Full Length Research Paper

Computer-aided learning for medical chart review instructions

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The purpose of this study was to develop computer-aided learning (CAL) of medical chart review instructions for pharmacy students and to study the efficiency and effectiveness of the CAL. The participants were forty-eight 5th year pharmacy students at Faculty of Pharmacy, Ubon Ratchathani University, Thailand. They were divided into two groups by simple random sampling: an experimental group (n = 22) that studied with the CAL, and control group (n = 26) that studied with traditional lectures. The results showed no significant difference in the mean of pre-test score between the control and experimental groups (14.62 ± 1.83 versus 14.18 ± 2.13; p = 0.452). There was also no significant difference in the mean of post-test scores, between the control and experimental groups (15.92 ± 1.76 versus 15.45 ± 1.57; p = 0.340). However, the post-test scores were higher than the pre-test scores with statistical significance (the control group 15.92 ± 1.76 versus 14.62 ± 1.83; p < 0.001; the experimental group 15.45 ± 1.57 versus 14.18 ± 2.13; p = 0.015). The overall user satisfaction of CAL was good (51.7%). The pharmacy students suggested that the CAL probably helps students to learn how to review medical charts and could be helpful as supplement to class lecture in order to gain more knowledge and skill from class room lectures, along with improved understanding and self-study.

Key words: Computer-aided learning, medical chart review instructions, pharmacy students.

INTRODUCTION

Computer-aided learning (CAL) or computer-assisted learning or computer-assisted instruction (CAI), is a form of self-instruction in which material can be presented via text, visual, sound, and motion digital files, providing a multimedia approach to learning (Rosenberg et al., 2005).

CAL in many areas of health profession education, such as orthodontic education, physical therapy, and nursing practice, is established as an effective and useful learning tool (Al-Jewair et al., 2009; Veneri, 2011; Triola et al., 2012). Moreover, the medical community also supported CAL as an alternate means of education

(Veneri, 2011; Holt et al., 2001; Velan et al., 2002). CAL program helps students to learn at their own pace, review lessons as they need, and access the course conveniently (Rosenberg et al., 2005; Hendricson et al., 2004; Rosenberg et al., 2003; Berridge et al., 2000). CAL is the tool to provide the standard benefits of student practice, self-assessment and immediate feedback. Many studies presented that CAL had beneficial results in facilitating learning, such as (1) providing animations that increase the students' interest and their understanding of the material, (2) providing practice activities that incorporate challenges and curiosity, (3) impacting student achievement, motivation and attitude, along with beneficial effects on classroom social interaction and the learning environment, and (4) providing a cost-effective supplement to conventional education (Berridge et al., 2000; Dharmappa et al., 2000; Bialo and Silvin, 1980;

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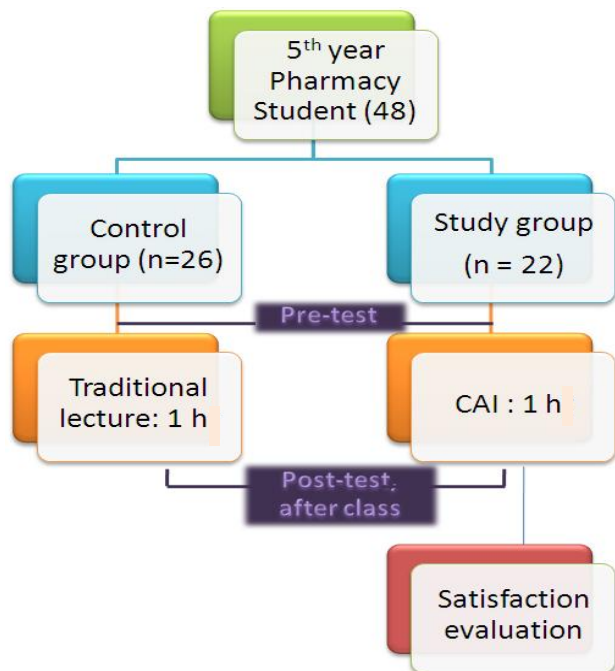
Figure 1. A quasi-experimental design using pre-test and post-test.

Figure 2. Main page of computer-aided learning for medical chart review instructions.

Becker, 1987; Batey, 1986; Bangert-Drowns et al., 1985).

