COMPUTER-ASSISTED INSTRUCTION: A STRATEGY FOR TEACHING SCHOOL TEACHERS ABOUT DIABETES

by

Jeanette Louise Priest

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Vonna Koehler — November 27 1996
Vonna Koehler, Ph.D., R.N. — Date
Committee Chairperson

Approved for the Major Department

Kathleen Chafey — November 27, 1996
Kathleen Chafey, Ph.D., R.N. — Date
Head, Major Department

Approved for the College of Graduate Studies

R A Brown — 12/15/96
Robert L. Brown, Ph.D. — Date
Graduate Dean

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Signature Jeanette Louise Priest

Date November 14, 1996

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ABSTRACT

Computer-assisted instruction (CAI) has evolved as an effective instructional tool. However, there is an inadequate amount of research on the use of CAI to specifically teach diabetes concepts to school teachers. Owing to the chronic daily rigors of caring for a child with diabetes and the scarcity of available school health care providers, it is likely that school teachers will be involved in observing or monitoring some aspect of the child's diabetes self management.

The purpose of this project was to create the prototype of a computer-assisted instructional program that addressed two key diabetes concepts: disease process and hypoglycemia. The theoretical perspective of the project was guided by Knowles' adult learning theory. The intention of the project was to help fill a gap in the knowledge base of school teachers and assist in promoting teacher competency in successfully coping with the child with diabetes in the rural school setting.

The project was developed using Apple's HyperCard software and utilized two design modes: tutorial and case study simulation. Results of field testing the CAI revealed that school teachers had positive experiences with the use of CAI for learning about diabetes. As nurses respond to the demands of providing public education, such as providing school teachers with basic diabetes education, the computer should be considered an appropriate and effective medium in the education process.

CHAPTER 1

INTRODUCTION

Statement of the Problem

Diabetes Mellitus is a chronic, lifelong disease that has the potential to affect people of every race, ethnic origin, sex, or age (Fain, 1993). Diabetes is characterized by inadequate quantities of insulin which leads to disturbances in carbohydrate, protein, and fat metabolism (Plawecki, Krueger, & Plawecki, 1986). As a clinical entity, diabetes is a disorder that affects virtually every organ in the body and is associated with degeneration and destruction of the blood vessels, the nervous system (neuropathy), the supporting and structural tissues of the eye (retinopathy), and the kidney (nephropathy) (Fain, 1993).

The National Diabetes Data Group developed a classification of Diabetes Mellitus. In 1979, the World Health Organization endorsed this classification which divided diabetes into two groups: Type I insulin dependent Diabetes Mellitus (IDDM) and Type II non-insulin dependent Diabetes Mellitus (NIDDM) (Fain, 1993).

In people under the age of 20 in the United States, diabetes incidence is approximately 12 to 14 new cases per 100,000 people (Fain, 1993). In people under the age of 20 in the United States, there are about 1.7 cases of insulin-dependent (Type I) diabetes per 1,000 persons. In addition, there are also

more than 123,000 children and teenagers with diabetes in the United States today (American Diabetes Association, 1993). Type I diabetes accounts for approximately 3% of all new cases diagnosed each year in the United States and affects approximately one out of 600 school-aged children (Balik, Haig, & Moynihan, 1986).

Because insulin dependent diabetes predominately affects children and young adults, the goal of health care services in the school is to promote optimal student wellness, thereby enhancing the educational program of the student. It is critical that a student's diabetic health problem be identified as it directly influences the student's educational program (Passarelli, 1994).

The school setting poses special challenges for children with diabetes, their parents, and school personnel (Balik, Haig, & Moynihan, 1986). For the school-aged child with diabetes, full participation in school is essential for achieving a complete sense of well being and minimizing a sense of being different. Parents fear a loss of control when the child spends a large portion of the day away from home. Parents sometimes have concerns about the teacher's ability to work with their child with diabetes. Hodges and Parker (1987) found that 63% of parents with children with diabetes did not believe that teachers were informed enough to provide safe care for those children in the classroom. A legitimate fear of both parents and children is that there will be no one in the child's classroom informed enough to cope with diabetic emergencies (Hodges & Parker, 1987; Lindsay, Jarrett, & Hillam, 1987). Furthermore, children with diabetes often have to work through this uneasiness each year as they enter

school because they will frequently have a new teacher (Clark, Plotnick, Wessel, & Zyna, 1992; Krauser & Madden, 1983).

Likewise, a teacher's anxiety level may be heightened as he/she accepts a child with diabetes into the classroom (Krauser & Madden, 1983). School personnel are frequently unsure about their responsibilities toward a child with diabetes. The response of school staff varies from minimal support to over-involvement. Providing information for teachers regarding the disease and symptom management enhances a child's school experience and reduces teacher anxiety (Balik, Haig, & Moynihan, 1986). The overall goal of educating school personnel about diabetes management is to ensure greater safety and physical, social, and emotional support for children with diabetes in the school environment (Henderson, 1993).

Background and Significance of the Project

In many rural areas, school nursing services are not available on a daily basis. Economics play a major role in the provision of school nursing services. Funding for school health services, which include nursing personnel, is generated from education dollars set aside by the rural city/county budget. The number of school nurse positions is often determined by the availability of budget monies rather than by student or community health care needs. In rural areas there is an ever-present scarcity of human and financial resources (Iverson & Hays, 1994; Passarelli, 1994).

In sparsely populated states such as Montana, several factors contribute to the need to provide education to school teachers regarding diabetes. The factors

include geographical isolation, scarce financial resources, inadequate numbers of school nurses, limited free time for teachers, and inadequate levels of diabetes education available to school systems (Robbins, 1981). Effective education on the subject of diabetes must be done without making increased demands on the school personnel system.

Rural schools can be 10 to 50 plus miles apart from each other. Such geographic isolation has implications for the delivery of health services such as dealing with diabetic emergencies (Davis & Droes, 1993). Frequently, the school nurse is available to visit a school only once a week. According to Ann Drenk, RN, PNP of Gallatin County Health Department in Bozeman, Montana (personal communication, March 23, 1995), a nurse is simply not readily available should a crisis arise at school involving a child with diabetes.

One of the consequences of inadequate human and financial resources in communities with small populations is that school nursing positions are frequently part-time (Davis & Droes, 1993). It is not unusual for school districts to share one school nurse among many schools. By way of illustration, in Utah, the school nurse position is being phased out and many districts have no full-time school nurse. Other Utah school districts have only one nurse to cover as many as 26 elementary schools (Gesteland, Sims, & Lindsay, 1989). As another example, in a county in South Central Kentucky, the school system employed one school nurse for more than 5,000 students (Lindsey, Browning, & Bastin, 1987).

Because of the setting in which many rural school nurses practice, professional isolation is also an issue. School nursing practice is independent, and

support from professional colleagues (such as diabetes educators) may not be readily available (Passarelli, 1994).

Owing to the chronic daily rigors of caring for a child with diabetes and the scarcity of available school health care providers, it is likely that school teachers will be involved in observing or monitoring some aspect of the child's diabetes self-management. Although the child's well being is ultimately the responsibility of the parents, it is reasonable to expect that when parents relinquish responsibility to the school, the school personnel need education about the child's special needs (Betschart, 1993).

To illustrate the knowledge needs of school teachers, Lindsay, Jarrett, and Hillam (1987) conducted a study in the Salt Lake Valley of Utah school districts. A random sample of elementary school teachers was surveyed to determine their understanding of diabetes. Results of this study indicated that teachers had an inadequate knowledge of the basic pathophysiology underlying the disease and were unable to recognize and treat the acute crises that arise in the elementary school classrooms. This study had limited validity and reliability in terms of the questionnaire used and so may have limited generalizability. However, the authors believe that study replication would generate similar findings. With limited availability of onsite school nurses on a day-to-day basis, the need to educate school teachers regarding the child with diabetes is emphasized (Lindsay, Jarrett, & Hillam, 1987).

Diabetes nurse educators need to extend essentials of diabetes education to encompass the school setting of which the child with diabetes is an integral

part (Robbins, 1981). Computer-assisted instruction (CAI) is an educational strategy that, in addition to written and oral material, will help fill the need for diabetes education of school teachers. The CAI will help teachers understand various aspects of diabetes management relevant to the school setting. Furthermore, with their teaching experience, knowledge of content, and clinical expertise, diabetes nurse educators can assume the role of CAI author. CAI's are seen as one strategy of imparting knowledge that is cost effective for the school environment and allows judicious use of scarce school health nursing resources.

Purpose of the Project

The purpose of the project was to author the prototype of a computer-assisted instructional program that addressed two key concepts about diabetes: disease process and hypoglycemia. The project was prompted by the author's interest in developing an educational intervention to help teachers to increase their understanding of diabetes in the context of the school health environment.

Computer-Assisted Instruction

Computer-assisted instruction is the process of providing written and visual information in a logical sequence by the computer (Billings, 1986). In its simplest form, CAI resembles a programmed text in which questions are posed at regular intervals. Immediate feedback is provided as to whether or not the learner's response was appropriate. More complex versions follow a branching pattern which allows the more knowledgeable learner to skip over material by correctly

answering certain questions. Such programs offer the learner an opportunity to explore a subject of interest in depth and are especially beneficial for schools in rural and remote geographic regions when the number of school nursing personnel is limited (Gold & Duncan, 1980). As with any medium of instruction, there are advantages and disadvantages to the use of CAI.

Advantages of CAI

Computer-assisted instruction can play a vital role in assisting teachers to interact with information about diabetes care. The current information explosion in the health care field increases the responsibility of diabetes nurse educators to efficiently disseminate knowledge through cost effective education (Billings, 1986). When human resources are short and instructional time is limited, nurses look to accomplish educational objectives in an expedient cost effective manner. Courseware can be developed to be compatible with the computer hardware that is already available at the school, thereby making it a cost effective investment for the school and the county health department. CAI is immediately accessible. It is available 24 hours a day whether used in the school computers or at home with a personal microcomputer. It is not necessary for a diabetes nurse educator to be present when a CAI is being used. Learners can schedule times for participation at their convenience, control the pace of learning, and repeat the program as many times as needed. A good instructional program does not get tired, as a teacher might. An instructional program provides active participation in the learning process and gives instant feedback (Billings, 1986; Heinrich, Fichandler, & Cuono, 1988; Masten & Conover, 1990).

However, use of an instructional medium, such as the computer, will not replace the personal role of the nurse as an educator. Computer technology delivers content and frees the nurse to address the human components of individual reinforcement and ongoing assessment (Armstrong, 1989). CAI can be an effective tool as it can be developed to facilitate the learner's particular area of interest (Chen, 1983). Therefore, more time is available for the diabetes nurse educator to respond to needs which are best served by face-to-face interaction (McKiel, 1991b).

Disadvantages of CAI

A major disadvantage of CAI is the time it takes to develop CAI courseware (Luker & Caress, 1991). Estimates are that one hour of CAI courseware requires 200 to 400 hours of development time (Billings, 1986; Masten & Conover, 1990). Development time is dependent on the experience of the author creating the instructional software; ease of use of the authoring software; use of graphics, color, sound, video (increases development time); and level of quality desired (Kearsley, 1986).

It is difficult to curl up in an easy chair and study with CAI. However, including instructional pamphlets with the courseware can help in overcoming this deficit. Also, by presenting content in smaller time-limited segments, during which one idea is presented on each computer screen, learner fatigue will be decreased.

For both instructor and learner changes in role may cause discomfort. Those diabetes nurse educators who prefer personal interaction with the learner

may feel uncomfortable using CAI. The learner who is used to receiving instruction passively (such as during a lecture) or prefers human interaction may have anxiety regarding the need to be an active initiator in the CAI process (Billings, 1986). Furthermore, the inability of the learner to ask questions of the instructor at the time of using a program may be viewed as a disadvantage (McKiel, 1991a).

Fear of technology, associated with computers, interferes with the use of the computer by some individuals, school teachers included (Feldman, Hollander, & Rezmovic, 1986; Mrs. Riebhoff, Belgrade Intermediate School Principal, personal communication , October 26, 1995). For this reason, it is desirable to develop user friendly courseware that guides the user through the options available at any given time. Having access to a help screen is invaluable if an error in negotiating the program is encountered.

Theoretical Perspective of the Project

The theoretical perspective for development of the CAI project was derived from principles of adult learning theory. The adult learner is a self-directed individual with a life of rich experiences who is internally motivated to learn what will help him/her cope effectively with real-life situations (Fabius, Grissom, & Fuentes, 1994). Adults tend to have several reasons for wanting to learn, but a frequent motivator is the desire to learn something they can use in their daily lives (Conklin, 1995). School teachers, as adult learners, may be

motivated to increase their knowledge base of diabetes in order to feel more comfortable when a child with diabetes resides in their classroom.

Knowles (1984) described the adult learner as one who wants control over what he/she learns so that the knowledge is applicable to situations of daily living. Knowles and others (Baldwin, Johnson, & Hill, 1994) believe that learning is collaborative and facilitative and should include active involvement of the learner. In keeping with these key ideas, prior to embarking on this project the author sent a small questionnaire (Appendix A) to the school teachers at a local intermediate school in which children with diabetes were enrolled. The questionnaire assessed the learning needs of the teachers regarding diabetes. Feedback from the questionnaire allowed the author to incorporate the teachers ideas for topics into the CAI.

Assumptions about Adult Learners

Adult learning theory is based on four assumptions regarding the learner. These assumptions relate to the areas of self-concept, acquired experience, learning needs, and benefits achieved by immediate application of learning (Aucoin-Gallant, 1994).

The first assumption is that an adult's self-concept revolves around being responsible for their own decisions and for their own life. As adults mature they prefer to be self-directed in their learning (Conklin, 1995). For example, adult learners could be people who want to learn in order to perform more effectively in their jobs, or they could be people with chronic diseases who want to learn to

manage their own health care. Other adult learners are motivated to learn for self-enrichment.

An individual's self-concept is motivated by internal incentives such as the desire to achieve and the need for enhanced esteem. In addition, the need to know new information is a motivating factor. The proactive learner, or the one who participates in the educational process, usually learns more, retains it longer, and makes use of the learning longer than the reactive or passive learner (Conklin, 1995; Couser, Moehrlin, Dietrich, & Hess, 1990; Knowles, 1984). Adults learn best when they can select the content and pace of instruction (Billings, 1986).

