

INSTRUCTIONAL DESIGN AND ASSESSMENT

Comparison of Computer-Mediated Learning and Lecture-Mediated Learning for Teaching Pain Management to Pharmacy Students

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Objectives. To assess the effectiveness, efficiency, and student satisfaction with computer-mediated instruction (CMI) versus lecture-mediated instruction (LMI) of pain management to doctor of pharmacy (PharmD) students.

Methods. This study compared the instruction of pain management by CMI versus LMI. An examination was administered and a student survey was conducted to determine effectiveness and student perception of efficiency and satisfaction with these teaching methods.

Results. Mean examination scores were not significantly different between the 2 groups, with 62 (91%) of the LMI group and 46 (94%) of the CMI group scoring $\geq 70\%$ ($p = 0.73$). Efficiency and student perception of learning significantly increased in the CMI group.

Conclusions. CMI appears to be at least as effective as LMI in teaching pain management to pharmacy students and students perceive that efficiency and learning is increased with CMI. Therefore, CMI seems to be a viable teaching option.

Keywords: pain management, computer-mediated instruction, assessment

INTRODUCTION

Proper pain management is a concern for patients and healthcare professionals. Pain is the primary complaint in over 50% of patients seeking medical care.¹ In a survey of community pharmacists, 73% reported that they routinely dealt with pain management issues.² In one study, 44% of those who sought medical attention for moderate to very severe acute pain reported no significant pain relief.³ Similarly, 40% of patients with moderate to severe chronic pain suffer from inadequate relief.⁴ The National Institutes of Health (NIH) estimated that the cost of pain in the United States including medical expenses, lost wages, and time lost from work exceeds \$100 billion each year.⁵ Given the magnitude of this problem, the standards of the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) now treat pain as a "fifth vital sign." However, it is often a topic that is not adequately taught in pharmacy curricula. One survey found that of 28 schools of pharmacy, only 2 schools had a standalone elective course in pain management.⁶ Most pain management was discussed in the therapeutics or pharmacotherapy sequence or as a component of the oncology module.

Typically, the schools did not mandate the instruction of pain management.

At Xavier University of Louisiana College of Pharmacy, pain management also has been taught in a fragmented way and at times omitted from the formal curriculum all together, mainly because of time constraints. As an innovative way of incorporating this topic into the curriculum, a CD-ROM on pain management was purchased for students to use on their own time in the University's Computer Assisted Instruction Laboratory (CAIL) in conjunction with a laboratory course. The current study was conducted to assess whether using this computer-mediated instruction (CMI) is a viable alternative to the traditional lecture-mediated instruction (LMI) of pain management. The primary outcome measure was the effectiveness based on examination scores of CMI versus LMI in learning pain management. Secondary outcomes were efficiency and student satisfaction as determined by a survey.

METHODS

This prospective study consisted of 2 arms that compared the effectiveness of CMI to LMI in the instruction of pain management to third-year doctor of pharmacy (PharmD) students. It was conducted through the Pharmacy Skills Laboratory course, which consisted of 4 class sections and 3-hour lecture periods. A convenience sample

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was used and prior to registration, the authors selected sections 1 and 2 to complete CMI and sections 3 and 4 to complete LMI. All students enrolled in the Pharmacy Skills Laboratory course were included in the study.

An interactive, multimedia program, *Pain Management: An Interactive CD-ROM for Clinical Staff Development* (Aspen Publishers, Inc, Frederick, MD, 2001) was used in the CMI group to instruct the students on pain management in adults. Based on the authors' review, this CD-ROM was deemed appropriate for education of pharmacy students as the major areas of pain management are covered at an appropriate level. The CD-ROM breaks down the major areas of pain management into 4 modules: (1) "Pain Assessment," (2) "Anatomy and Pathophysiology of Pain," (3) "Pharmacology," and (4) "Treating the Whole Patient." According to the software manufacturer, each module required between 1 hour and 1 hour, 30 minutes, to complete. Students assigned to the CMI group were given the opportunity to complete 2 of the 4 modules in the CAIL during 2 normally scheduled 3-hour Pharmacy Skills Laboratory class periods. However, this schedule was not strictly enforced and students were allowed to complete the modules on their own time if they wished. The LMI group was instructed over two 3-hour lecture periods. The material presented was based on the material presented in the CMI. Two modules of the CMI were covered in each of the lecture periods. A different instructor taught each of the lecture periods.

