any educational innovation.

From this study, guidelines will be developed to facilitate understanding of planning factors and hopefully reduce the difficulties in dealing with the factors that are identified. All of the institutional members of ASAHP attending the meeting in Houston responded to a questionnaire and reported that planning guidelines for CAI were needed and agreed to participate in this study. This and subsequent support from ASAHP officers and fellow members has encouraged me to proceed. I am now seeking your personal assistance. Enclosed is a questionnaire that asks for some institutional information regarding CAI and a rating of factors that may be influential in considering and/or planning for CAI.

Because time is a critical factor in this study and your response is most important, your earliest attention is requested. A self-addressed air mail stamped envelope is enclosed.

I appreciate your participation and will be certain that you receive a copy of the results of this survey of ASAHP deans and directors.

Best wishes and thank you for your help.

Sincerely yours,

John Casbergue
OMERAD Fellow

JC/js

Enclosures: Questionnaire 91
Stamped return envelope

ASSOCIATION OF SCHOOLS OF ALLIED HEALTH PROFESSIONS

One Dupont Circle, N.W., Washington, D.C. 20036 Telephone: (202) 293-3422

Executive Director
WILLIAM M. SAMUELS

MEMORANDUM

TO: Institutional Membership

FROM: William M. Samuels

RE: Computer Assisted Instruction Project

At the ASAHP annual meeting last November in Houston, John Casbergue spoke to the Institutional Membership regarding a proposed project to identify the factors influencing the consideration of and/or planning for computer assisted instruction (CAI) in allied health professions educational programs. With these factors now identified, planning guidelines for administrators and faculty will be developed.

Such guidelines (based on the experience of those with established CAI instructional systems and knowledge of computers and the diffusion processes) should facilitate planning and improve our decision making capability regarding the consideration of CAI or other educational innovations. The members present in Houston unanimously agreed such a study would be helpful to allied health education and urged John to continue.

The enclosed research instrument is our opportunity to participate in this effort. This and future studies in allied health education should be of value in planning and developing educational programs. Please give this your earliest consideration and return the instrument to John.

By the way, John is an ASAHP member and is on leave from his position as associate professor in the School of Allied Medical Professions at Ohio State University. He is completing his Ph.D. in instructional development and technology in medical and allied health education at Michigan State University. Should you have any questions please feel free to contact John at the Office of Medical Education Research and Development, Fee Hall East, Michigan State University, East Lansing, Michigan 48823.

WMS/ss

President

RAYMOND C. BARD, Ph.D.
MEDICAL COLLEGE OF GEORGIA
AUGUSTA, GEORGIA

President-Elect

LOUIS A. REIBLING, R.T., Ph.D.
BELLEVILLE AREA COLLEGE
BELLEVILLE, ILLINOIS

Secretary-Treasurer

J. RHODES HAVERTY, JR., M.D.
GEORGIA STATE UNIVERSITY
ATLANTA, GEORGIA

Immediate Past President

AARON L. ANDREWS, M.P.H.
FERRIS STATE COLLEGE
BIG RAPIDS, MICHIGAN

OFFICE OF MEDICAL EDUCATION RESEARCH AND DEVELOPMENT

FEE HALL EAST

June 6, 1973

Dear _____:

On May 16, I sent a letter and questionnaire asking for your perception of factors influencing the adoption of computer assisted instruction (CAI) in allied health professions educational programs. I know this is a very busy time of the year with school terms ending, reports being due, and that sometimes mail goes astray. I have taken the liberty of sending another copy of the questionnaire in case the first did not reach you. If you have already responded to the previous questionnaire, please disregard this request - and, thank you.

The Association of Schools of Allied Health Professions has been most supportive of the study and I would like very much to have your participation as dean or director of an allied health educational program. If you are not using CAI, the questionnaire will only take five to seven minutes to complete. The factors that are identified as critical in adopting CAI will be examined in light of current knowledge of CAI, planning and decision making.

The major benefit will be a set of guidelines for administrators and faculty of schools in allied health education that have not yet become involved with CAI. This was, as noted in Bill Samuel's letter, viewed as a significant need by the institutional members of ASAHP.

If you will return the completed questionnaire in the pre-addressed stamped envelope, your important contribution will add much to the study. Your participation is appreciated and I will be certain that you receive a copy of the findings from the survey.

Best wishes and thank you for your help.