The CAI addressed the first assumption by incorporating topics on diabetes that were rated very helpful by teachers who responded to the Area of Diabetes Interest questionnaire (Appendix A). The CAI is menu driven and allows the user to choose any topic within the program. The CAI was designed so that the user can receive help with negotiating the program or can quit the program at any time desired. Therefore, users of the CAI are allowed to set their own pace by selecting the next display screen or event. Having the user click a forward button or previous button displayed on each screen accomplished this. A previous button allows the user to review what they just saw or did. The CAI can be used at any time that is convenient for the user (Kearsley, 1986).

The second assumption about adult learners is that life experiences serve as rich resources for learning. Any group of adults presents a wide range of individual differences in experience compared to a group of youths. Any group of

adults will be more heterogeneous in terms of background, motivation, needs, goals, interests, and learning style than that of a group of youths. Therefore, when educating adults, greater emphasis is placed on tapping into their experience through using educational techniques such as simulation exercises, problem-solving activities, and case studies (Knowles, 1984). The CAI addressed this assumption by use of case study simulations relevant to the school setting requiring application of content learned. In addition, multiple choice and true or false questions were interspersed throughout the program to facilitate problem solving.

The third assumption is that adults are aware of their own learning needs. Adult learners will explore why they need to learn something, will probe the benefits they will gain from learning, as well as the negative consequences of not learning. Adult learners must believe their learning activities will be helpful in attaining their desired goals. If that perception does not exist, adults will stop participating. Regardless of what it may be, it is always the felt learning need which motivates individuals to pursue their educational endeavors in spite of obstacles that may appear in their way. Learning needs often reflect personal, social, religious, cultural, or escape goals (Seaman & Fellenz, 1989). The CAI addressed this assumption by having clear learning objectives with real life goals in mind. Ideas for case study scenarios were derived from learner experiences.

The fourth assumption is that adult learners benefit by the immediate application of learning. Adult learners want to use learned information immediately. They are task-centered, competency-based learners (Conklin, 1995;

Knowles, 1984). Adult learners are motivated to learn something they believe will help them perform tasks or deal with problems which they confront in their life situations. The CAI addressed this assumption by providing immediate positive feedback of the learner's efforts in the case study simulations, thereby increasing motivation for learning (Conklin, 1995). The CAI provided appropriate knowledge in the tutorial section. In addition, remedial feedback was provided for incorrect learner responses in the case study simulation section.

Though normal adults are motivated to keep growing and developing intellectually, motivation is frequently blocked by such barriers as time constraints and inaccessibility to opportunities or resources (Knowles, 1984; Tough, 1979). For the adult learner, a learning environment which is supportive, while promoting problem solving through case studies simulation, is ideal (Fabius et al., 1994). A computer-assisted instructional program can be written to encompass this learning environment by using interactive tutorial and case study simulations. Menu driven interactive programs give an outlet to the proactive adult learner by providing choices for learner control and constructive feedback. Providing major ideas in small segments 10 to 20 minutes in length enhances motivation and addresses time constraints (Billings, 1986).

Any teaching strategy incorporated into the CAI design in which the content and skills seem useful and relevant to the learners will facilitate the learning process (Conklin, 1995). For this reason, highly interactive, simulation-like representations are important for learning. Computer-based applications can be used for such simulations (Montague, 1988).

Teaching is central to a nurse's management of health care. There is no practice or education role that does not include the teaching and learning process (Conklin, 1995). Awareness of principles of adult learning and use of those principles are important to the development of CAI for use by school teachers. Utilizing adult learning principles in designing a CAI will facilitate the teacher's ability to cope effectively with the diabetic child in the classroom. Utilizing adult learning theory also increases the effectiveness of linking computers to instruction.

CHAPTER 2

REVIEW OF LITERATURE

Introduction

Since the Industrial Revolution, machines and technology have been assuming an ever-increasing role in the formal education process of our increasingly technological society (Dusewicz, 1981). Furthermore, in recent years computer use in health care activities has become widespread. Computers are being used for a variety of purposes including (a) education of medical, nursing, and allied health care professionals (Health Sciences Consortium, 1995), (b) management of patient and nursing information systems (Lenkman, 1985), (c) computerized diagnostic devices, (d) patient education (Armstrong, 1989; Masten & Conover, 1990), and (e) electronic resources for health professionals (Masten & Conover, 1990; Montana Area Health Education Center, 1992; National Library of Medicine, 1995). The increasing use of computers in the health care field is further evidenced by increasing numbers of studies assessing the knowledge, attitudes, and behavior of health care providers and patients in relation to the use of computers (Anderson, Donnelly, & Hess, 1992; Greene, Beaudin, & Bryan, 1991).

Much of the literature examines the value of teaching health related information within a computer-based information environment. Computers

enhance the instructional process. The microcomputer can be programmed with any health education content and address any consumer group (Phelps & Dennison, 1982). The following review of literature explored the historical development of CAI and barriers associated with CAI use. The review discussed CAI and its use for the education of nursing students and persons with diabetes. There was very little information in the literature related to the use of computers as a method to help teachers learn about diabetes. The latter section of the literature review addressed information about CAI as a learning tool for use with adult learners and was, therefore, applicable to school teachers.

Historical Overview of CAI Development

Programmed instruction refers to learning efforts which are planned by a teacher but are initiated and directed by the individual learner. A teacher plans the learning activity even though there is very minimal contact between the instructor and the learner (Seaman & Fellenz, 1989). Programmed instruction technology, a forerunner of computer technology, was originally conceived by Sidney Pressey in the 1920s (Dusewicz, 1981). He developed a self-instructional electromechanical device that presented test material to the student and also gave feedback on whether or not the correct answer had been selected. Early programmed instruction technology utilized behavioral learning principles by providing small portions of task-based material and the use of reinforcement through reward (Cooper, 1993).

By the 1950s, programmed instruction was characterized by individualized learning with booklets. This method provided learners with practice and feedback so that they could move at their own pace (Osguthorpe & Zhou, 1989). At this time, B. F. Skinner advanced Pressey's ideas on the learning process and programmed instruction with the development of the concept of operant conditioning. Operant conditioning was also known as reinforcement theory, which is one aspect of behaviorism. Skinner's theory, reinforcement theory or operant conditioning, is fundamental to behaviorism. Behavioral theory is based on the idea that learning occurs through the formation of stimulus-response associations. For instance, a behaviorally based CAI would be characterized by learning objectives that have observable responses. Lessons interspersed with questions that require response with immediate feedback are also characteristic of a behaviorally based CAI (Hannafin & Rieber, 1989). In operant conditioning, learners produce a particular response under prescribed conditions before rewards are provided. The focus of behaviorism is upon the intended outcomes of instruction. That is, if the outcomes of instruction are response, then the objectives must describe these responses (Meierhenry, 1982). The response is considered to be instrumental in bringing about the reward. For instance, a correct response to a question posed would elicit positive reinforcing feedback such as "Good job!"

Skinner's views also emphasized two concepts. These concepts were the need for the individual learner's control of his/her rate of progress and active participation in the learning process. Furthermore, it was Skinner's belief that

learning could take place entirely through self-instruction without the use of other materials (Dusewicz, 1981). The concepts of control of the rate of progress and active participation of the learner are important concepts to incorporate into a CAI for adult learners. Adults learn best when they can select the pace of instruction (Billings, 1986). Furthermore, an adult learner usually learns more and has greater retention of content when they are proactive in the learning process (Knowles, 1984)

Though programmed instruction technology grew out of the work of B. F. Skinner in the 1950s; it became nearly obsolete by the late 1960s. Programmed instruction, though still utilized, has not always been popular with adult learners, who often labeled it as boring or irrelevant (Seaman & Fellenz, 1989). During the late 1960s, instructional science became interested in the way in which learners receive, organize, process, retain, and use information rather than predicting learner performance based on stimuli and responses (Dreher and Caputi, 1992; Osguthorpe & Zhou, 1989). However, due to Skinner's educational research, programmed instruction technology served as the forerunner for the more enduring field of educational technology and computer-assisted instruction (Osguthorpe & Zhou, 1989).

Principles of behaviorism became the cornerstone of early computer-based instruction and still predominate CAI design today. Some authors suggest that behaviorally based instruction is effective for some low-level learning, such as rote recall or simple concept acquisition, but does little to promote higher processing or understanding (Cooper, 1993; Hannafin & Rieber, 1989).

Since the 1970s, learning theories such as cognitivism, humanism, and androgogy have evolved and have influenced computer-based instruction. Although differences exist between the various learning theories, all play important roles in designing instruction. The latter theories, when applied to CAI design, facilitate moving from lower to higher levels of learning. Emphasis today is on the more complex intellectual processes such as thinking, language, and problem solving. Complex intellectual processes are thought to be important aspects of the learning process which are needed for the performance of real-life tasks (Dreher & Caputi, 1992). The influences of cognitivism, humanism, and androgogy have the potential to strengthen instruction by enhancing the perspective from which design decisions are made for computer-assisted instruction (Hannafin & Reiber, 1989). Consequently, because of additional knowledge gained about learning through various learning theories, computers have great potential for enriching and improving education.

Barriers to CAI Use

With the permeation of technology into our homes, schools, and workplaces, it is tempting to suggest that the fear associated with computer use or "technophobia" will soon be a problem of the past. Technophobia is an issue that cannot be ignored. The following part of the literature review will look at results found in the studies addressing this issue.

Though new and powerful technology has benefits that are great, problems with implementing that technology are common (Feldman, Hollander, &

Rezmovic, 1986). Part of the problem with the use of computers by educators is "technophobia," a phenomenon seen in studies of thousands of college students, business people, elementary and secondary teachers, and students (Rosen & Weil, 1995). Technophobia is defined as fear of current or future interactions with computers or computer-related technology (Feldman et. al., 1986; Rosen & Weil, 1995). People who are technophobic lack computer experience because they actively avoid the technology. The avoidance is caused by anxiety and intrinsic negative self-statements such as "I'll never be able to learn this" (Rosen & Weil, 1995). Rosen and Weil suggest that technophobia is a psychologically-based problem.

A large scale, cross-sectional study by Rosen and Weil (1995) surveyed a convenience sample of 587 school teachers to assess technophobia in the public school system in a large urban area. The sample was not representative of all teachers in the five school districts accessed. Furthermore, the fact that participation was voluntary suggests that the sample may have been biased, although the direction of that bias is not apparent. Though these factors affect generalizability, the study did demonstrate clearly that between one third and two thirds of the teachers did not hold a positive attitude and did not feel comfortable with computers.

Feldman et al. (1986) editorialized about technophobia and health educators. The authors have numerous suggestions for overcoming technophobia, a condition they characterize as a social phenomenon. One is choosing user-friendly software that guides the user through the options available at any

given time. Providing hands-on experience, a comfortable learning environment, and learning the computer in small increments are other useful suggestions.

One of the greatest challenges that prevents integrating computers into the patient education setting is countering negative attitudes of patient educators. According to Luker and Caress (1991), few studies have explored the possible use of computer-assisted learning as a means of educating patients. Ill health and anxiety may complicate the patient education process. However, it has also been noted that successful implementation of computer-assisted learning is largely determined by the acceptability of the method to the patient educators. Patient educators differ widely in their ability to use computers, their familiarity with available courseware, and their attitudes toward the technology. Uncertainty, fear of change, inertia, and concerns about the technology itself often contribute to the incompatibility between facilitating learning and integrating CAI into a patient education setting (Lewis, 1990).

Some research studies have also indicated negative attitudes toward CAI among nursing students. A descriptive study by Baldwin, Johnson, and Hill (1994) was used to determine perceptions toward CAI with regard to nursing topics such as physical assessment, medical terminology, and charting/ documentation. The study was limited by small sample size (n=39) and the participation of only one baccalaureate nursing program. Results of the study suggested that students were largely dissatisfied with CAI, especially with the length of time required for each topic and the clarity of information presented.

The students preferred faculty demonstration of psychomotor skills when learning to perform basic nursing skills (72% of sample).

Fabius, Grissom, and Fuentes (1994) conducted a study comparing two teaching methods (live instructor and CAI) to teach cardiopulmonary resuscitation (CPR) recertification to nursing staff in a large urban teaching hospital. In the study, a computerized interactive learning laboratory was used for cardiopulmonary resuscitation (CPR) training of nursing personnel. A pretest/posttest experimental design was used. The researchers compared knowledge scores, pass/fail rate, time spent teaching and learning the material, satisfaction with the teaching method, and skill retention between two teaching methods. While no significant differences were found between the groups in regards to knowledge and performance scores, significant differences were found in time spent, learner satisfaction and pass/fail rate, all favoring the traditional form of didactic instruction. Didactic instruction consisted of live instructor demonstration, group discussion, and written material. The authors concluded that subject matter relating to psychomotor skills, such as CPR, is best taught using traditional teaching methods of lecture and demonstration.

The findings in the studies by Baldwin et al. (1994) and Fabius et al. (1994) suggested the importance of careful selection of appropriate topics for presentation by this medium of instruction. Equally important was clearly presenting the topics in short segments. This method of presentation will help to avoid user dissatisfaction with the time spent to complete the topic. Also, the findings suggested that CAI is better utilized for non-psychomotor learning tasks.

Even though there are many software programs related to diabetes information, some diabetes educators believe that computers have yet to make a major contribution to the teaching and learning process in diabetes education. A study by Anderson, Donnelly, and Hess (1992), which surveyed 816 randomly selected members of the American Association of Diabetes Educators, found that computer usage was in non-educational applications such as writing reports and keeping patient education records. Participants agreed computers did not enhance their diabetes education programs significantly and that written materials were more useful than computers.

Certainly, technophobia and negative attitudes are factors that can inhibit the use of computers by any adult learner who is so inclined. Furthermore, use of the technology may not suit some people's learning style or the subject to be conveyed. While technophobia and negative attitudes are factors, the author's project has overcome them by being designed as "user friendly" as possible. The content covered was adequate for presenting diabetes concepts, yet brief, so the user's time would not be wasted.

The Use of CAI in Nursing Education

The 1960s

Computer-assisted instruction has been used to educate nurses since the late 1960s, although its widespread use was slow getting established. Belfry and Winne (1988) used selected qualitative and meta-analytic methods to synthesize research literature involving CAI instruction for nursing education between 1966

and 1983. According to Belfry and Winne, most of the articles published in the first decade of computer use were narrative reports of experiences with CAI at particular schools or hospitals. The researchers found that many of the research articles analyzed indicated that CAI was an effective method for teaching nursing students. However, these conclusions were usually based on informal, subjective reports of students and teachers. In addition, the review included only a few studies which compared CAI with traditional teaching methods (Cohen & Dacanay, 1994).