The curriculum of the Pharmaceutical Sciences Faculty consists of both theory and practice. When pharmacy students practice on wards, they need to react to situations as quickly as possible. The challenges they have to face include building effective working relationships with other health care provider teams, contacting their patients. For student preparation, we develop many strategies to provide knowledge and skills; for example, an intensive course for developing communication skills, or short course training for medical

teams and for patients. Along with personal communication, another significant challenge that our pharmacy students face is locating and analyzing data on medical charts. Students often cannot point out important data on medical charts, used for monitoring the pharmacotherapy of each patient.

A medical record or medical chart is a legal document containing hospital-specific admission information, initial patient history and physical examination, daily progress notes made by health care professionals who interact with the patient, consultations, nursing notes, laboratory results, diagnostic procedures, dietary recommendations, radiology and surgery reports (Wiedenmayer et al., 2006). For pharmacy students who will be eventually working in clinical pharmacy, the understanding and proper usage of these medical records is a crucial skill. However, there is limited instructional media available in the practical environment of a clinical pharmacist ward round, especially concerning medical chart review instructions for pharmacy students. The clinical pharmacy curriculum at Ubon Ratchathani University has a one-credit hour clinical pharmacy laboratory course about using the medical charts.

The purpose of this quasi-experiment was to develop CAL of medical chart review instructions for pharmacy students, and to study the efficiency and effectiveness of the CAL.

METHODOLOGY

CAL development

Traditional lecture and CAL (1 h) consisted of three parts. Part 1 included definition of medical records, characteristics of medical records, components, maintenance of medical records and, confidentiality. Part 2 dealt with medication history evaluation from the medical record, and Part 3 demonstrated cases of patient medical records. The illustrative examples of CAL are given in figure 2 to 6.

The system design and content of CAL were evaluated by hospital pharmacists and practice nurses. The system aims to deliver content based on the standard form of medical charts in all levels of hospitals in Thailand, presented using a simple user interface and easy-to-follow navigation. CAL employs multimedia, interactive tasks and self-assessment tests to motivate students and to expand their knowledge and understanding of medical chart review. CAL design relies heavily on textual content, video, audio, still graphics and animation. For example, a CAL session start with a narrator (electronic teacher) (Garcia et al., 2007) using cartoony explanations that evoke interest and make the material easier to remember. This is followed by bulleted lists that show the components of medical charts, along with still graphics that illustrate each part of the medical record.

