The Development of a Multimedia Interactive Learning (MIL) Program in Diabetes Care for Health Care Professionals in Northeastern Thailand

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ABSTRACT

Objective: This paper reports the development of a multimedia interactive learning (MIL) program in diabetes care for health care professionals in northeastern Thailand. It aims to be a supplementary tool for health care professionals to enhance their knowledge and skills in diabetes treatment.

Methods: The program was developed via software called "Authorware Professional 7.1®". Additionally, audio and video clips were implemented into the program as part of the multimedia interactive functions. The program covers different aspects of diabetes care including; basic knowledge of diabetes, available treatments (e.g., oral medications, insulin, non-medication treatments), patient monitoring (e.g., diet, exercise, blood glucose check up), case studies (e.g., patient cases), and assessments (e.g., multiple choice questions). Moreover, the insulin injection techniques were demonstrated via video clips. Interestingly, the program itself will be running via a mouse-clicking with automatic audio sounds. After the completion of the program, an attitude survey towards a MIL program was conducted next.

Results: The overall results were positively favorable. Some changes were made into the program based on the recommendations. A further evaluation of the effectiveness of the program with the health care professionals needs to be conducted via a well designed study. More surveys regarding the attitudes toward the program will be continually performed.

Conclusion: a multimedia interactive learning (MIL) program was completely developed. The usefulness of the program in diabetes care management via health care professionals is still needed. Further evaluations of attitudes toward to the program need to be done.

Keywords: Authorware Professional®, computer based learning program, diabetes care, Penfill®, 30 baht governmental health insurance

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In Thailand, it is essential for health care professionals to understand fully diabetes and its management as it is a serious cause of death and amputations.[1] Furthermore, diabetes is responsible for a large amount of budget expenditure.[2,3] This situation similarly occurs in other countries around the world.[4] Health care professionals such as doctors, pharmacists, and nurses are dealing on a daily basis with diabetic patients. They also are required to recognize the di-sease, gather relevant patient information, and give appropriate care. Traditionally, the process of knowledge and skills learning has depended upon such conventional methods as class teaching and textbooks, but difficulties arise due to time available, hospital personnel's lack of patient care experience, busy work schedules, and the large number of patients.[5,6] In an attempt to overcome these difficulties, a certain number

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of interactive multimedia materials have been introduced to health environments.[7-9] Some previous studies showed that interactive programs were successful in achieving some the objectives of enhancing knowledge, developing clinical skills, and improving the quality of life.[10,11] Thus, the process of learning skills requires extra practice via modern technology.[12] The rapid change of technology in recent years provides the impetus for many instructors, health care professionals, and students to revisit their ideas about the teaching-learning pro-cess.[13]

Pharmacy today in Thailand is unique, as the modern practice of pharmacy is highly dependent on the use of computers for order entry, drug information, and dispensing. Other health care professionals, such as physicians, nurses, and dentists, still have the ability to practice with significantly less technological dependence compared to most pharmacists.[14] Thus, major factors influencing the integration of technology for pharmacists are mounting prescription volumes, rapidly expanding medication developments, and the complexity of drug interactions.[15-17] Additionally in pharmaceutical education, the implementation of computer technology on clerkship rotations theoretically should be implemented without delay. Hypermedia, multimedia interactive learning, and web-based learning have also been used to instruct future pharmacists, both in the classroom and in the field, in a variety of exercises from taking a patient history to the administration techniques for eye drops.[18-20] Other demonstrated uses of multimedia interactive learning program are for teaching congestive heart failure therapeutics, compounding medications, geriatric care, and interactive webbased therapeutic problemsolving.[21-24] In the process of training medical students, many multimedia programs have been developed to improve student accomplishment in a wide array of medicine. Such skills include taking history and physicals, learning techniques for examining pediatric patients and performing neurologic evaluations, intubating patients, and improving cardiac auscultation skills.[25-31] Recently, the authors have developed a multimedia computer-based learning program in diabetes management. However, the program was developed in English version as part of the collaborative research with the University of Canberra (UC), Australia.[32] The result of the effectiveness of this program was conducted with final year pharmacy students. The overall results were positively favorable. However, some limitations were addressed including; language barrier and manuscript for non-English users, etcetera.[33] Thus, the authors now are aiming to develop a multimedia interactive learning (MIL) program for Thai clinical pharmacists as well as other health care professionals (e.g., physicians, nurses, and students) involved in diabetes care. The structure of the program was adapted from a previous program.