The 1970s

In 1974, the use of CAI in National League for Nursing accredited baccalaureate programs was infrequent. The limited use can be attributed to the fact that early applications of CAI were written for large mainframe computers. An increased use of computers for instructional purposes was not seen until the 1980s. The increase coincides with the proliferation of microcomputers. In addition, authoring software made it easier for nursing faculty members to create CAI's tailored to their own instructional needs (Cohen & Dacanay, 1994).

The 1980s

Since the 1980s, CAI has emerged as a viable learning tool (Halloran, 1995; Hebda, 1988). Computer-assisted instruction has been shown to decrease faculty work loads ("Using CAI as an Alternative," 1990) and facilitate the development of critical thinking and decision making skills (Halloran, 1995; Parkinson & Parkinson, 1989). In 1985, the National League for Nursing

reported that 284 baccalaureate and higher degree programs in nursing had CAI available (Gaston, 1988).

According to a 1989 national survey of nursing programs by the Southern Regional Education Board, 91% of the 393 responding directors and deans reported the use of computers for teaching undergraduate nursing. Furthermore, in 38% of the programs, computers were used to teach 5% to 25% of the curriculum. As much as 6% of the sample reported using computers to teach more than half the curriculum ("Using CAI as an Alternative," 1990).

A study by Deardorff (1986) compared the presentation of medical information about sexually transmitted diseases by computerized format with written and face-to-face format. The participants were undergraduate students (no distinction made between pre-nursing and non-nursing students) enrolled in introductory psychology courses. The study appeared to give a favorable outlook for CAI usefulness as a learning tool. The investigator concluded that CAI is just as effective as written material in terms of learner recall of medical information. In a research study by Gaston (1988), CAI and lecture were compared for effects upon knowledge, retention, and attitudes of baccalaureate nursing students taking a research course at a midwestern state university. An experimental two-group posttest design with a second posttest was used. No significant differences were found in knowledge, retention, or attitudes between the CAI and the lecture group. Attitudes toward CAI were found to be positive. While Gaston's study (1988) supported the premise that CAI is as effective as lecture for student

knowledge and retention, the ability to generalize the investigator's findings is limited due to the setting-specific sample.

The 1980s showed an increased use of CAI by nursing school faculty. CAI as a learning tool was demonstrated to be equally effective as written material and was positively received by nursing students.

The 1990s

In today's nursing programs, students often have limited contact with clients experiencing complex health problems and may have few opportunities to make decisions about their care. Abbreviated clinical time schedules and limited sites for clinical experiences can prevent students from being exposed to certain problems. However, CAI has been shown to be an effective teaching tool that facilitates decision-making skills as well as critical thinking. CAI has also been shown to positively affect student achievement (Lowdermilk & Fishel, 1991).

CAI as an effective teaching modality was cited in two recent studies applying epidemiology to community health nursing (Russell, Miller, & Czerwinska, 1994), and teaching Acquired Immune Deficiency Syndrome (AIDS) to nursing students (Wood, 1992). The study by Russell et al. used CAI to teach epidemiological concepts to community health nursing students (n=106). Seventy-seven percent of nursing students chose CAI plus lecture as the preferred teaching/learning method instead of text plus lecture. The majority (63%) of students clearly explained that the CAI helped them to better understand the lecture.

Wood's (1992) quantitative analysis compared two groups of nursing students using CAI to teach AIDS concepts. One group was given a linear-format CAI on AIDS. The other group was given a concept-map format CAI on AIDS. The research attempted to explore how students learn when information is arranged in different ways. Qualitative results indicated that students preferred the use of computerized concept maps as a learning method. Both quantitative and qualitative results indicated that the students using concept maps also consistently showed better student retention of information presented within the program featuring concept maps.

Lowdermilk and Fishel (1991) studied the use of computer simulation as a strategy to evaluate critical thinking and clinical decision-making skills. Participants were senior nursing students (n=64) enrolled in a clinical course in advanced nursing. All students completed a CAI specific to the student's clinical placement. Those students in the experimental group completed three additional simulations. Seventy-eight percent of the participants responded to the attitudinal questionnaire. The authors found that the majority (more than two thirds) of nursing students' attitudes toward the CAI experience were positive and helpful. Students stated they would be interested in future CAI learning experiences, thereby confirming findings from other studies (Gaston, 1988; Schare, Dunn, Clark, Soled, & Gilman, 1991).

The purpose of a study by Halloran (1995) was to evaluate differences in achievement between a control group taught by traditional classroom lecture and an experimental group taught using computer-managed instruction (CMI). The

sample was comprised of junior nursing students enrolled in a medical/surgical course. The research was limited by use of a small convenience sample (n=28); however, the results demonstrated a trend toward improved examination grades in the group being taught with CMI. Although the latter group demonstrated increasingly higher test scores as the semester progressed, no statistical difference was found in achievement between the two groups. In undergraduate nursing education, the use of CAI as primary and adjunct instruction has been reported to be as effective as traditional methods of instruction in terms of student achievement measured by end of unit examinations (Cohen & Dacanay, 1994; Halloran, 1995). The research by Halloran also pointed out that a combination of face-to-face lecture and computer-assisted instruction may bridge the gap between various learning styles and learning needs.

Nursing education must relate to nursing practice in a meaningful way. Building the knowledge base and decision-making skills of nursing students and practicing nurses is a goal that may come by way of various educational formats. The use of computers, in concert with additional media, learning strategies, and teaching techniques, can effectively enhance and add meaning to nursing instruction (Lewis, 1990).

CAI as a Learning Tool in Diabetes Education

The content presented in any diabetes education program is neither simple nor quick to convey. The skill in teaching diabetes information to laymen is demanding. If teaching is to be effective, there must be a means to assure

conformity to standards and competence among those educators who deliver it. Computers can assist health professionals to achieve high levels of conformity and competence (Cook, 1987).

A variety of computer software programs exist that have been developed for use in diabetes care and education. Programs are available to help clients (a) adjust insulin doses (Sivitz, Davidson, Steed, Bode, & Richardson, 1989) and plan meals, (b) store data such as blood glucose values, (c) and provide complete nutritional analysis of diet choices (Smith, Pike, Jakubowski, & Pardoe, 1988). There are programs which (a) offer self-paced instruction (Engvall, 1994), (b) test a client's knowledge of diabetes (Cook, 1987), (c) document client education outcomes (Farris, Stoupa, Mendenhall, & Mazzuca, 1994), and (d) provide specialized instruction for children using a variety of formats including games. In addition, computer programs have been developed to help health care professionals sharpen their diabetes management skills. Whether used for learning how to maintain a nutritionally appropriate diet or how to inject insulin, computer programs assist health professionals and people with diabetes in the performance of a variety of diabetes-related tasks (Smith et al., 1988). However, no software programs were mentioned in the literature that address diabetes management for school teachers.

CAI Use with Adult Learners

As mentioned earlier, very little research has addressed the use of CAI to teach diabetes specifically to school teachers. However, teaching strategies known

to be effective with adult learners are also applicable strategies for school teachers, who are also adult learners.

A number of different instructional strategies have been utilized for presentation of educational materials to adults. These include traditional lectures, videotapes, individual tutoring, and written material among others. While each of these has been useful in specific situations, computer-assisted instruction also has a number of characteristics that make it an effective option for adult learners.

Several authors (Bolwell, 1993; Cook, 1987; Engvall, 1994; Fabius et al., 1994; Halloran, 1995; Lowdermilk & Fishel, 1991; Luker & Caress, 1989; McKiel, 1991b; Schare et al., 1991) list a number of characteristics of computer-based instruction which make it a suitable choice for adult learners, such as school teachers, receiving health education. Characteristics include (a) achievement gains and retention equal to or better than other methods, (b) learner control, (c) facilitating decision-making skills without doing harm, (d) individualization of pace and content, (e) reduced personnel costs and operational costs, (f) consistent delivery of precisely presented content, (g) privacy, (h) flexibility in scheduling around the clock access, (i) efficiency of revising, and (j) immediate feedback.

The effectiveness of CAI is largely dependent upon the quality of the software produced. A major limitation cited in the literature is the shortage in high quality and appropriate commercially produced health education software (Lewis, 1990). Many early software programs were developed by computer programmers who did not possess expertise in health or education (Petosa & Gillespie, 1984). To make the most effective use of CAI, educators must know

which types of computer-assisted instruction are most appropriate for meeting different learning objectives or are most suited to certain learners (Belfry & Winne, 1988; Lewis, 1990). Though numerous guidelines exist for software assessment, Posel (1993) developed a software evaluation tool to facilitate the evaluation process of software which even inexperienced hospital nursing personnel used successfully. Software shortages are a major obstacle on the widespread utilization of computers in the health education and other adult education settings (Armstrong, 1989; Chen, 1983; Lewis, 1990).

A major limitation to CAI as a learning method for adults is related to the absence of the educator for interaction and the inflexibility of the learning method. Examples of these limitations include (a) the developer of the CAI determines the learning goals for all learners, (b) limited flexibility in learning activities or procedures, (c) inability of learners to raise questions or gain information relevant to their specific needs, (d) limited or nonexistent relationship with educator and peer learners, (e) use of hardware, the initial cost of which is expensive and which may be unfamiliar to the learner to use (McKiel, 1991a; Seaman & Fellenz, 1989). The use of computers to facilitate learning is diminished if they are employed to the exclusion of other media or personal interaction (Lewis, 1990; McKiel, 1991a).

Several suggestions have been made for improving upon the limitations of preprogrammed computer instruction. First, present content at the mature learner's level by presuming they have had some experience with the content and build into the programs ways of gaining remedial instruction for those who need

it. Allowing adults some input into the manner and pace of proceeding through the content usually adds appeal. Allowing as much learner input and choice as possible will keep the CAI meaningful to the potential audience. Allowing for choice can be done by incorporating a menu driven program within the CAI. Building variety into examples, illustrations, and applications increases the possibility of touching on topics to which the learner can relate (Keller & Suzuki, 1988; Seaman & Fellenz, 1989).

It is essential to involve the learner in the CAI to avoid being boring. Learning is an active process. A CAI that transforms the passive learner into an active participant facilitates the learning process. Content presented in a software environment is much better received when it is "user friendly." A non-threatening atmosphere includes a good orientation to the program, little reinforcements, progress indicators, and a help section, which are excellent ways of building support for the learner (Lewis, 1990; McKiel, 1991a; Seaman & Fellenz, 1989).

A paucity of research exists on the use of CAI to specifically teach diabetes concepts to school teachers. However, the effectiveness of CAI as a learning tool used in other adult population settings is evident in reviewing the literature. The author's CAI project is intended to fill a gap in the knowledge base of school teachers and assist in promoting teacher competency in successfully coping with diabetes in the rural school setting.

Summary

In developing instruction to be delivered via the computer, it is helpful to gain an awareness of the historical and current issues discussed in the literature related to instructional technology in health care. Various learning theories, such as behaviorism, cognitivism, and androgogy, have contributed to the CAI design process in the current project. A teaching tool that is developed and supported by theory and research in its design is more likely to help the learner achieve the intended instructional objectives (Dreher & Caputi, 1992). CAI has evolved as an effective instructional tool in nursing education and adult health education. This is especially true when used in conjunction with other teaching strategies such as lecture and written materials. However, computer-assisted instruction may be more effective for cognitive learning tasks (presenting information) than for psychomotor tasks (skill acquisition) where a live instructor is preferred by learners. It is important to be aware that not everyone in a target population will readily accept a CAI as a learning mode. However, many learners can benefit from a well developed user friendly CAI.

CHAPTER 3

PROJECT DESIGN

Introduction

The process of creating instructional software is known as "authoring." In this chapter the process of authoring the CAI project will be presented. Issues addressed include the first three phases of the authoring process which were planning, design, and development. One important aspect of authoring a CAI is good documentation of the design. Two levels of design documentation are needed. They are a general description and a detailed description. A general description provides a brief overview of the program including the goal or purpose, the learning objectives of the program, and a description of the target audience (Kearsley, 1986). The general description will be covered in phase one. A detailed description of the design of the CAI project will be presented in phase two. Adult learning theory was utilized as a framework for development of the CAI program.

Phase One: Planning

Target Population

The first step in the initial planning process was characterizing the target population for whom the program was designed. The target population for the author's project was adult learners who were professional school teachers actively teaching kindergarten through 12th grade. An assumption had been made that, prior to viewing the CAI, the teachers had received some diabetes education through a parent, school nurse, or diabetes educator. This assumption was based on the author's previous interaction with the school teachers of the Intermediate School in Belgrade, Montana. Diabetes education had been provided to the teachers by the mother of a child with diabetes and the author.

Knowledge Needs Assessment

Once the audience was identified, an informal assessment form was developed by the author. The ten-item "Area of Diabetic Interest Assessment" (Appendix A) used a four-item Likert-type scale for responses. The purpose of the questionnaire was to ascertain diabetes knowledge needs of school teachers. The first seven items in the assessment tool were potential topics that might be seen as menu items in the CAI program. The last three items addressed time limitations that teachers have available for viewing a CAI. An open-ended question was included to encourage the expression of topics not mentioned in the first seven items.

The assessment form was administered to the teachers in an intermediate school in Belgrade, Montana. The Belgrade Intermediate School was known to the author to be actively dealing with several children with Type I diabetes. A cover letter (Appendix B) was included with the form introducing the author and the overall goal of the CAI project.

Thirty-three assessment forms were distributed by the school principal to each teacher's school mailbox. Sixteen forms were returned completed, a 48.4% response rate. Data generated from the assessment form guided the author in determining topics to be addressed in the program. Of 16 respondents, 63% thought it would be very helpful to have information about general diabetes disease facts. Eighty-one percent of respondents thought that facts about high and low blood sugars would be helpful, and 63% of respondents felt that management of high and low blood sugars in the school setting would be helpful. Results from the knowledge needs assessment guided the author in developing topics for the CAI program chosen as most helpful by the school teachers.