Sincerely,

John Casbergue
OMERAD Fellow

JC/js

cc: William Samuels

A STUDY OF THE FACTORS INFLUENCING THE DEVELOPMENT OF
COMPUTER ASSISTED INSTRUCTION IN HEALTH PROFESSIONS EDUCATION

This instrument has two parts:

PART I: INSTITUTIONAL INFORMATION ON THE USE OR NON-USE OF CAI

PART II: GENERAL QUESTIONS AND A RATING OF ITEMS THAT MAY OR MAY
NOT BE FACTORS INFLUENCING THE DEVELOPMENT OF CAI

Confidentiality of responses will be maintained.

Please proceed through the instrument in the sequence presented. There
are some parts that may be omitted based on your responses.

Please return the completed instrument in the enclosed stamped envelope
by May 25, 1973.

Thank you for your cooperation.

Definitions of terms as used in this study

1. Computer assisted instruction in this study is limited to the use of
the computer as the medium of instruction. This includes the tutorial,
inquiry or dialogue, simulation, and problem solving modes.
2. Diffusion is the process by which new ideas are communicated and spread
to the members of a social system. This includes the process of
identifying factors that affect adoption or rejection of new ideas
or innovations.
3. Critical factor is defined as a condition or process which under pre-
vailing conditions influence acceptance to the extreme.
4. Health professions education programs in this study refer only to those
related to allied health programs (not programs for physicians or
dentists). Your institutional membership in ASAHP has defined your
program within this definition. (A similar study may be conducted at
a later time among educational programs for physicians, dentists,
nurses and pharmacists.)

PART I: INSTITUTIONAL INFORMATION ON THE USE OR NON-USE OF CAI

1. Name: _____
2. Position or title: _____
3. Name of institution: _____
4. Which of the following do you consider most descriptive of your position or activities? (Please check the most appropriate response).
☐ Administrator ☐ Faculty Member ☐ Other, please specify _____

USE OF CAI AT YOUR INSTITUTION

(Please check the most appropriate response or fill in requested information).

5. CAI has been used in our health professions educational program. (If checked no, please go to PART II; if yes, please continue). ☐ Yes ☐ No
- 6 a. We have utilized our own computer facilities. ☐ Yes ☐ No
- 6 b. We have utilized computer facilities and CAI programs from other institutions via computer terminals and/or telephone lines or networks. ☐ Yes ☐ No
- 7 a. On-going CAI programs are an integral part of our instructional programs. ☐ Yes ☐ No (If no, go to question 8., if yes, please continue).
- 7 b. How many CAI programs are in regular use by students in your health professions educational program?
☐ (1-5) ☐ (6-10) ☐ (11-15) ☐ (More than 16)
 If yes, approximately how long has your institution had CAI as an on-going part of your educational program?
☐ (Less than 1 year) ☐ (1-2 years) ☐ (2-3 years) ☐ (3 or more years)
8. CAI has been used only for experimental or demonstration purposes.
☐ Yes ☐ No
 If 8. is yes, for how long?
☐ (Less than 1 year) ☐ (1-2 years) ☐ (2-3 years) ☐ (3 or more years)

THIS IS THE END OF PART I

PART II: GENERAL QUESTIONS OR COMMENTS

1. Do you anticipate that your health professions educational program will be using CAI as an integral part of your educational program in the next five years? ____ (yes), ____ (no).

Any reactions or comments?

2. CAI is an appropriate instructional strategy to consider in the education of health professionals. (Please check the most appropriate response.)

Strongly agree	Agree	Indifferent	Disagree	Strongly disagree
----------------	-------	-------------	----------	-------------------

3. Has your institution utilized CAI as an on-going or experimental program and has it discontinued such use? ____ (yes), ____ (no).

If yes, would you briefly describe the reasons why CAI was discontinued:

PART II: RATING INSTRUMENT OF FACTORS THAT MAY INFLUENCE THE DEVELOPMENT OF CAI IN HEALTH PROFESSIONS EDUCATION

After reviewing the literature and interviewing persons associated with the educational institutions contributing CAI programs to the Lister Hill National Center for Biomedical Communications CAI Experimental Network, a number of factors were identified. These factors have been categorized as facilitating or inhibiting in the development of CAI.

