Work in Progress: Interactive Multimedia for Diabetes

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Abstract

Staff of the Faculty of Health Science and the Department of Mathematics and Computing, Central Queensland University, have been involved for the last ten months in the development of an interactive educational multimedia package aimed at diabetics and their primary caregivers.

Using a problem-based approach, simulations, and a database of diabetes information, it is anticipated that the final multimedia product will be delivered on CD-ROM and distributed Australia-wide to diabetes clinics and health science/nursing programs.

This paper will describe the initial design stage, implemented by a CQU honours student, and the plans for the prototyping later in 1994.

Introduction

Mid-1993 staff of the Central Queensland University (CQU) Faculty of Health Science and Department of Mathematics and Computing initiated discussions on the development of an interactive multimedia education package for diabetes education. This discussion resulted in a joint application for a 1994 CAUT grant which sought funding to develop a teaching program to be distributed using CD-ROM technology:

> This project seeks to reduce the tedium of teaching repetitive materials with a self-paced learning and evaluation tool for introductory-level university students, health workers, diabetics (there are hundreds newly diagnosed each year in Australia) and their families who require considerable information to effectively manage a diabetic condition. A user-tested multi-media teaching program on compact disk (CD) will provide students in pre-professional health programs with a tool for their own learning and for patient education; multiple entry points enable the lecturer and student tailor the program to meet individual needs.

While this first application was unsuccessful, development has continued and in Semester 1, 1994, the program design was completed by a CQU student as a project for the honours computing subject, Computer Applications in Learning and Training [the CALT subject is described in Clayton et al, 1993]. A further application for funding is currently (June 1994) being developed and the honours student is anticipating developing a prototype of the package in Semester 2 using ‘foot care’, an important subset of the diabetes package, as the content topic.

This paper describes the student's design process and briefly outlines the prototype development in Semester 2.

Design Criteria

The Faculty of Health Science provided the general design specifications:

- The intended users are generally divided into three groups: nursing students, health workers, diabetics and their families. Since diabetes can affect any one regardless of age (Insulin Dependent Diabetes Mellitus (IDDM) usually occurs in children or young adults), the lowest level would include users less than 12 years old.
- The program will integrate audio (voice), video clips, animation, graphics, colour and text to create a multi-media system. Use of graphics or pictures will give a better understanding of a situation than merely describing it with words. Similarly, animation would help to explain a complicated process that would otherwise need a lengthy text-based explanation. On top of this, multi-media is able to reproduce scenarios closer to a real life situation.
- Colour pictures and graphics will enhance visual discrimination and present a clearer perception to the user. This makes the screen livelier and more interesting. Having audio or voice output will transform a silent machine to a talking tutor. This trains the user to

listen to the 'patient' (represented by the talking picture in the design developed) carefully before any action is taken. In short, real life situations are brought to the computer.

With the present multi-media features found in computers, it is hoped that this would give users a better impression of the lessons and longer retention of information, making learning more effective.

- Lessons or tests are not to be set up in a strict linear fashion. Modules are to be in the form of interactive case studies; scenarios involving relationships between a nurse and the patient would be ideal where the user could learn from a 'simulated' experience. The user would then 'answer' the required questions as part of completing the actions required by the simulation.
- The design should be flexible, allowing the user to make selections for the case study they are interested in. It should also provide different levels of difficulty for several user levels.
- Information (help in navigation as well as technical support in diabetes management) is to be provided upon request and should cover basic topics on what diabetes is about, basic anatomy and physiology, diabetics' diet, exercise, danger signs and terminologies. This information might be organised in topical order using a tree structure. Multi-level information could be achieved through the use of hyperlinks which allow cross referencing of related topics.
- The program must be stimulating and at the same time non-threatening. It should be able to attract the attention of users and encourage them to solve the case studies at their own pace. This will make learning interesting and fun.
- One program objective is to provide the instructor or lecturer with a tool for student evaluation. This will enable the instructor to check the student's progress and monitor the difficulties the students face when they are going through the lessons.
- This tracking mechanism will record the student's activities in the order or sequence of events. A student should be allowed to start from the basic level and slowly proceed to the higher level, another student might attempt to solve some more complicated lessons, skipping basic topics.
- A hard copy printout of reference material is not required as users may readily obtain similar information from libraries and health centres. The design should mainly focus on interactive learning.

Proposed Design Approach/Methodology

The proposed basic screen design is illustrated in Figure 1 below. All of the navigation tools are consistently placed at the bottom of the screen. The basic design shows two main interaction areas. Graphics, animations and technical information (x-rays, charts, and diagnostic information) will be presented on the left side of the screen, here represented by a 'movie' player. User activities will be presented on the right side of the screen.

In a typical scenario, for example, activating the video will allow a patient (Granny Brown here) to describe her/his situation. Allowable activities will be presented on the right (including a text version of 'questions' posed in the video) and answers may also be entered here. If the user requests additional information, Granny Brown's *history*, for example, a pop-up box will present that information.

The proposed design uses a Problem Based Learning (PBL) approach, where learning is achieved through the process of problem solving. The user is given a problem, presented as a clinical case study, where s/he must gather and organise the facts of the case, and decide how to resolve the 'patient's' situation through a process of free inquiry, reasoning and decision making. The case study problems, not a set syllabus, provide the stimulus and framework for learning.