Information Gathering

The author spent several weeks gathering and reviewing consumer/layman level resources regarding general diabetes care. The resources gathered came from various sources including the American Diabetes Association, American Diabetes Internet Home Page, Barbara Davis Center for Childhood Diabetes, and various pharmaceutical companies. A complete list of resources is too numerous to list here but is included in a bibliography within the CAI program. The aforementioned resources guided the author in presenting the tutorial portion of

the CAI at the appropriate comprehension level of the adult-learner, non-medical audience. The objective was to teach the material by keeping the text simple and by avoiding excessive medical jargon. Comprehension level of non-medical adult learners is facilitated if the reading level is kept at or below the educational level of the target population (Steinberg, 1991).

Other sources of information were obtained on-line through an internet school nurse network electronic mailing list (SCHLRN-L@ ubvm.cc.buffalo.edu). One of the purposes of electronic mailing lists is to serve as a forum for group discussion (Fraase, 1993). The author requested members of the list to share any experiences they had with teachers dealing with or not dealing with diabetic emergencies in the school setting. Numerous responses were obtained relating to scenarios involving hypoglycemic reactions and diagnosing hyperglycemia. Some of these scenarios were useful in reinforcing ideas to be developed for CAI case studies.

Overall Goal and Learning Objectives

Instructional projects help learners achieve certain outcomes. These outcomes are called goals (Steinberg, 1991). The overall goal for the CAI project was to provide relevant information about diabetes and management of common diabetic emergencies such as hypoglycemia and hyperglycemia. Furthermore, the project was intended to enhance or supplement any diabetes education that had already been received by the school teachers through the school nurse, parents, or diabetes educator. By doing so, the diabetes knowledge base of school teachers would be reinforced so they would feel more effective in identifying and managing

common diabetic problems most likely to occur in the classroom. The scope of the project included basic pathophysiology of diabetes, epidemiological facts, hyperglycemia, and hypoglycemia as the general subjects covered in the program.

An instructional program guide (Appendix C) was developed by the author and included specific learning objectives. The learning objectives were stated in behavioral outcomes and included (a) define Type I diabetes, (b) identify the symptoms of high blood sugar and what treatment can be done in the classroom setting, (c) identify sources of glucose in the diet and in the body, (d) identify the functions of insulin, (e) identify the symptoms of low blood sugar (hypoglycemia or insulin reaction), (f) identify when hypoglycemia is most likely to occur at school, (g) identify immediate treatment of hypoglycemia, and (h) apply diabetes knowledge in a case study simulation. Also included in the program guide are installation and operating instructions for viewing the program, computer system requirements needed to run the program, and a list of resources for further reading.

Phase Two: Design

There are several modes of computer-assisted instruction. The CAI project utilized two modes, tutorial and case study simulation.

Tutorial

A tutorial program is an instruction sequence that presents educational material in statements (Landa, 1984). It is generally used for teaching a subject (Lewis, 1990). Instruction must be sufficiently complete to insure learning, but brevity is also important. In CAI, the size of the display screen limits the amount

of information that can be presented at one time. A paragraph on paper is easier to read or scan than the same material on a computer monitor screen. The same paragraph that looks good on paper can be a crowded display screen that creates visual confusion and makes concentration difficult (Landa, 1984). Moreover, if the program includes unnecessary information, the adult learner's time will be wasted and the program will not be completed should the learner become bored. Furthermore, excessive text consumes computer memory and processing resources (Steinberg, 1991). The CAI project was written to meet the need of making the presentation of information adequate for the teachers to learn the material but efficient enough not to waste their time or computer resources. Figure 1 demonstrates this concept.

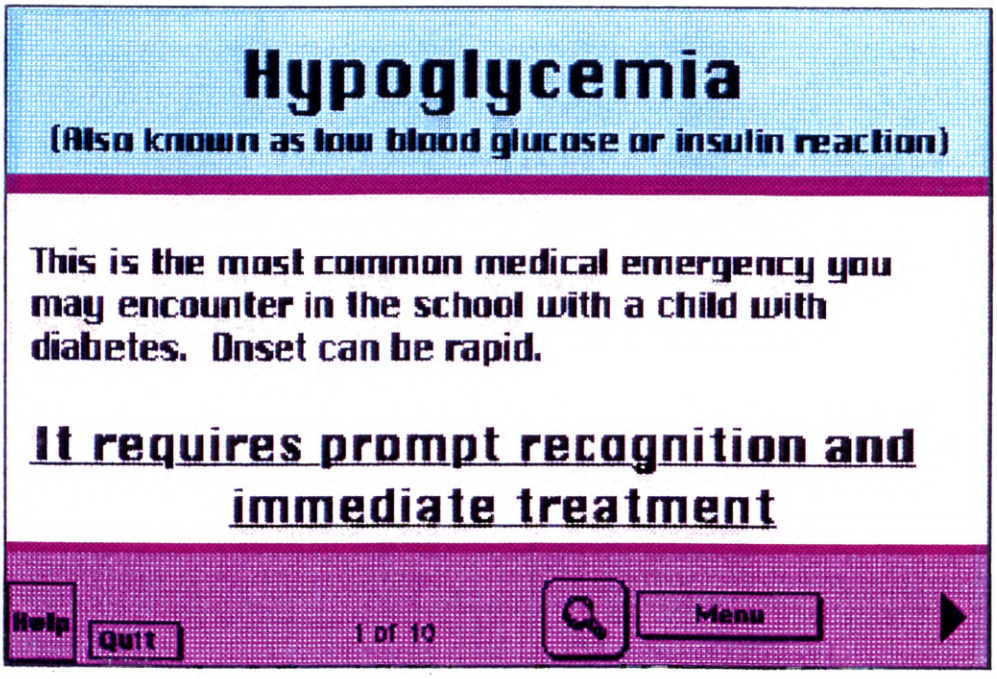


Figure 1. Tutorial screen display.

In the tutorial mode the computer presents information in text and pictures and then queries learners at regular intervals. The objectives of asking questions during learning are to keep the learner actively engaged and to foster remembering (Steinberg, 1991). The questions used in the CAI project require cognitive processing of the content presented. In order to answer the questions, the school teacher has to read and understand the material presented. Immediate feedback is provided as to the whether or not the learner's response was appropriate (see Figure 2).

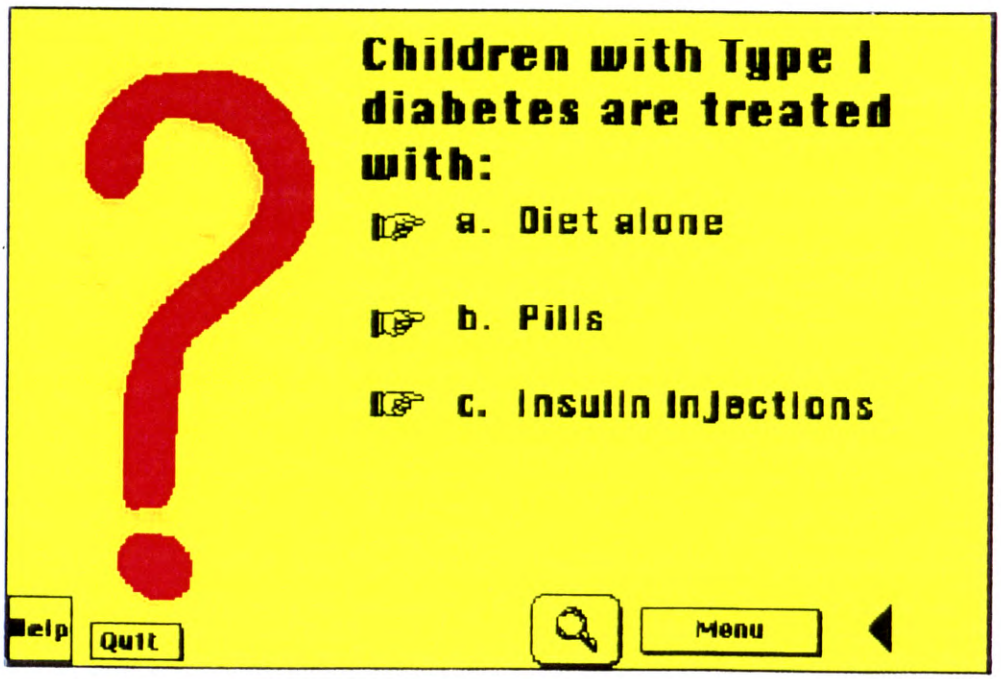


Figure 2. A sample question.

In Figure 2 a mouse click on "a." was programmed to give an answer of "Sorry, diet alone can treat some forms of Type II diabetes." A mouse click on "b." will give the answer "Try again," allowing the learner the opportunity to

answer the same question. A mouse click on "c." will cause the screen to flash while a harpsichord plays a musical chord and the answer displayed is "Correct! Children usually require 2 insulin injections a day along with 2-3 snacks a day." The use of music and sound effects gives positive reinforcement for the correct answer. Additional information is provided with the correct answer. Elaboration on why answer "a." was incorrect is also provided. All of the questions used in the CAI project were either true/false, yes/no, or multiple choice. All the questions are closed-ended and offer a specific choice of answer from which the correct one must be chosen. Each response provides immediate feedback and positive reinforcement as well as elaboration on some of the incorrect and correct answers.

Simulation

A simulation is a representation of an event. The event may have happened in the past or reflect an estimate of future occurrences. A simulation can bridge the gap between textbook knowledge and practical experience in the real world (Steinberg, 1991). The advantage of simulations is that they expose individuals to reality in a way that would not otherwise be possible given factors such as cost, time, safety, and resources. Though simulations allow for problem solving in a penalty-free environment, they are, of necessity, an oversimplification of reality (Lewis, 1990).

The case study simulations in the CAI project allow the learner to apply diabetes management concepts without the consequences of inflicting harm as may occur in the real-life management of a child experiencing hypoglycemia or hyperglycemia. Two case study simulations were presented in the CAI program,

affording additional interaction and application of information learned in the tutorial topics. The simulation case studies dealt with specific diabetes concepts of hyperglycemia and hypoglycemia assessment and management in the school setting (see Figure 3).

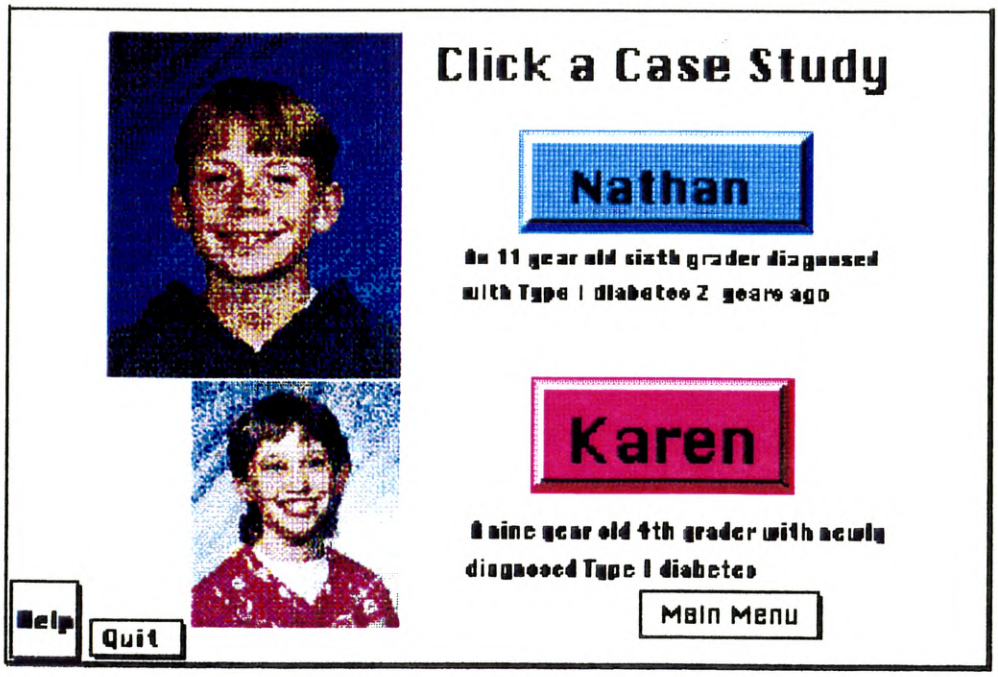


Figure 3. Case study simulations.

Phase Three: Development

Once the target audience, general topics, and learning objectives had been decided on, the next step was to develop each topic as a lesson on the computer. Having no prior computer programming experience, the author enrolled in an upper level undergraduate course called Educational Software Design (EDCI-451) through the College of Education at Montana State University. The course

offered techniques for designing, developing, creating, and evaluating educational software for use with microcomputers. A requirement of the course was to produce a finished program. The program produced for the software design course was the author's diabetes CAI project. Input from the course instructors was received throughout the creative process.

The next section of the chapter will describe the creative process of transforming the author's ideas for a diabetes guide for teachers into a program formatted for the microcomputer.

HyperCard

The software application program used to develop the CAI project was HyperCard 2.3. HyperCard was developed for the Apple Macintosh microcomputer, a computer widely found in the local Montana schools. HyperCard is a software program that allows nonprofessional programmers to create educational software applications. HyperCard was developed as a personal tool kit for accessing and manipulating information that can exist in such varied forms as text, graphics, video, music, voice, color, and animation (Engvall, 1994). When working with any computer, applications are used to create documents such as letters and research papers. These applications are software tools such as word processors and graphics programs. In the same way, one uses HyperCard to create documents. A HyperCard document is known as a stack, and it is made up of identically sized cards. The card's size is roughly 5 by 7 inches and can contain any combination of graphics and text (Beekman, 1992). The author's CAI project stack contains 112 cards.

Perhaps the most interesting HyperCard object is the "button." HyperCard stacks and cards are linked by buttons. A button is a screen area that is sensitive to user input via the Macintosh mouse. Buttons can link the user in a sequential or nonlinear manner to text, graphics, video, music, color, and animation. A typical function of a button is to let the user move from one card to another in a sequential or linear fashion (Eckols & Rossett, 1989). For example, in Figure 4, the arrows in the lower right corner of the card are buttons that cause the previous card or the next card in the stack to be displayed. These buttons allow for the adult learner to have some input into the manner and pace of proceeding through the content of each topic in the tutorial section.