MATERIALS AND METHODS

1. Development of Multimedia Interactive Learning (MIL) Program includes:

A MIL program was developed using the Authorware Professional 7.1® version 7.1. This is a software program that allows the number of icons to be incorporated into a logical flow chart to form interactive programs ideally suite to MIL. A particular advantage of Authorware Professional® version 7.1 for this project was that it allowed users to create, store, edit, and retrieve items of multimedia information, such as audio and video, within the interactive environment. Some screen-play examples of the MIL program were demonstrated as in Fig 1-4. The MIL program contained seven sections of diabetes care management. All contents selected were based on a standard guideline of diabetes mellitus care from the Ministry of Health, Thailand. The contents included:

1.1) Program instruction: this describes the appropriate use of the program. The instruction was written in such a way that it was easy for a new user to understand.

1.2) Basic Knowledge of Diabetes Mellitus: MIL contains various topics regarding diabetes mellitus including:

- Definition
- Diagnosis/screening test
- Medical complications

Macrovascular complications (such as hypertension and hyperlipidemia)

Microvascular complications (such as neuropathy, nephropathy and retinopathy)

1.3) Available diabetes treatments: the current treatments of diabetes mellitus were described. Details of oral diabetic medications included: category, mechanism of action, side-effects, drug interactions, and patient education. Regarding insulin treatment, some essential information was described including: category, mechanism of action, side-effects, and techniques of insulin injection (such as syringe and Penfill®). Additionally, the MIL program contains non-drug treatments such as diet, exercise, and self monitoring blood glucose (SMBG). A multimedia interactive program was used to demonstrate how to use insulin properly.

1.4) Patient monitoring: blood glucose monitoring is one of the effective monitoring parameters. Signs and symptoms of hyper- and hypoglycemia were also included. Additionally, the prevention of medical complications secondary to diabetes mellitus was important. Audio and video clips were implemented related to this topic.

1.5) Health assurance in diabetes patients in Thailand: as health care professionals might not be familiar with the health insurance policy, the MIL program provided some crucial information including: thirty baht governmental health insurance, private sector health insurance, and third party and oversea health policy.

1.6) Case studies: diabetes mellitus patient cases were provided after the users completed the program sessions. The patient information included: chief compliant, history of present illness, past medical history, allergy history, social and family histories, past medication, physical examination, laboratory, and diagnosis. The difficulties of patient cases were ranked from easy to complicated.

1.7) Self assessments: the self-interactive response was used via multiple choice questions (MCQ). The total score was provided prior to the completion of the program.

2. Evaluations of a MIL program

Content validation

Validation of the appropriateness of the diabetes mellitus contents was performed by three clinical

specialists, a general medicine physician, a clinical pharmacist, and a general medicine nurse, all experienced with endocrine disorders. Changes were made based on their recommendations.

Usability test

After the self learning tool was developed, its benefits were evaluated. This was done by the authors assessing the attitudes of Sapasithiprasong Hospital staff, physicians, pharmacists, and nurses involved with diabetes patient care. The staff was provided with a CD-ROM of MIL program with a two weeks' allowance for the completion of the program session. They were asked to share their opinions toward the MIL program via a questionnaire paper based on a previous study.[31]

This study had no conflict of interest regarding the software and multimedia utilization.

RESULTS

A. The MIL program development

The steps of the MIL program were adapted from guidelines described by Alessi & Trolip.[34,35] These involved:

1) Defining the learning process
2) Collecting the information source
3) Process of authoring the MIL tool
4) Designing of the interactive multimedia
5) Preparing the multimedia.

The authoring system used to develop the program was Authorware Professional® version 7.1. This software makes the process of courseware development even easier than using an authoring language. It is more user friendly than authoring software, as it is mostly menu-driven. It is also an icon driven authoring system based on 4 basic icons can be drawn in the program flow line. Interestingly, the program is so easy to use that even the developer without any experience can develop the course.