The first two parts of the examined CAL program presented material at the most basic knowledge level of the taxonomy of educational objectives in the cognitive domain (Bloom et al., 1956), while the third part tested skills at the comprehension, application and evaluation levels, with the latter considered to be the highest level within the cognitive domain (Kausar et al., 2008). Students evaluated the quantitative and qualitative data, and made decisions regarding their appropriate use in case studies that involves drug therapy monitoring in each patient. Each part had an appropriate format and content, such as 60 s video clips with Microsoft
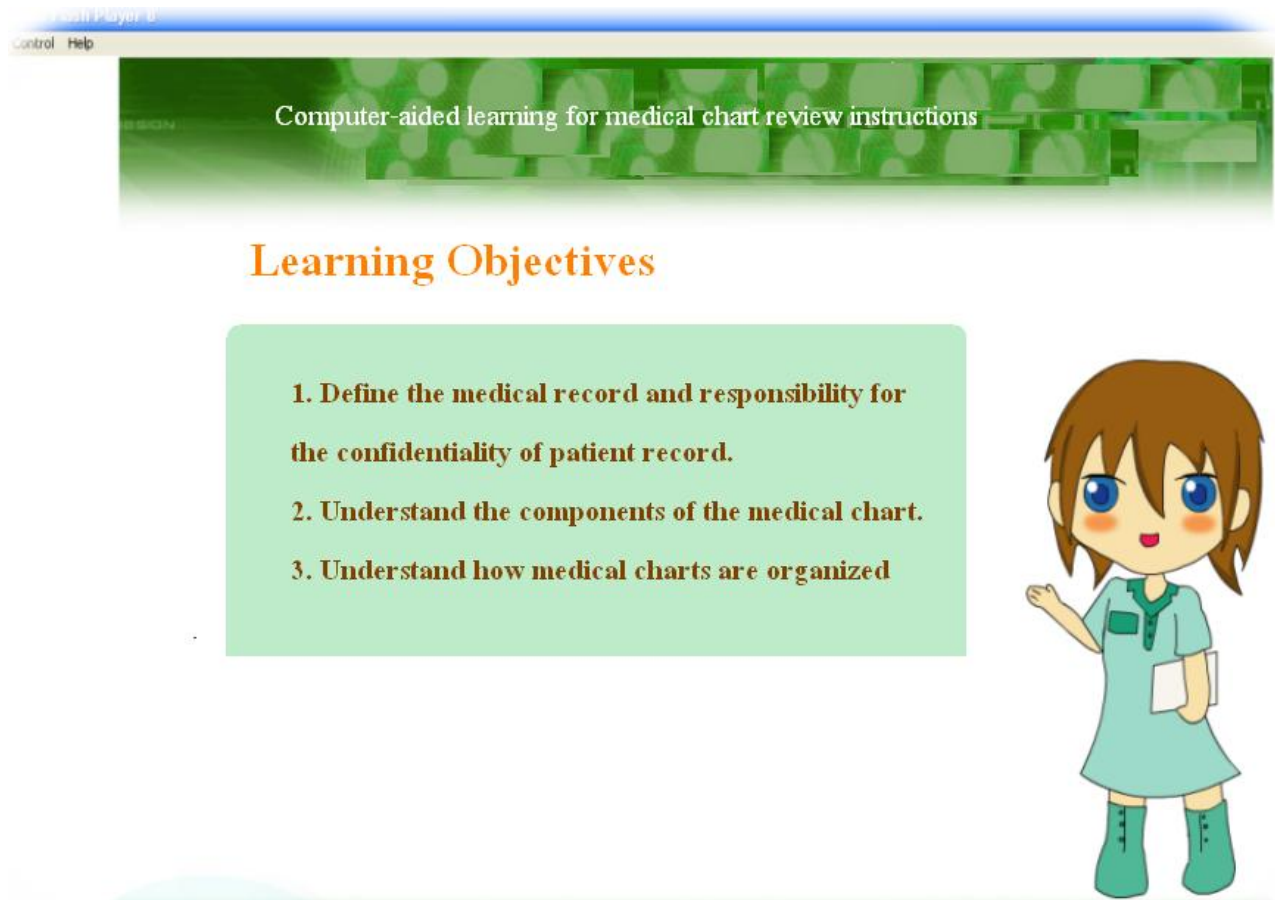
Figure 3. Learning objectives for of medical chart review instructions.

Powerpoint™ presentations. The CAL was concluded by a 20-question self-assessment part. That tested the pharmacy students' knowledge about the medical chart, and involved their analytical thinking skills to retrieve patient data to use in pharmacotherapy monitoring.

Sample

The sample for this research consisted of forty-eight students of the Bachelor of Pharmaceutical Sciences Program at Ubon Ratchathani University: 5th year pharmacy student with no experience about using medical records. Due to the small sample size, the students were divided into two groups by blocked randomization using grade point average (GPA) as a reference (Veneri, 2011). Pairs of students were matched by GPA randomly assigned to each group to ensure that the GPA of both groups was identical. The control group (n = 26) was taught using traditional lectures while the experimental group (n = 22) was taught using CAL. Participation was voluntary and students were informed that the study would not affect their grade in the course.

Research tools

The research tools used in this study included (1) construction of CAL on medical chart review instruction by Adobe Flash 8, Adobe Captivate 4 and Adobe Photoshop 11, (2) questions with three sections: demographic data, pre-test or post-test questions, other comments, and (3) self-report Likert scale for assessment of attitude toward CAL (Ary et al., 2010). It was ratable on a 1 to 5 rating scale: 1 = Poor, 2 = Fair, 3 = Good, 4 = Very Good, 5 = Excellent.

Pilot test was also constructed. Content validity of a multiple choice question (MCQ) test was evaluated by expert pharmacists at various academic institutions and hospitals. They were invited to review the content, clarity and relevance of the test. The item analysis was done by measuring the difficulty level in the 0.5 to 0.7 range. The appropriate discrimination index from 0.35 to 0.50 was also tested (Kausar et al., 2008). Items with a difficulty level and discrimination index below or above the mentioned range were discarded. From the remaining question set, 20 items were selected for the final version of the test. The reliability of the test (Cronbach's alpha coefficient) was 0.863.

Results were assessed by descriptive and analytical statistics, including total scores, means and standard deviations. Students' 't'-test was used to determine the significance of differences between the groups. P-value of less than 0.05 was considered as statistically significant difference.

Data collection procedures

The students were given a pre-test prior to the use of the program, and a post-test after 1 h of practice. The questions in both tests were equivalent with regard to the degree of difficulty and the

Figure 4. Video clip to illustrate steps of patient medication history taking from medical chart within the application used with film and sound.