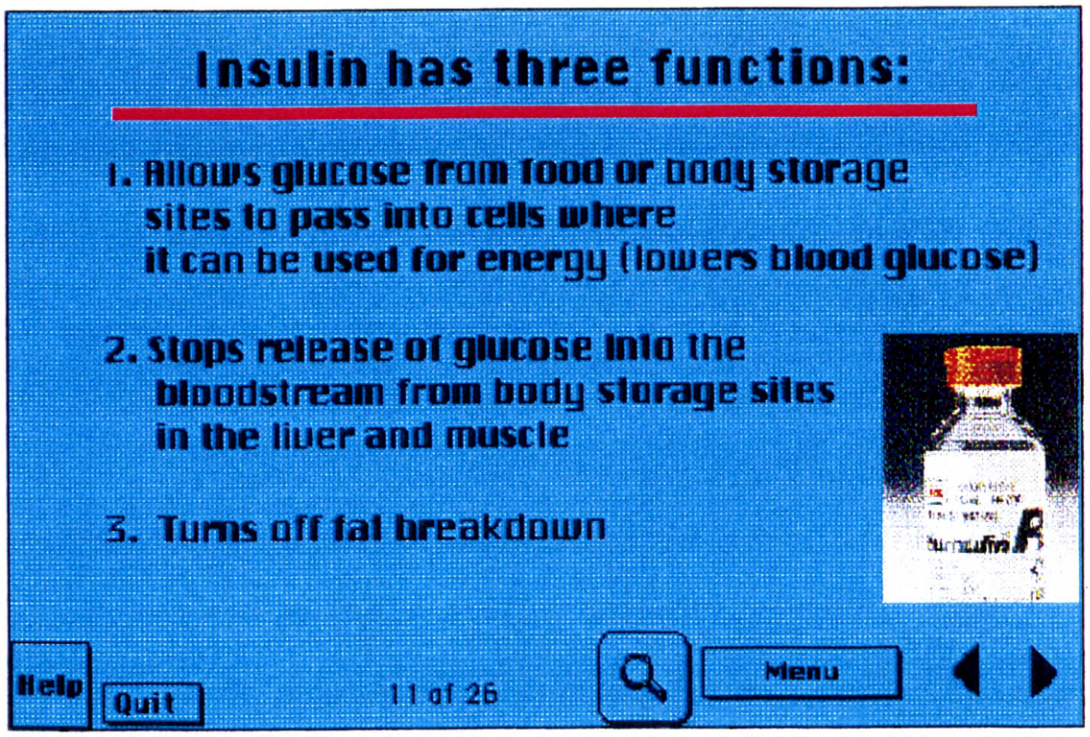


Figure 4. Buttons for navigating the program stack.

There is always the risk that too many buttons can overwhelm the user unless they are arranged in a clear, understandable way (Beekman, 1992). Because the author has used several buttons on every card, they have been arranged so that the universal buttons are all together in a row at the bottom of each card. Each of the buttons all look and act the same way on each card. The exception is in the case study topic. This section is navigated differently than the tutorial section and will be discussed later.

The button that looks like a magnifying glass in Figure 4 will display the subject index when clicked with the mouse (see Figure 5). Additionally, by clicking a subject in the index, the user is linked to the card in the stack that

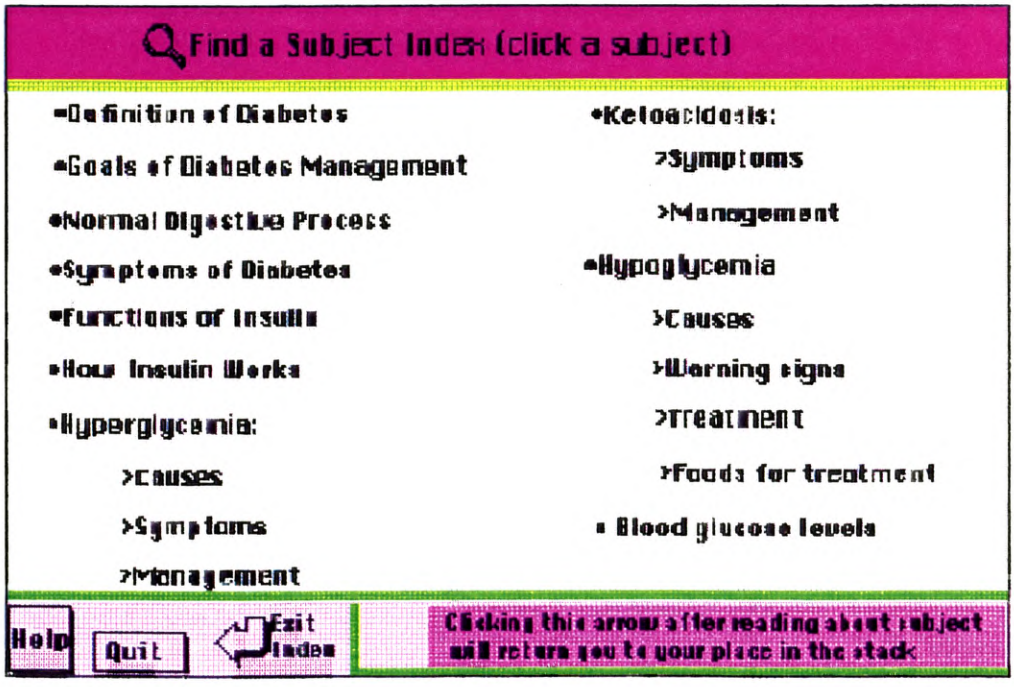


Figure 5. Subject Index offers branching to remedial information.

displays information on the chosen subject. Each of the subjects in the index is an invisible button.

The subject index feature allows for quick review of content already viewed. For example, if the subject "Symptoms of Diabetes" is clicked in the subject index, the user will view the card in Figure 6. When the user is finished viewing the chosen card, a mouse click on any portion of the card in Figure 6 will take the user back to his/her place in the program. This is an example of interactive nonlinear branching, known as "hypertext." Hypertext is frequently implemented with buttons and is a hallmark of HyperCard.

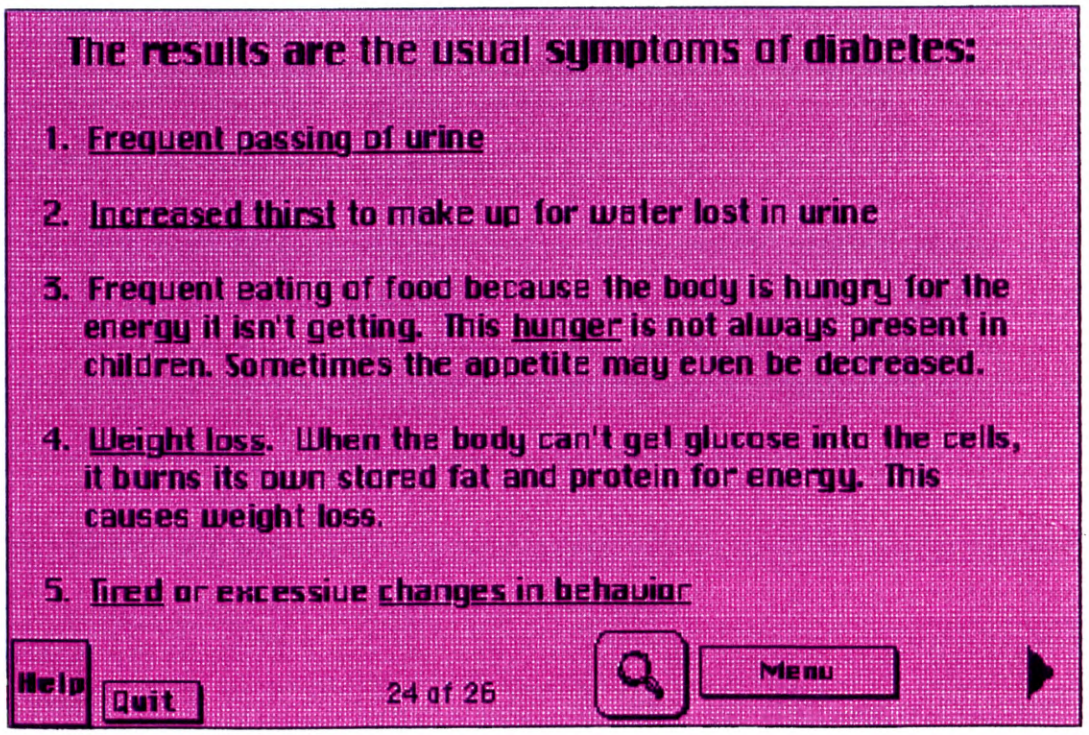


Figure 6. Symptoms of diabetes card accessed directly through the Find a Subject Index card.

Navigating the Tutorial Topics

The CAI program is menu driven. There is a main menu with six topics to choose from (Figure 7). The first four topics in the program menu, which are the tutorials on Type I diabetes, can be navigated in a linear fashion. Each topic is a button that takes the user to the topic branch. The user is presented content in a sequential manner, as though turning pages in a book. Linear navigation is executed by using the next card ► and previous card ◄ arrows.

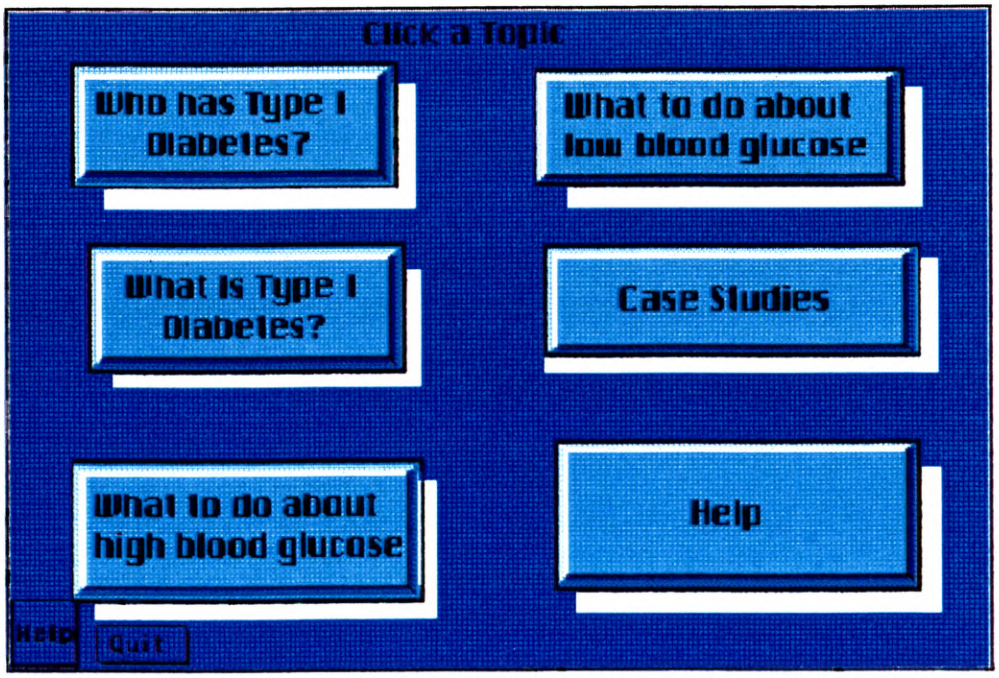


Figure 7. Main topic menu.

The main menu is easily accessed at any point in the program (except in the case study simulations) by clicking the "menu" button. This button is located in the lower right of each tutorial screen display (see Figure 1 and Figure 2). The

tutorial portion of the program is located in the first four topics: "Who has Type I diabetes?," "What is Type I diabetes?," "What to do about high blood glucose," and "What to do about low blood glucose." The learner may access any of these topics as he/she chooses based on prior experience with the knowledge. The author made every effort to present material that is relevant to the school setting. Although users can view the menu topics in any sequence, the program was designed to progress from basic concepts to complex concepts. Each topic is a linear branch of self-contained information that builds on the previous topic of information. When first viewing the program, it is preferable to view topics from the upper left corner of the menu screen to the lower right.

The topic "Who has Type I diabetes" gives the learner a general definition of Type I diabetes and how it is distinguished from other types of diabetes. This topic branch also addresses epidemiological facts and statistics such as prevalence, incidence, risk factors, and mortality.

The topic "What is Type I diabetes" elaborates on the definition of Type I diabetes by explaining it from a physiological standpoint. Normal digestive processes are presented with text, graphics of anatomy, and animation of the cellular insulin/glucose process. How diabetes differs from this process is also explained. The functions of insulin are introduced. The topic ends with a discussion of the physical symptoms of diabetes.

The topic "What to do about high blood glucose" suggests goals for diabetes management in the school setting. The term hyperglycemia is defined. Causes, symptoms, and school management of hyperglycemia are presented. The

concept of ketoacidosis and how it differs from hyperglycemia is introduced. The causes, symptoms, and school management of ketoacidosis are presented.

The topic "What to do about low blood glucose" is the last tutorial topic. In this branch, hypoglycemia is defined. Subjects discussed are causes of hypoglycemia, when it is most likely to occur at school, symptoms for mild to moderate reactions, treatment recommendations as well as prevention are discussed. Severe hypoglycemia and the proper use of glucogon is introduced.

Adult learners depend on knowledge about their progress through a program to make the best use of their limited time. They may flip through a book to see how much they have left to read. It is not easy to look ahead this way in CAI, so authors need to display this kind of progress information (Steinberg, 1991). Each card in the tutorial topics of the CAI project was numbered, i.e., "24 of 26" (see Figure 6), to let the user know where they were within the individual topic. This means the user was on card 24 of 26 total cards in the topic branch.

The Help Menu

The user can also link directly to other parts of the program that offer help with navigating the program stack, offer more detailed information on a particular word, phrase or topic, or quit the program at any time. The "Help" button that appears on every card in the stack links the user to the "Help Menu." The help menu contains three topic buttons: instructions, bibliography, and glossary (see Figure 8). The help menu is also the last topic on the main menu.