The MIL program can also be used with a standard Personal Computer (PC). It is an auto-run program, thus the users can install the MIL program without the installation of the authoring software (Authorware Professional® version 7.1). The total time to complete the program sessions is approximately 2 hours. However, when the usability test was launched, the hospital staff was allowed to finish the program at any time. The average time for completion was one to one and a half hours. The program was designed for the users to be able to easily follow the instructions (Fig 1). The audio and video clips were made to support the program contents including: technique of insulin injection, self-monitoring (for example diet, exercise and self-monitoring blood glucose) (Fig 2). Multimedia presentations regarding insulin treatment were also included. As mentioned earlier, patient cases were provided for self-assessment. All cases were in Thai with a familiar format – patient demographic data, patient illness information, diagnosis, physical examination, laboratory, and current treatments (Fig 3). After reading the patient cases, twenty multiple choice questions (MCQ) were provided. When a correct answer was confirmed via the "confirm button", an automatically interactive response was analyzed. If the answer was "incorrect", the program provided the correct answer immediately and then moved to the next question. The hospital staff could choose whether or not to go through all questions (Fig 4).

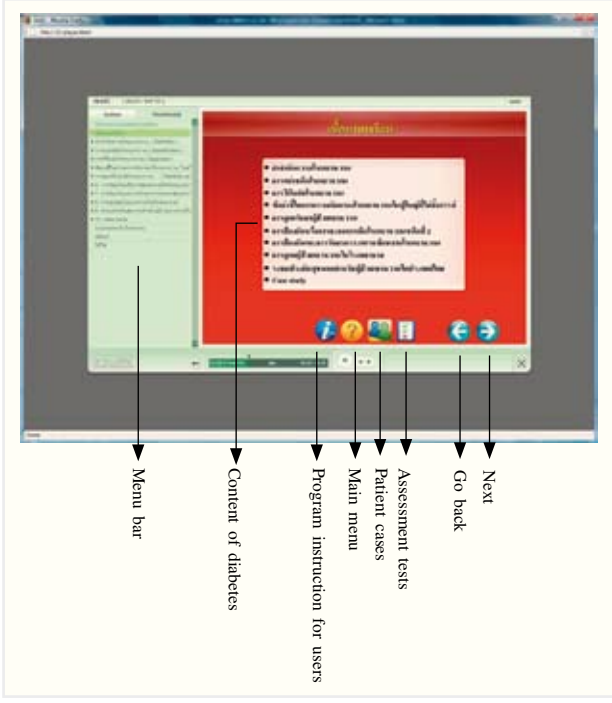


Fig 1. A main first screen of a MIL program

DISCUSSION

In the current diabetes care environment where resources are becoming increasingly scarce and costs must be reduced, the provision of adequate time and specialists becomes increasingly difficult. This is exacerbated by the fact that hospital staff often have limited time to devote to learning due to constraints such as busy work schedules and lack of staff. As a consequence, health care professionals often do not acquire as much knowledge and skills development as they



Fig 2. A video clip demonstration of insulin injection technique (Penfill®)

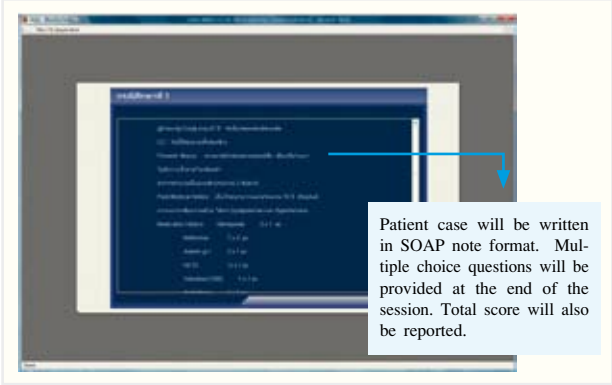


Fig 3. Case study of diabetes patient

might need or want. A multimedia interactive learning tool (MIL) that can provide basic knowledge and skills in diabetes care management may alleviate some of these problems. Noticeably, apart from the aim of MIL development including; to develop an easy-friendly interactive MIL program for health care professionals in diabetes care, the courseware developer must consider several important factors mentioned in a previous study.[37] These factors include; 1) the availability of the multimedia authoring tools within the institution, 2) the degree of server access privileges extended to the developer, 3) the operating system to support, 4) the types of media used (e.g., hypertext, digital video, animation), 5) the time and cost investment, and 6) the amount of time and resources available for the project. There were no noticeable difficulties regarding the availability, operating system, and type of media related to the MIL project. Regarding the cost and time investment, the time spent in the six steps of a MIL program development might take approximately two to three months. Additionally, the developer had to pay for the software and multimedia. However, the program can be repeatedly used multiple times. Also, the content of the program can be modified to other subjects within the same function structure. Thus, it is a one time investment with the fully long run benefits. More importantly, many previous studies indicated that a multimedia interactive tool can provide opportunities for users to gain knowledge and skills on their own. In addition, users could independently acquire skills that are not included in textbooks or classes.[13,38-40] Nevertheless, the authors admitted some further adjustments of the program structure and function are still needed.