Outcome Measures

Computer-based examination scores and examination pass rates based on scores $\geq 70\%$ were used to determine the effectiveness of the 2 teaching methods. The 1-hour examination was included on the CD-ROM and consisted of 40 randomly generated, multiple-choice questions. All students had a 3-day window to take the examination, which was scheduled 2 weeks after the modules were completed. Students were allowed to take the examination only once. Prior to taking the examination, students were required to sign-in with a CAIL staff member.

A student survey instrument was used to measure students' perception of efficiency of the 2 teaching methods. Questions addressing this issue included the number of modules the students felt they had adequate time to study and the total number of hours students studied outside of class time. The survey instrument was also used to determine students' satisfaction with the different teaching methods. Questions addressing this issue included preference to learn pain management via the alternate teaching method, perception of knowledge gained, and satisfaction with the amount of time spent with faculty members. The student survey instrument included 7 mea-

surement items as well as demographic data that took into account native language and computer proficiency. The survey instrument were administered to the students and collected by the Pharmacy Skills Laboratory course coordinator.

Statistical Analysis

Descriptive statistics for the ordinal and nominal data from the survey instruments were reported as percentages and examination scores were reported as means. The Fisher exact test was used to compare the differences between the CMI and LMI survey responses and the examination pass/fail rate. The mean examination scores were compared using the student's *t* test. The Web-based Simple Interactive Statistical Analysis (SIAS) programs were used for the inferential statistics. A power analysis was performed using 2008 Power Analysis and Sample Size software program (NCSS Statistical Software, Kaysville, Utah). A sample size of 40 was required to show a power of 0.8. Significance was set *a priori* as a *p* value less than 0.05.

RESULTS

One hundred seventy-seven students participated in the pain management training, which was conducted in the fall semester of 2003. Sixty-eight students were included in the LMI group and 49 were included in the CMI group. All students were included in the effectiveness portion of the study. The survey instrument was distributed to all students and completed on a voluntary basis. Sixty-one completed survey instruments (90%) were collected from the LMI group and 44 (90%) from the CMI group. Table 1 shows baseline characteristics of the participants. There were no differences between the groups with regard to native language, computer proficiency, or baseline pain management knowledge.

Mean examination scores were not significantly different between the 2 groups. The mean examination scores of the LMI and CMI groups were 32.3 (± 3.7) and 32.4 (± 3.4) out of 40 possible points respectively ($p = 0.85$). Examination pass rates between the 2 groups were also not significantly different. Sixty-two (91%) of the LMI group and 46 (94%) of the CMI group passed the examination with $\geq 70\%$ ($p = 0.73$).

Efficiency was determined by the number of hours the students studied pain management outside the pharmacy skills laboratory setting and by the number of pain management modules the students felt they had adequate time to study. The number of hours the students studied was independent of study group ($p = 0.57$) as demonstrated in Figure 1. However, those in the CMI groups felt

Table 1. Demographics of Pharmacy Students Participating in a Study Comparing Computer- and Lecture-Mediated Instructions for Teaching Pain Management

	LMI, No. (%) n = 61	CMI, No. (%) n = 44
Language ^a		
English is my first language	45 (74)	32 (73)
English is my second language (or beyond)	12 (20)	10 (23)
No response	4 (7)	2 (5)
I am proficient with computers ^b		
Strongly Disagree	0	2 (5)
Disagree	3 (5)	1 (2)
Agree	33 (54)	26 (59)
Strongly Agree	20 (33)	13 (30)
No response	5 (8)	2 (5)
Baseline perception of pain management knowledge ^c		
Poor	15 (25)	7 (16)
Fair	24 (39)	24 (54)
Satisfactory	19 (31)	10 (23)
Good	3 (5)	3 (7)
Excellent	0	0

Abbreviations: CMI = computer-mediated instruction; LMI = lecture-mediated instruction.