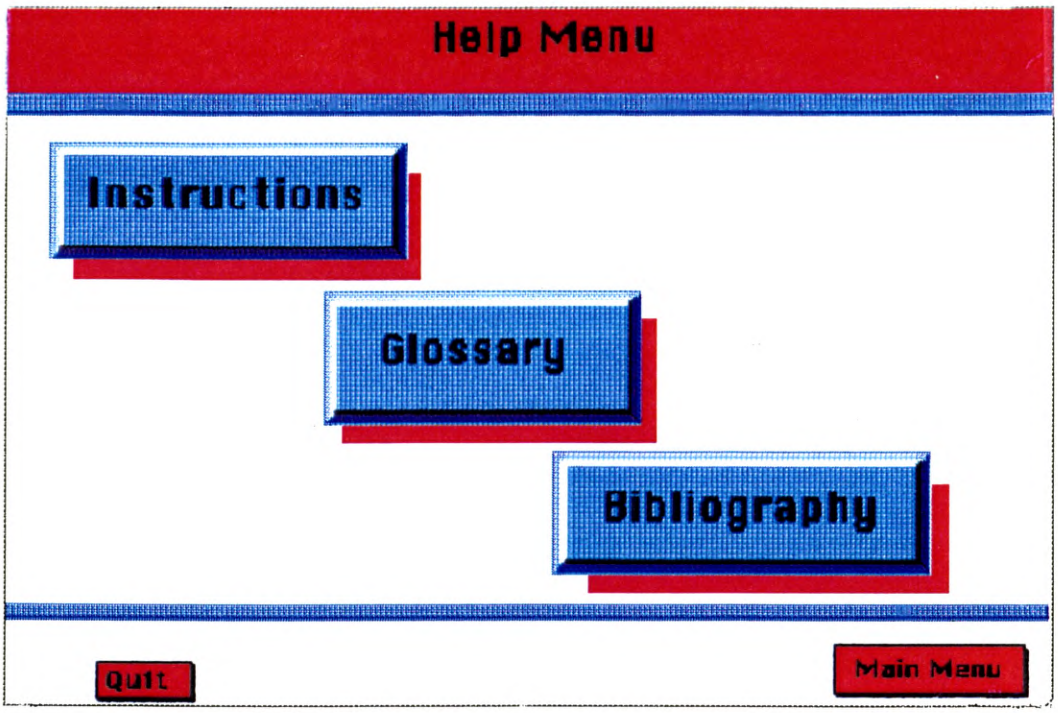


Figure 8. The help menu.

The "Instructions" button in the help menu links to a card (Help Instructions) that gives detailed information on the functions of all the buttons in the rest of the stack. The "Help Instructions" serve as user friendly on-line support for navigating the program when the author is not available.

The second item in the help menu is the "Glossary" button. The glossary, like the subject index, is another example of the hypertext capability of the CAI project. It is an alphabetical listing of definitions for a limited number of terms and phrases used in the tutorial portion of the CAI. Specific terms in the glossary can be viewed directly from where they are used in the tutorial portion of the program. This is accomplished by using the mouse to click on the term. The

glossary can also be viewed in a linear fashion, card by card from A to Z, directly from the help menu. Thus the interactive hypertext capability allows users to determine what they need or want to read and the order in which they will read it.

Terms and phrases that are defined in the glossary are identified in the tutorial portion of the CAI by appearing more bold than the surrounding text. The highlighted words are known as "hotwords" (see Figure 9). Hotwords are so named because when the user chooses to click on the highlighted text, the user is linked to the card in the glossary where the term appears (Figure 10).

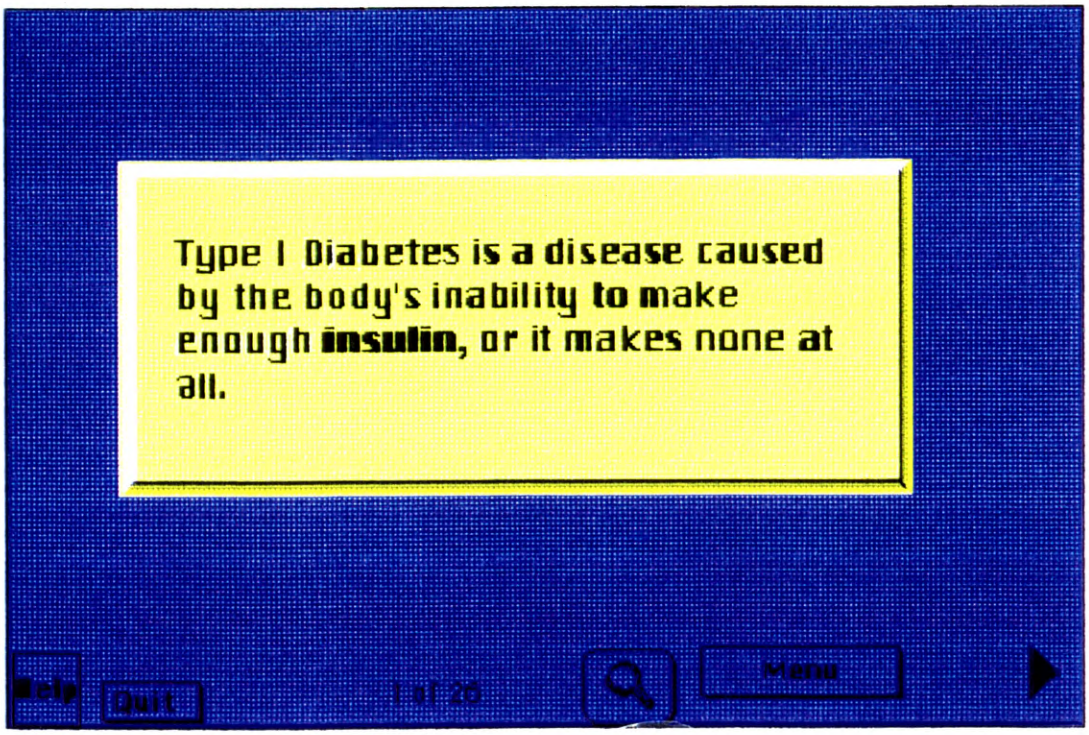


Figure 9. Hotwords identified with highlighted text.

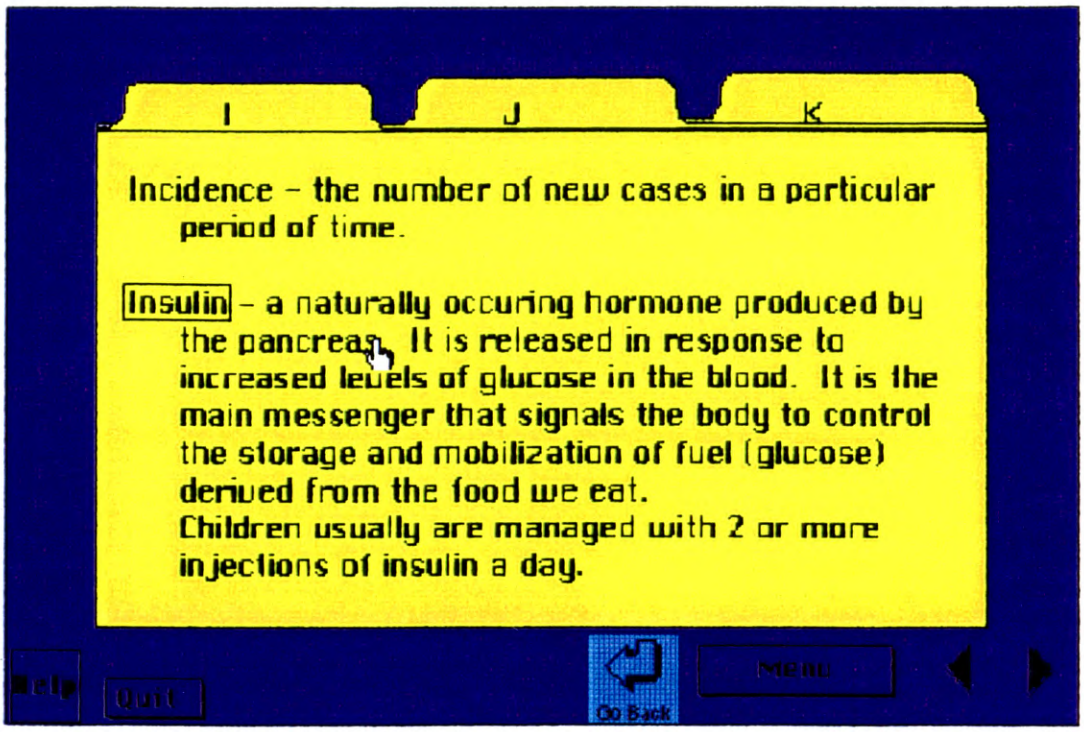


Figure 10. Glossary.

When the user wishes to return to his/her place in the main program, he/she need only click the "Go Back" button on any of the glossary cards. The "Go Back" button prevents the user from getting lost by bookmarking the user's place in the program. The user has the choice of viewing only the selected card or exploring the rest of the glossary before being linked back to his/her place in the program. The use of hotwords provide an explicit means that helps in selecting a more active rather than passive approach to learning.

The "Bibliography" button is the third item in the help menu. This button links the user to a card that has a scrolling list of the resources used in the development of the CAI.

Quitting the Program

Clicking the "quit" button, which is placed on every card, will bring up a dialog box asking the user if he/she is sure he/she wants to quit. This dialog box allows the user the option to continue with the program in case the button was clicked accidentally. Otherwise, the user may quit at any point in the program that is convenient for him/her.

Navigating the Case Study Topic

The "Case Studies" button is the fifth item in the main topic menu (see Figure 7). As mentioned earlier, this branch offers a different instructional strategy and is therefore navigated differently than the tutorial topics. The goal of the case studies simulations presented in the CAI project is participation in managing a diabetes emergency. Physical phenomena, such as a hypoglycemic reaction, cannot be a direct experience that the educator can provide a school teacher. Although it is not feasible for the school teacher to achieve the goal of direct participation, he/she can experience the event through the computer simulation.

Simulation helps to develop a relationship between theory and its application. By permitting the manipulation of reality, learners are afforded the opportunity to observe effects and develop problem-solving and decision-making skills regarding diabetes management in the school setting. Furthermore, simulations are fun, promote the transference of skill to the real world, and actively involve the learner. Simulations are especially advantageous for individuals who are worried about making mistakes because they allow for

experimentation in a penalty-free environment. This instructional strategy is helpful for adults who are sometimes reluctant to take risks (Lewis, 1990).

In the CAI project two case studies are presented. One case study involves a child experiencing hyperglycemia and the other is one experiencing hypoglycemia. Both offer the school teacher the opportunity to assess, diagnose, and choose appropriate treatment.

The user is given information about the setting and the scenario describing a child experiencing a diabetes emergency (see Figure 11).

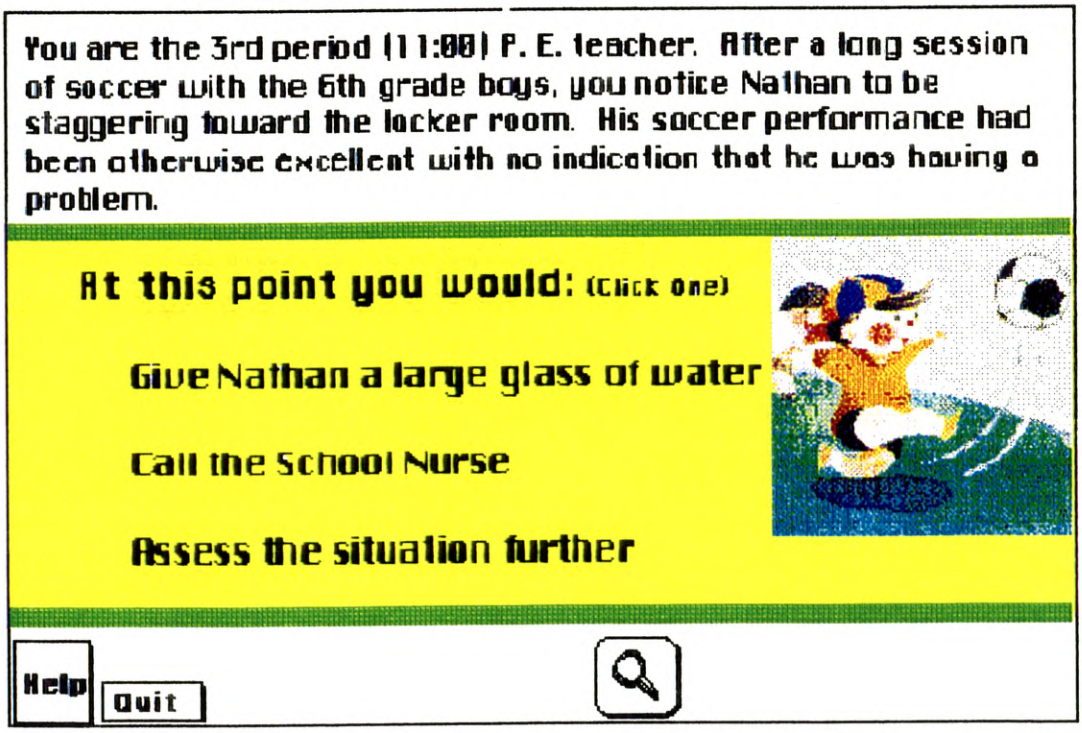


Figure 11. Case study diabetes emergency scenario.

The learner has less control over the movement within the case study simulation. In order to advance, the user must provide the correct choice. An incorrect choice will provide a feedback message and sometimes access to remedial information with the "Find a Subject Index" button (magnifying glass). The program will always allow the user to return to the previous card (previous button in lower right corner of Figure 12) to make another choice until the correct choice is made.

Figure 12 is the response to the choice "Call the School Nurse" on the card in Figure 11. When the correct choice is made the computer will advance the user to the next part of the case study. Because a standard of performance is

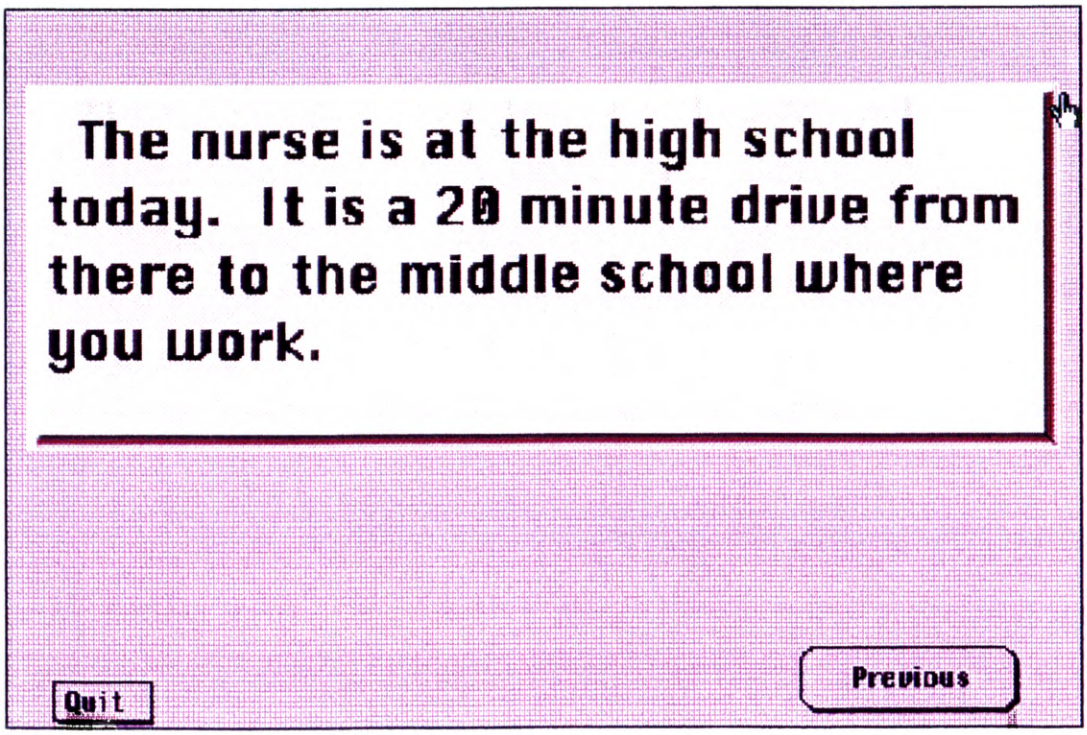


Figure 12. Feedback message to incorrect response in a case study.

part of the goal, more control has been assigned to the program. Each of the case studies require the user to assess the situation, make a diagnosis, and choose a treatment before completion of the case study.