The overall result of the usability of the MIL program was favorable. The assessment can be divided

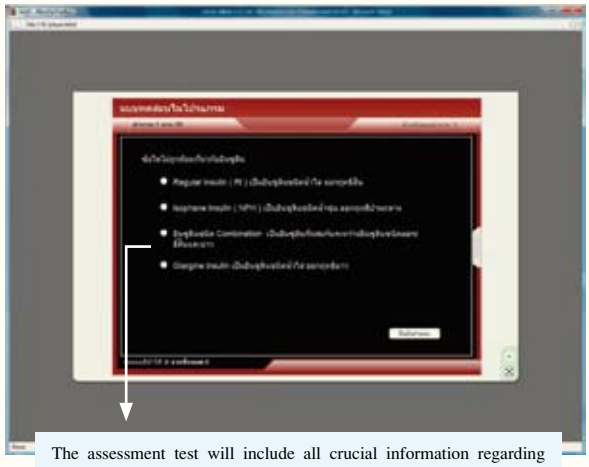


Fig 4. An example of a multiple choice question related to diabetes care

into two aspects, basic knowledge and skills of diabetes care management, and the program structure. Regarding basic knowledge and skills of diabetes care management, the volunteers stated the MIL program can facilitate their basic knowledge in areas such as insulin injection techniques and awareness of diabetic care management. Some constraints were stated, for example, the clinical skills in diabetes care could not be appropriately assessed via the questionnaire paper, making a further evaluation of this aspect necessary. Similarly, appropriate assessments of the awareness of diabetic care and the improvement of basic knowledge and skills also needed attention. The volunteers' responses to the program schedule were positive and included comments about the ease of the program visualization, good program design, and effective implementation of multimedia interactive video clips.

A number of limitations need recognition and attention to avoid uncertainty about the use of a MIL program in real clinical practice. The involvement experienced multimedia instructional designers for the further MIL program design, development, and evaluation should be addressed. The complexity of the program's procedures, especially for those not familiar with hospital protocol, must be addressed. Some staff remarked about the poor quality of audiovisuals used in the

TABLE 1. Mean scores on MIL evaluation survey (n = 15)

Questionnaire items	M
I had no problem understanding what I was to do for insulin injection technique	4.00
The computer-based design activity was appropriate to this activity	4.35
It was easy for me to visualize what I needed to do from the visuals presented on the computer screen	4.20
The computer project took a reasonable amount of time to complete	4.31
I felt adequately prepared to use the computer to complete the computer-based design project	4.38
The audiovisuals and video clips in the computer program were clear	3.85
I like the idea of using the computer to learn construction insulin injection techniques	4.85
I will use the skills I gained from the program for diabetes management	3.80
The computer based learning program made me more aware of patient care management in diabetes	4.00
I enhanced my knowledge of patient care in diabetes by using the computer based learning program	3.95
Responses were made on a 5-pont Likert scale (1= strongly disagree, 5= strongly agree)	

program, and alterations were made to rectify these. Also, a larger number of volunteers in the evaluation of the effectiveness of the program are required to strengthen the findings of the study.

Further evaluation of the effectiveness of the MIL program needs to be conducted with a well constructed study design. Firstly demographic data of the volunteers needs to be stated, such as computer background experience and familiarity with computer-based learning programs and types of computer software use experience. The main focus of evaluation must be on the enhancement of knowledge of diabetes care, improvement of the insulin injection techniques, and patient self monitoring. Thus it should compare various methods of learning, including traditional methods of class teaching and textbooks, problem-based learning (PBL), and a multimedia interactive learning (MIL) programs. A comparison of the effectiveness of the MIL program among health professionals from different hospital sites is recommended. Finally, a further attitude survey towards this MIL program should be performed after its implementation.

CONCLUSION

An MIL program in diabetes care management is likely to be a useful multimedia interactive tool for the purpose of self learning, especially for hospital staff. However, due to some limitations of the program functions, as well as the usability results, additional work in program functions and study methodology adjustments is required. Also investigation of the effectiveness of the MIL program with a large number of health care professionals from different hospitals and a comparison between different methods of learning requires further development.

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