Figure 5. Clinical case demonstration as an example of the medical chart record.

content examined. The test items were designed to evaluate the knowledge about medical chart and the ability to integrate and solve common problems in clinical practices. Each test included 20 tests with MCQs, and the allotted test completion time was 30 min.

RESULTS

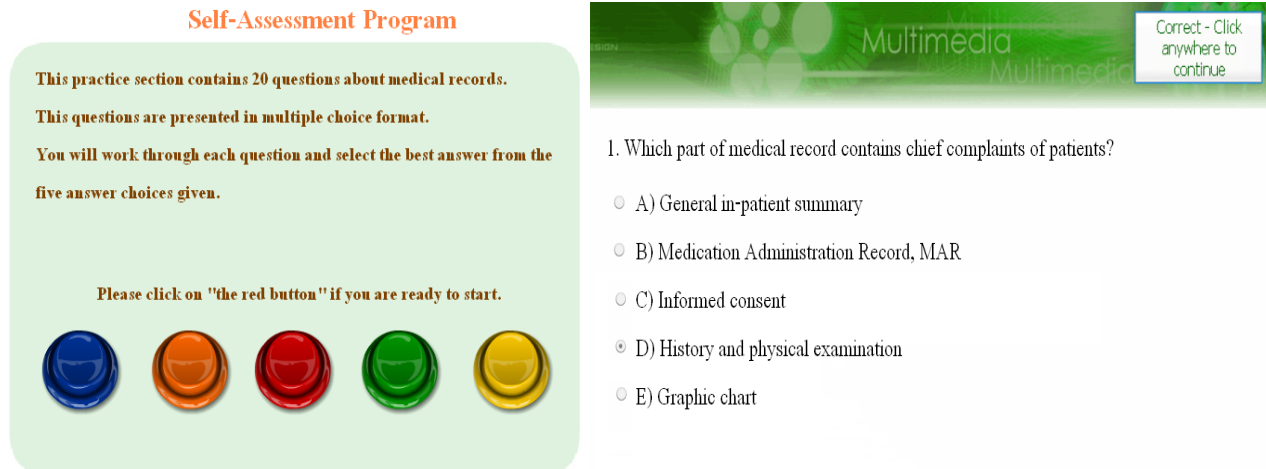In sample characteristics, the majority was 77.1%, of the

Figure 6. This screenshot is an example of a self –assessment program. The left part is a guide to self assessment and the right part is a sample of test.

participating students that were female. There were no statistically significant differences between the two groups in all characteristics; for example, gender (p = 0.509), age (p = 0.496), GPA (p = 0.625), ability in computer usage (p = 0.270).

The results showed that the mean of pre-test and post-test score between the control and study groups had no significant difference. However, the post-test score was higher than the pre-test score, with statistical significance in both groups as shown in Table 1. The overall user satisfaction of CAL was "very good" (51.7%).

Student feedback revealed that this CAL is very useful for medical record instruction. Most of them (77.27%) were satisfied with the self-assessment part ("very good"). The narrator, video and animation parts received the same rating by most participants (54.54%). All of the scores are shown in Table 2. Overall, the student would like to use CAL as a supplement to the conventional lecture.

DISCUSSION

In this study, most participants reported a satisfactory experience and the willingness to use the program in the future. This feedback is similar to what Adler et al. (2003) earlier reported in a study that assessed a CAI program for the pediatric emergency department. Both this and Adler's study showed no statistically significant differences between CAL and traditional methods. However, the difference in the quantity of knowledge gained using pre-post tests was statistically significant in both groups. Regarding the efficacy of CAL in terms of knowledge gain, Al-Jewair (2009) found that in general, a significantly greater knowledge gain using CAL was evident in studies that controlled for pre-intervention knowledge and studies that did not.

There are recently reports that the use of CAI or CAL are rising in health profession education (Triola et al., 2012). Further, Cook et al. (2008) evaluated studies of the impact of CAI as compared to traditional education and to no intervention found that CAI was consistently superior to no intervention but there was no difference between CAI and traditional teaching method. Moreover, Kausar et al. (2008) revealed that total gain in cognitive domain by CAI was significantly superior to the total gain in cognitive domain by class room lecture method. Additional, Cook et al. (2010) have conducted meta-analysis of comparisons of two CAI interventions which found that interactivity, practice exercises, feedback and repetition of study material were associated with higher learning outcomes and interactivity, and use of audio was associated with higher satisfaction (Cook et al., 2010; Triola et al., 2012). However, Cook et al. (2001) also found the contrary of popular belief that CAI is not necessarily more efficient than other methods and the learning outcomes show a strong and statistically significant association with time on task (Cook et al., 2010; Triola et al., 2012).