Interactivity

Interactivity is the primary basis for using the computer in instruction (Kearsley, 1986). Interactivity is produced by branching within a program. The menu in the CAI project allows the user to link with a topic branch. The magnifying glass button links the user to the Find a Subject Index, which in turn will link the user to the card with the subject. Another interactive example is hotwords that link the user with the glossary.

HyperTalk Scripting Language

How does it happen that a mouse click on a button produces a specific computer response? Many of the functions in HyperCard, such as linking buttons to specific cards or text fields, is preprogrammed to make the software user friendly. However, cards and buttons can also be set up to perform a wide range of other functions by writing scripts using "HyperTalk." HyperTalk is the programming language that is part of HyperCard. For example, the user can click on the "Pancreas" button on the card in Figure 13a to see the description of that particular internal organ. Figure 13b shows what the card in Figure 13a looks like after a user clicks on the "Pancreas" button.

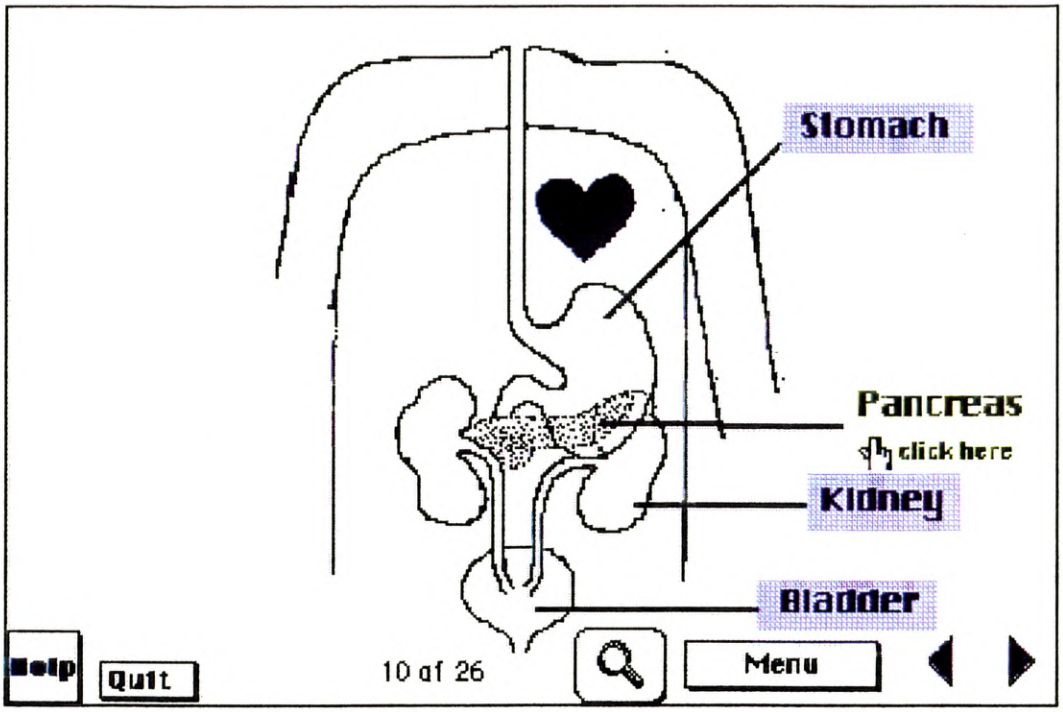


Figure 13a. Card with a button that links to an invisible text field.

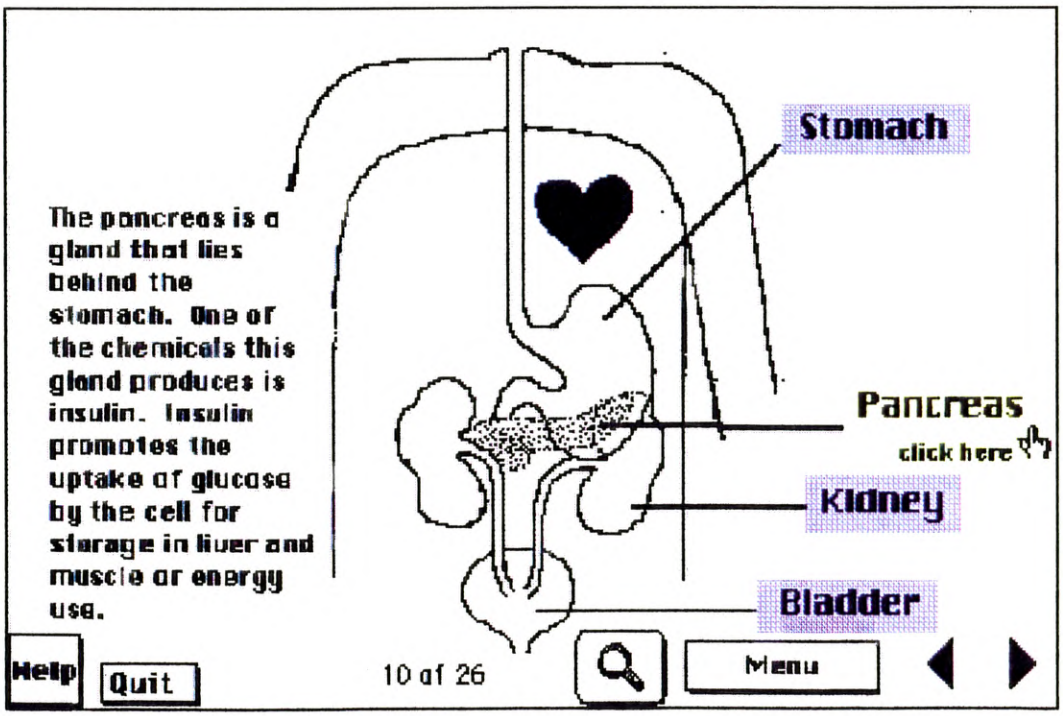


Figure 13b. Clicking on the pancreas button on the card in Figure 13a reveals a hidden text field.

Clicking on the "Pancreas" button caused the following series of HyperTalk programming statements or scripts that are associated with the button:

```
on mouseUp
   set visible of card field "pancreas" to ¬
   not the visible of card field "pancreas"
end mouseUp
```

Although a CAI developer does not need to learn scripting to use HyperCard, this simple script is instructive. It specifies an event that can occur with respect to the object with which it is associated (a mouse click on the button) and the actions to be taken when that event occurs (including showing the field called "pancreas" and making the field disappear when it is clicked with the mouse after it has been made visible).

This segment of HyperTalk code is called a handler. It specifies how the stack (program) should "handle" the mouse-up event for the "Pancreas" button. Scripts may be associated with all HyperCard objects such as buttons, fields, cards, backgrounds, and entire stacks. Interactivity is created by the user initiating an event with a mouse click on any of the above-named objects. The CAI author had programmed the computer response by the use of built-in scripts or writing individual scripts to handle the mouse up (mouse click) event.

The development of a CAI requires knowing the audience it is intended for and their knowledge needs. Having had considerable experience with the content helps in lesson development. Deciding on instructional strategies (tutorial, drill and practice, simulation, games) will provide a framework for presenting content. Programming to create interactivity will facilitate an active learning environment for adult learners.

CHAPTER 4

PROJECT OUTCOME

Evaluation

An important phase of authoring takes place after the initial program has been developed. This is the process of evaluation and revision as a result of field testing. Prior to field testing with school teachers, the CAI was reviewed by each member of the author's professional project committee. The review by committee members ensured content accuracy, relevance, and applicability to the school setting. Positive and constructive feedback was provided by the committee members.

An evaluation form was modified by the author for evaluating the CAI (Northwest Regional Educational Laboratory, n.d.). Evaluation of the diabetes CAI was broken down into four categories of evaluation: (a) content characteristics, (b) instructional characteristics, (c) program, operation and documentation, and (d) quality. Space for writing recommendations was also included on the form. Items under content, instruction, and program operation were phrased as statements, i.e., accurate content, well defined objectives, clear, nicely formatted screen displays. The evaluator could agree or disagree on a 5-point scale. The quality category had three items which were judged on a scale of 1 (low quality) to 6 (high quality).

Three school teachers agreed to view and evaluate the CAI. The teachers taught third to eighth grade. Each teacher spent anywhere from 35 to 60 minutes to complete the program. Results of the teachers evaluations were very positive. All three teachers agreed or strongly agreed with each item under the first three categories (content characteristics, instructional characteristic, and program, operation, and documentation). All three teachers rated the quality of all three categories (content characteristics, instructional characteristics, and technical characteristics) of the CAI as 5 to 6.

Based on the teacher's feedback only minor revisions were made. Recommendations included changes for typographical, punctuation, and grammatical errors. Minor changes in wording were also suggested. Other recommendations included the use of additional case studies as well as an overall quiz at the end of the program to verify learning of the content. Overall, the teachers reported positive experiences with the use of the CAI for learning about diabetes in the school setting.

Limitations

Two limitations related to project development were identified. First, designing and producing a CAI program takes a considerable amount of time, effort, and money. Somewhere between 300 and 400 hours were spent by the author learning to use the software and putting together the diabetes CAI. Certainly, familiarity with the authoring software will decrease time required in any future projects. Also the author's CAI incorporated imported graphics and

video clips that required the use of university-owned scanner and computer video equipment. For the CAI author who must purchase or rent additional equipment to complete a project, there will be increased financial burden in addition to considerable development time.

Second, the limited number of interactions in the decision-making case study simulations may not be sufficient to capture the essential diabetes concepts. Developing additional case studies, as suggested by one evaluator, may help this dilemma.

The program cannot individualize instruction nor answer questions that the school teachers may have about diabetes. However, once a school teacher completes the program, a health care professional should be available to answer specific questions when possible.

The use of technology has its limitations. There is no CAI that can identify a "teachable moment" for a learner that will provide a lesson to be remembered forever. Technology cannot replace the diabetes nurse educator's relationship with the school teacher. Clearly, the purpose of CAI is to facilitate and enhance learning relationships, not to replace them. At the same time, CAI is intended to enhance and supplement the teaching/learning process, not to replace the role of the diabetes nurse educator.

Recommendations and Implications

On the basis of this project, it seems reasonable to make recommendations and suggestions for future endeavors. Future work may encompass several areas.

It is strongly recommended that future efforts focus on evaluating the effectiveness of CAI as a teaching modality versus other means of presentation. Are diabetes nurse educators confident with the teachers' knowledge base and ability to manage diabetes emergencies in the school setting after being taught with any of these teaching modalities? This is one question about which more information is needed.

Examining the learning preferences of school teachers will indicate the extent to which methods of presentation used in the education process are in congruence with learner preferences. Do a variety of ways of learning similar subject matter lead to more effective decision-making skills in managing diabetes emergencies in the school setting? Additional research is needed comparing teacher satisfaction with various teaching methods used for presenting diabetes information.

Additional CAI programs need to be developed. A CAI that addresses the topic of blood glucose testing and interpretation of results will be useful in some education settings. The impact of nutrition on blood glucose readings needs to be an additional topic.

The outcome of the author's CAI project suggests several implications for nursing practice. First, CAI case study simulations provide school teachers with the information that will enable them to make decisions about diabetes problems in a safe environment. This is a benefit in a rural setting where encounters with diabetic children may be limited and the number of school nurses available to make onsite diabetes management decisions may also be limited. School teachers

can then apply diabetes knowledge learned from CAI simulations later in actual decision-making situations.

A second nursing implication is that nurse educators can author CAIs that address other clinical situations such as critical care, wound management, or pain control which all require critical thinking and clinical decision-making skills. Topics such as wound management or pain control could also be adapted specifically for family members who are caring for loved ones in the home setting. The potential to improve the quality of education, both in nursing and consumer health, can be accomplished by publishing, marketing, and distributing nurse authored CAIs through a reputable educational software publishing company.

Finally, the dissemination of diabetes information in a well designed CAI can reach the global community by utilizing the World Wide Web (WWW) on the internet. If commercialization is not the primary goal and knowledge dissemination is, then internet technology can be used to link the author's CAI project to statewide and global internet communities. Metnet (Montana Educational Network), the Virtual Medical Center, or the development of a personal home page are a few examples of internet communities to be found on the WWW. According to Lewis (as cited in Shellenbarger & Thomas, 1996), it is estimated that approximately two million people currently have Web access, and that number continues to grow daily. Metnet would provide school teachers with statewide access to the CAI. The Virtual Medical Center or a personal Web page will give global access to the CAI project. By becoming a resource on the Internet, the author's CAI can positively influence the knowledge and

contribution that professional nurses can make in the quality of diabetes care and information available.

Summary and Conclusion

Information about diabetes that targets parents of children with diabetes, health professionals, and adult individuals with diabetes is plentiful. However, there is very little information that addresses diabetes specifically for the school setting. The author's CAI project was intended to weed through much of the information available and consolidate that which is most meaningful for the school setting. The CAI was developed to answer the shortage of high quality and appropriate software, which is cited in the literature as an obstacle to widespread use of computers for health promotion education.