Please give your perceptions regarding the cruciality of these factors by checking the box that most reflects your feeling of degree of cruciality. The list of items were prepared as a basis for this study and is not in any way to be restrictive. Please add any items you consider critical in the space provided at the end of each list.

Thank you for your continuing cooperation.

Facilitating Factors

97

	DEGREE OF CRUCIALITY				
	Not a Factor	Minor	Considerable	Critical	I Cannot Rate
Availability of a large number of documented (well described) and validated (tested, with known effectiveness) CAI programs related to health professions education.					
The students are committed to and support CAI as an effective way to learn.					
A reliable computer facility is available.					
Establishment of a central office or division to lead, coordinate and facilitate development of CAI materials (includes faculty, development, evaluation and technical personnel from various sections or departments with some full time positions).					
Individualized learning is an accepted learning mode in curriculum.					
Highly qualified director of CAI available. (Knowledgeable and experienced in education, technical aspects of CAI and administration.)					
Faculty and CAI staff work together in planning and development of CAI materials.					
Existence of a national CAI network with CAI programs in health professions education content areas available to institutions without CAI capability. (Requires only computer terminals that can be linked by phone to large CAI computer systems located elsewhere.)					

Facilitating Factors

98

DEGREE OF CRUCIALITY				
Not a Factor	Minor	Considerable	Critical	I Cannot Rate

Top level health professionals educator is present to serve as liaison between CAI staff and academic departments, schools or other CAI user institutions.

CAI is an integral part of the health professions educational program.

--	--	--	--	--

Adequate funds are available for personnel, computer hardware, development, and operating costs.

--	--	--	--	--

The faculty are committed to and support CAI as an instructional medium.

--	--	--	--	--

Competent faculty and medical personnel who are knowledgeable in computers in medicine and technical staff who are experienced in CAI are available.

--	--	--	--	--

Funding for CAI efforts based on task analysis of educational needs.

--	--	--	--	--

Top level administrative support of CAI as an integral part of educational program.

--	--	--	--	--

The faculty perceive CAI as a means of saving time for student and teachers.

--	--	--	--	--

What other facilitating factors would you add to the list?

1. _____
2. _____
3. _____
4. _____

Of those factors which you rated or listed above, which do you consider to be the most critical?

(Write in here please) _____

General ~~commen~~ts - please ~~commen~~t freely:

Inhibiting Factors

100

	DEGREE OF CRUCIALITY				
	Not a Factor	Minor	Considerable	Critical	I Cannot Rate
High initial investment costs are required for people, time and hardware.					
Inadequate evaluation mechanisms exist for cost benefit and cost effectiveness analyses.					
Cost benefits are unknown.					
Available CAI programs do not relate to curriculum of multitude of health professions education programs.					
Faculty do not recognize alternative forms of CAI.					
There is a lack of top level administrative support.					
No on-going faculty and CAI staff organization exists.					
There is a lack of institutional framework for development of CAI.					

Inhibiting Factors

	DEGREE OF CRUCIALITY				
	Not a Factor	Minor	Considerable	Critical	I Cannot Rate
Lack of perceived need for CAI by health professions educators.					
There is a lack of adequate software - programs and courses.					
Transmission problems cause frustration and loss of interest.					
Faculty do not recognize how to utilize CAI as an integral part of instructional system(s).					

What other critical inhibiting factors would you add to the list?

1. _____
2. _____
3. _____
4. _____

Of those factors which you rated or listed above, which do you consider to be the most critical?

(Write in here please) _____

General comments - please comment freely:

You have completed the survey instrument. A summary of responses will be forwarded to you as soon as the data are compiled and analyzed.

Thank you again for your cooperation.

John Casbergue

APPENDIX H

EVALUATION FORM FOR
PROTOTYPE CAI GUIDELINES

APPENDIX H

These guidelines for the development of CAI are a prototype and I would like your evaluation of their usefulness to you as a medical educator who might want to consider CAI as an instructional medium.

Would you please respond to the following questions:

1. Were the terms used appropriate and understandable?

YES NO

If no, what terms were unclear? _____

2. If you were to be considering CAI, would these guidelines be helpful?

YES NO If no, what problems did you note? _____

3. If the check list questions were available with a weighted scoring system, would it be helpful in aiding you in the consideration of CAI?

YES NO

Comment? _____

4. Please offer any comments or suggestions you have regarding the guidelines and what you would find more helpful. _____

Thank you.

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