The results of the objective evaluation show that there is a significance improvement with the performance of the students after class. This study had time limit for the student to evaluate their knowledge. In the next phase, we plan to assess the knowledge and skill of the student when we give them much longer period to use CAL for self-study. In further study, we should have a time for practicing such as 2 weeks and then take a post-test again to evaluate the knowledge after self-learning experiences. However, it is challenging to exert precise control over the adherence to exact time limits due to the open and flexible nature of this particular learning environment. Thus, while efforts are made to collect such data, these limitations reduce its significance in these analyses (Kunawaradisai et al., 2010). This study has

Table 1. Pre- and post-test scores between the control and study groups.

Group	Scores (mean ± SD)								P-value+
	Pre-test				Post-test				
	Part 1	Part 2	Part 3	Total	Part 1	Part 2	Part 3	Total	
Control (22)	3.73 ± 0.83	5.96 ± 1.51	4.92 ± 0.27	14.62 ± 1.83	4.15 ± 0.88	6.77± 1.50	5.00±0.00	15.92±1.76	0.001
Study (26)	3.64 ± 0.79	5.91 ± 1.48	4.64 ± 0.90	14.18 ± 2.13	4.09 ± 0.75	6.45±1.10	4.91±0.29	15.45±1.57	0.015
P-value++	0.701	0.992	0.137	0.452	0.592	0.409	0.120	0.340	

p-value+ of total scores of pre- and post-test scores within the control and study groups. p-value++ of Total scores of pre- and post-test scores between the control and study groups. Part 1, Definition and component (5); Part 2, taking medication history (10); Part 3, case demonstration (5). (n = 48).

Table 2. User satisfaction scores(n=22).

S/N	Question	User satisfaction scores				
		5 = Excellent	4 = Very good	3 = Good	2 = Fair	1 = Poor
		n (%)	n (%)	n (%)	n (%)	n (%)
1	Information interesting level	9 (40.91)	10 (45.45)	3 (13.64)	0 (0)	0(0)
2	Objective clarity	4 (18.18)	11 (50.00)	6 (27.27)	1 (4.55)	0(0)
4	Amount of content	6 (27.27)	12 (54.54)	3 (13.64)	1 (4.55)	0(0)
4	Ease of use, appropriate navigation	10 (45.45)	9 (40.91)	3 (13.64)	0(0)	0(0)
5	Graphics, animations, video	9 (40.91)	9 (40.91)	3 (13.63)	1 (4.55)	0(0)
6	Overall presentation	7 (31.82)	10 (45.46)	3 (13.63)	2 (9.09)	0(0)
7	Language, narration and symbol	5 (22.72)	14 (63.64)	2 (9.09)	1 (4.55)	0(0)
8	Text size	1 (4.55)	13 (59.09)	5 (22.72)	2 (9.09)	1 (4.55)
9	Self-assessment module	3 (13.64)	17 (77.27)	2 (9.09)	0(0)	0(0)
10	Order of learning based on user's need	5 (22.73)	12 (54.54)	5 (22.73)	0(0)	0(0)
11	Stimulate of study	6 (27.27)	11 (50.00)	5 (22.73)	0(0)	0(0)
12	Availability anywhere	13 (59.09)	8 (36.36)	1 (4.55)	0(0)	0(0)
13	Lecture support	12 (54.54)	8 (36.36)	2 (9.10)	0(0)	0(0)

n = 48

emphasis on knowledge; the future should be evaluating the skill of pharmacy student to retrieve data from medical chart. Even though CAL provide many advantage, many studies support that it should be used as a teacher support instrument or used as a teaching tool rather than taking over the teaching process as a whole, which is similar to our study (Sumei, 2012; Garcia et al., 2007). The student like to have CAL but still would like to have a class which they can learn and share their idea between the teacher and student or between their friends as well.

Conclusion

The pharmacy students suggest that the CAL probably helps them to learn how to review the medical chart and could be helpful as supplement to class lecture in order to gain more knowledge and skill from class room lecture and to enhance understanding and self-study.

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