The case situations must be designed in such a way that they lead the user through different paths depending on their response to the problem presented. Different paths might present a different form of problem at different levels of difficulty. This will cater for users with differing experience and knowledge levels. This approach meets the requirements of not having a strict linear learning path (didactic questions presented in a predetermined pattern).

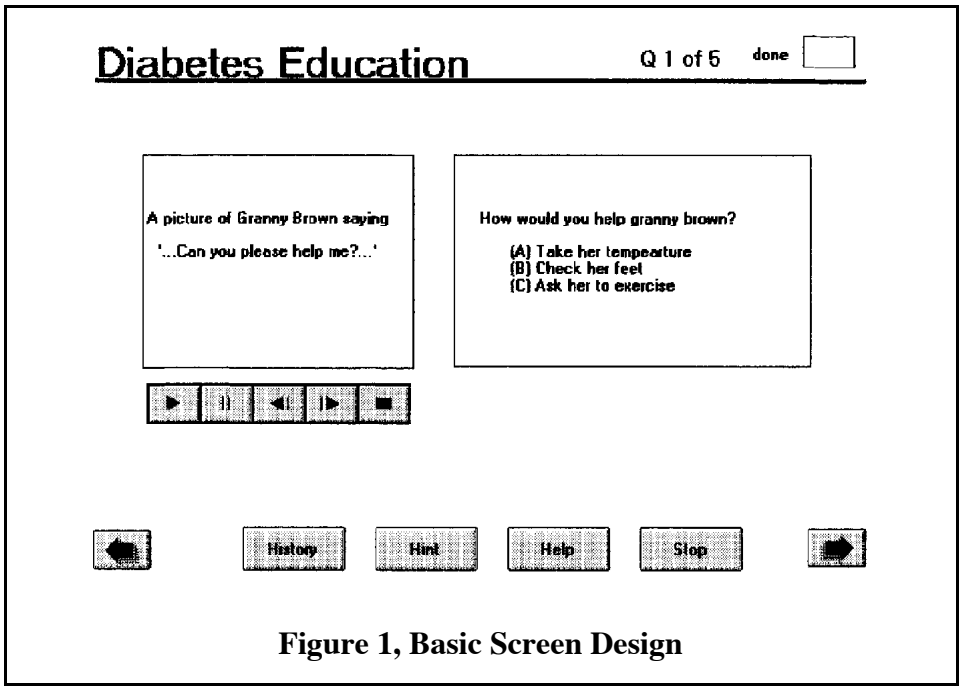

Figure 1, Basic Screen Design

If, however, the user wants to get more information directly, s/he could obtain the required information through the 'help' option. This permits the user to look up specific topics, either to aid in solving the problem or just for additional information.

An overall concept map will also be provided in the HELP option and will show all the available case studies on different topics. The user will be allowed to choose the topic s/he wants. In the prototype design, there will be only one case study, based on foot care. It will consist of five questions which can be completed in any order. In some of the more complicated and critical topics, users must answer the questions in a linear fashion. There are, for example, some medical procedures which must be done in a specific order.

Potential Problems and Constraints

File size—As this program is built on a multi-media platform, there will be a large number of relatively large graphic and similar files (video clips, animation and still pictures). For example, 15 seconds of animation might require 250-300 frames, potentially 5-10 megabytes of memory depending on the screen size and animation tool used.

Image Quality—A high resolution system will be required for displaying reasonably sharp images, probably at least 1024 x 720.

Expertise—Technical knowledge on diabetes is required to build up the database and create case studies that are as close to real life situations as possible.

Client Reaction

The proposed design has been presented to the Health Science 'client' and has been approved for continuation to the prototype stage.

Information about diabetes may be presented as a special unit in the curriculum or as part of several units at various levels, depending on the structure of the curriculum, whether it is 'problem-based' or organised on a 'medical model', etc. Students often need to review this information later in their programs and during clinical practice. The project will provide students with an accessible, personal tutor at the point when the information is needed.

Teaching diabetic patients (and their families) about their own self-care is an important part of the Health Science student's professional development, but the students are often handicapped by a lack of suitable teaching materials or understanding of appropriate teaching strategies. At its 'entry' or 'orientation' level, the material on this CD will help students with both of these learning tasks.

Prototype Development

Carr (1988) argues that too many software developers design products 'for themselves', forgetting the users. To be effective, the programmer (or the courseware author) must:

> Realise that programming is ultimately for the user—the consumer of the software. You must view the process of developing software as a user-driven, software development cycle (18).

His iterative eight step process (Carr, 1988, 20-24), which is summarised below, emphasises contact with users.

- Know Your Users.
- Select Appropriate Tools.
- Spend Time on Preliminary Designs.
- Use Your Team's Latent Talents.
- Design and Develop Through Evolution.
- Empathise with Users.
- Deliver the Product.
- Listen to Your Market.
- Reset to Phase One.

The consistent message is that user needs are paramount. For the academic institution there are two users, the academic designing a subject or course who requires resource materials (courseware) to use in the delivery of effective instruction, and the student receiving that instruction. The former's needs will sometimes be fulfilled by an individual author prototyping method, determining the needs of the latter requires a program of consultation and testing over the whole life cycle of the courseware. When the needs of the two conflict, common sense suggests that the needs of the 'real' user, the student, must take precedence.

Summary

The purpose of this design was to create an interesting and effective learning environment. The Problem Based Learning approach, which uses case studies to teach, encourages reasoning abilities. The simulated situation will be presented to the user in the same way as it will be encountered in reality. This problem solving approach should help users to manage real-life difficulty.

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