The purpose of this paper was to describe the process of authoring a prototype computer-assisted instructional program that addressed two key concepts about Type I diabetes: disease process and hypoglycemia. Adult learning theory provided a theoretical perspective to guide the design of the program. Utilizing the principles of adult learning theory in designing a CAI for use by school teachers increases the effectiveness of linking computers to instruction.

The literature suggests that CAI is an effective instructional tool in adult health education. Furthermore, teaching is a primary role of a nurse's management of health care. For school teachers who may be having to cope with a child with diabetes in their classroom, computer-assisted instruction is a

teaching strategy that can be used for presenting diabetes concepts. In this situation, school teachers need to know relevant facts about the disease and simple management strategies for common diabetic emergencies that can occur in the school setting such as insulin reaction and high blood glucose reaction. These topics and others were addressed using an author-developed CAI as the medium.

Becoming a part of the future requires the sharing of knowledge through innovative, timely, succinct, and friendly mechanisms. The expanding role of the diabetes nurse educator necessitates utilizing instructional strategies that can teach self-care to consumers of health care as well as others involved in the individual's care. Thus, as nurses respond to the demands for public education, such as providing school teachers with basic diabetes education, the computer should be considered as an appropriate and effective medium for assisting in the education process. CAI provided by the computer can address this demand.

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APPENDICES

APPENDIX A

AREA OF DIABETIC INTEREST ASSESSMENT

Area of Diabetic Interest Assessment

The first 7 items are potential topics that might be seen as menu items in a CAI module. Please rate them according to how important or helpful such information would be to you.

Please circle the number that fits your knowledge needs.

	Not helpful	Somewhat helpful	Mostly helpful	Very helpful
1. Information about general Diabetes disease facts	1	2	3	4
2. Facts about low blood sugars (insulin reactions) and high blood sugars	1	2	3	4
3. Management of high and low blood sugars at school	1	2	3	4
4. What to expect if a child with diabetes is sick with something other than diabetes	1	2	3	4
5. What to do about various blood sugar readings off a blood glucose monitor	1	2	3	4
6. How insulin works in relationship to food and activity in the school setting	1	2	3	4
7. Information re: ketone urine testing results	1	2	3	4

8. Would you prefer to see topics presented in short blocks?

9. How much time do you have to work with a module?

10. Is there a topic about diabetes that you would like to see done that is not mentioned above? If so, please elaborate.

Thank you in advance for your participation.

APPENDIX B
COVER LETTER

October 27, 1995

Dear Teachers:

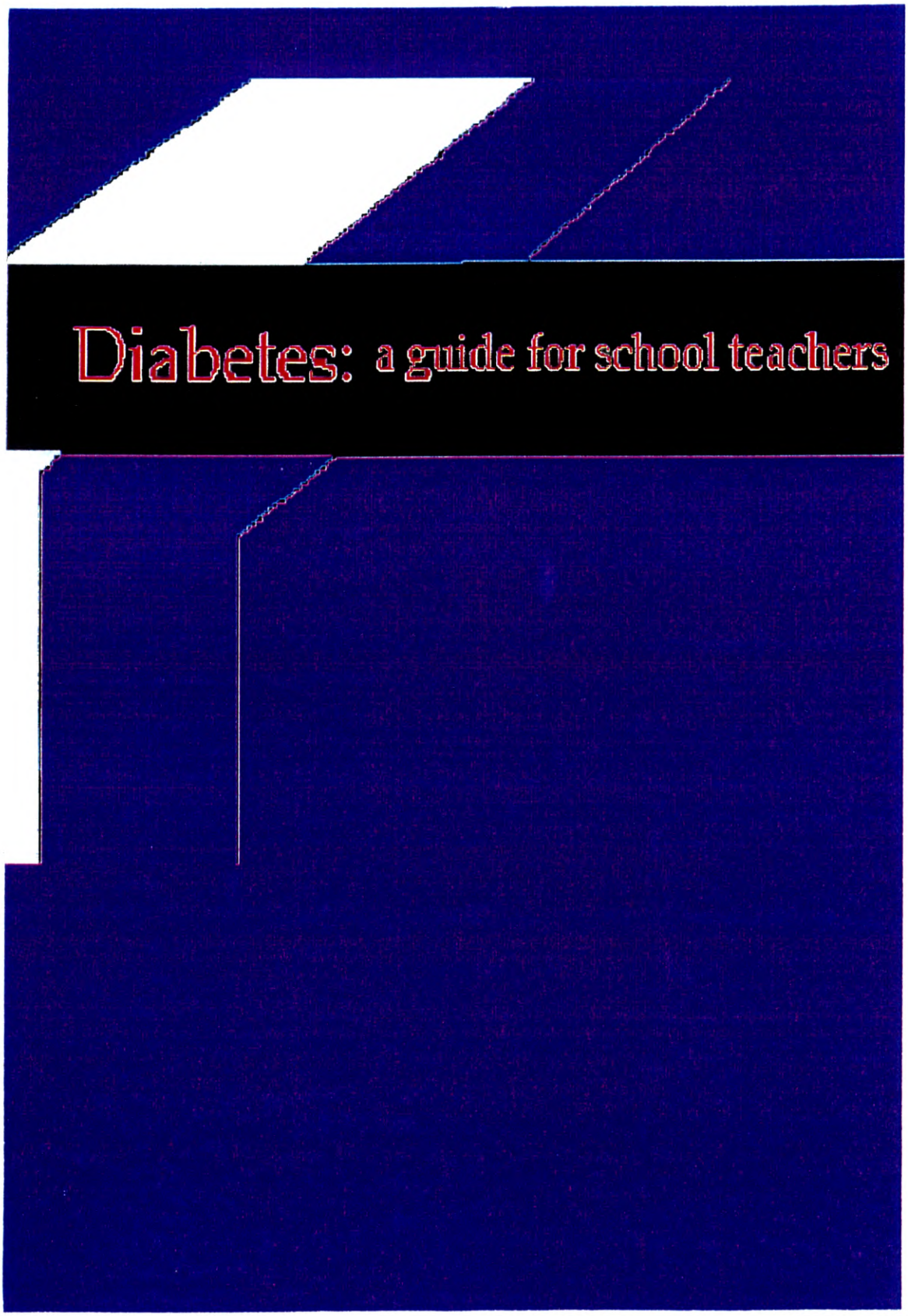
My name is Jeanette Priest, RN. I am a graduate student in the College of Nursing at Montana State University. Prior to entering graduate school I was a diabetes educator in Livingston, MT. As a part of my degree requirements, I will be doing a professional project which involves developing the script for an interactive computer assisted instructional (CAI) module. This module will include information about diabetes that will help school teachers understand various aspects of the disease. The intention of the project is to serve as an adjunct to any written and personal diabetes information that may be received from the parents of a child with diabetes or from the school nurse. Before developing this resource, I would like input from you, the school teachers, regarding the kinds of information you would like to see presented in a CAI format. My hope is to develop this to make use of interactive computer technology as well as the use of simulations to reinforce the material presented. Your participation in filling out this assessment form is entirely voluntary and very much appreciated. Please complete by November 2, 1995. Return your completed copies to Mrs. Riebhoff's office. I will pick them up there next week.

Sincerely,

Jeanette Priest, RN, BSN

APPENDIX C

INSTRUCTIONAL PROGRAM GUIDE


Diabetes: a guide for school teachers

Diabetes - a Guide for School Teachers

System requirements

- Color Macintosh computer
- 2 MB RAM
- Disk drive
- Hard disk drive with 2.8 megabytes of free space
- System 7.0 or higher

Program description

Diabetes - a Guide for School Teachers is an interactive computer-based program that allows school teachers to review and apply knowledge on Type I diabetes. The program was designed using Hypercard software. The program is self-paced by having topics to choose from in a menu format. This allows you to complete topics one at a time at your leisure. Each topic may take 10 minutes or less to complete. Multiple choice, true/false, yes/no questions with immediate feedback are also integrated into each topic to confirm your mastery of the content. Colorful screen designs, line drawings, photographs, animation, and sound are also incorporated into the program. Another feature is a subject index that allows you to review specific topics and then return to your place in the program. Realistic case studies allow you to apply knowledge of the content to potential school situations.

A Help Menu has instructions for using buttons to negotiate the program. This menu also has access to the glossary that provides a definition or explanation of a particular term. The glossary can also be accessed via "hotwords." A mouse click on a bold term or phrase will take you to the term in the glossary. The "Go Back" button will return you to your place in the program. A bibliography can also be found under the help menu. Attached to the last page of this program guide is a supplemental reading list.

Learning Objectives

School teachers need to understand as much as possible about diabetes when a child with Type I diabetes resides in their classroom. This knowledge will help them feel more secure about diabetes and will help them manage common diabetic problems, especially when a school nurse is not readily available.

This computer assisted instructional program (CAI) was developed to supplement whatever instruction you received from the child's parents and school nurse.

The CAI provides information about:

- Who gets diabetes? - facts and statistics
- What is diabetes? - the disease process and how it differs from normal metabolic processes
- What is hyperglycemia (high blood sugar) and hypoglycemia (low blood sugar)?
- Case studies - a fun way to apply concepts to "real life" situations that might occur in school.

By the end of this module you should be able to

- Define Type I diabetes
- Identify the symptoms of high blood sugar and what treatment can be done in the classroom setting
- Identify sources of glucose in the diet and in the body
- Identify the functions of insulin
- Identify the symptoms of low blood sugar (hypoglycemia) or insulin reaction.
- Identify when hypoglycemia is most likely to occur at school
- Identify immediate treatment of hypoglycemia
- Apply diabetes knowledge in a case study simulation

Installing and Operating

1. Start the computer
2. Insert diskette 1 *Diabetes - a Guide for School Teachers* into the disk drive. With password program, go to file, double click file, enter password to access hard drive.
3. Double click "*Diabetes Guide 1.1 sea*"
4. A dialog box will appear asking to load Final segment, click on eject.
5. Insert Final segment diskette (Disk 2).
6. Click on load button.
7. A dialog box will appear, click on desktop button.
8. Select your hard drive, double click it.
9. Then click on extract (Disk 2 will be ejected)
10. Dialog box to insert Disk 1 will appear, insert disk asked for. Extraction process will begin.
11. Continue to follow direction on dialog box.
12. Open hard drive and locate *Diabetes Guide f.*
13. Double click *Diabetes Guide copy5* to start program.

*Installation hints: If problems occur in the installation process, try restarting with extensions off (hold shift key down while restarting until "extension off" is seen in dialog box).
Be sure to restart (to turn extensions back on) to run program.

Resources

American Diabetes Association (ADA)
Montana Affiliate, Inc.
1601 2nd Ave., North
4th Floor Center
Box 2411
Great Falls, Montana
1-800-232-6668
406-761-0908

American Diabetes Association Internet Home Page
http://www.diabetes.org/default.html

Controlling Low Blood Sugar Reaction [brochure]
Becton Dickinson Consumer Products
Becton Dickinson & Company
Franklin Lakes, New Jersey 07417-1883

Managing Your Diabetes [brochure]
Eli Lilly and Company
Indianapolis, Indiana 46285

Managing Your Diabetes [video]
Eli Lilly and Company
Indianapolis, Indiana 46285

Understanding Insulin Dependent Diabetes
H. Peter Chase, M.D.
Barbara Davis Center for Childhood Diabetes
University of Colorado Health Science Center
Copies may be purchased from:
The Guild of the Children's Diabetes Foundation at Denver
700 Delaware St.
Denver, Colorado 80204
(303) 623-CURE

This program was developed by Jeanette Priest, RN, as partial fulfillment of her Master of Nursing degree at Montana State University, Bozeman, Montana. Revisions to this program were completed in September, 1996. Address correspondence:

Jeanette Priest, RN

122 Suce Creek Road

Livingston, Montana 59047

APPENDIX D

SOFTWARE EVALUATION FORM

Software Evaluation

SA-Strongly Agree A-Agree D-Disagree SD-Strongly disagree

NA-Not Applicable

A. CONTENT CHARACTERISTICS

1.	SA	A	D	SD	NA	Accurate Content
2.	SA	A	D	SD	NA	Amount of learning justifies time spent
3.	SA	A	D	SD	NA	Accomplishes stated objectives
4.	SA	A	D	SD	NA	Sequence is logical and clear
5.	SA	A	D	SD	NA	Instructions are clearly stated
6.	SA	A	D	SD	NA	Level of difficulty is appropriate for adult learners
7.	SA	A	D	SD	NA	Politically correct, nondiscriminatory
8.	SA	A	D	SD	NA	Content relevant to school setting

B. INSTRUCTIONAL CHARACTERISTICS

9.	SA	A	D	SD	NA	Well defined objectives
10.	SA	A	D	SD	NA	High learner involvement
11.	SA	A	D	SD	NA	Effective feedback for correct responses
12.	SA	A	D	SD	NA	Effective feedback for incorrect responses
13.	SA	A	D	SD	NA	User control over rate of presentation
14.	SA	A	D	SD	NA	User can select to go back and review previous frames of information
15.	SA	A	D	SD	NA	Learning can be generalized to an appropriate range of situations
16.	SA	A	D	SD	NA	Graphics/color/sound are used for appropriate instructional reasons
17.	SA	A	D	SD	NA	Use of program is motivational
18.	SA	A	D	SD	NA	Instruction supplements previous learner knowledge/experience

C. PROGRAM, OPERATION, AND DOCUMENTATION

19.	SA	A	D	SD	NA	The user support materials are comprehensive
20.	SA	A	D	SD	NA	The user support materials are effective
21.	SA	A	D	SD	NA	Clear, nicely formatted screen displays
22.	SA	A	D	SD	NA	Information displays are effective
23.	SA	A	D	SD	NA	Menus and other features make the program "user friendly"
24.	SA	A	D	SD	NA	Incorrect selection of keys does not cause program to abort
25.	SA	A	D	SD	NA	Instructions can be skipped if already known
26.	SA	A	D	SD	NA	Loading instructions clear; program easy to load
27.	SA	A	D	SD	NA	The program appropriately uses relevant computer capabilities
28.	SA	A	D	SD	NA	The program runs properly and easily

D. QUALITY

Write a number 1 (low) or 6 (high) which represents your judgment of the quality of the program in each division below:

_____ Content Characteristic
_____ Instructional Characteristics
_____ Technical Characteristics

RECOMMENDATIONS:

**Modified from MicroSift from the Northwest Regional Educational Laboratory