^a $p = 0.88$

^b $p = 0.57$

^c $p = 0.38$

that they were able to adequately study significantly more material ($p < 0.001$) (Figure 2).

There was no significant difference between the groups in regard to preference of learning method ($p = 0.13$). Figure 3 demonstrates the perception of knowledge of pain management between the 2 groups before and after completion of the program. Both the LMI and CMI groups indicated a significant gain in their knowledge of pain management once their modules were complete. However, there seems to be a significant increase in perception of learning in the CMI group over the LMI group ($p < 0.001$).

When asked whether they had adequate time with faculty members for questions and answers, 75% of students in the CMI group felt they did not versus 38% in the LMI group ($p = 0.01$). Two in the CMI group and 9 in the LMI group either had no opinion or did not respond.

When asked to comment on how to improve the teaching of pain management via their assigned mode of teaching, 23 (38%) of the students in the LMI group stated that the lecture time was too long. Other comments from the LMI group indicated that they would have preferred to use the computer program so that they could

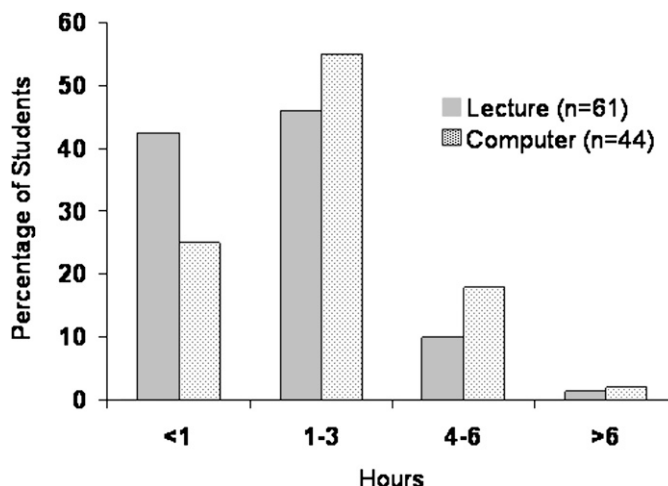


Figure 1. Number of hours the students studied outside of the classroom ($p = 0.29$).

complete and have access to the Pain Management modules on their own time. It was also felt that pain management should be included as part of the Disease State Management lecture series and that it was a “bad idea” to schedule the examination during the same weeks as other tests.

Comments from the CMI group included 4 students who said they needed “more time” to complete the tutorials so they could “spread out” the information and 4 students who said the tutorial couldn’t hold their attention for that length of time so they left early. Other comments from students in the CMI group indicated that the computer laboratory had too many distractions, that an examination should be given with each module and standardized questions should not be used, the tutorial should “talk more,” students should experience “real life” pain management situations, and that “case studies” should go along with each module.

DISCUSSION

Other studies have found that using CMI is a viable teaching option. In a study of nursing students, effectiveness and satisfaction were compared between an interactive, multimedia CD-ROM and traditional methods for teaching nurses to perform a 12-lead electrocardiogram (ECG).⁷ Traditional methods included a self-study module, a brief lecture and demonstration by an instructor, and experience with a plastic manikin and an actual 12-lead ECG machine. The CD-ROM group was taught the same material but used an interactive, multimedia CD-ROM in addition to the traditional self-study module. Seventy-seven senior baccalaureate nursing students participated, with 32 in the traditional learning group and 45 in the CD-ROM group. Effectiveness was measured by comparing

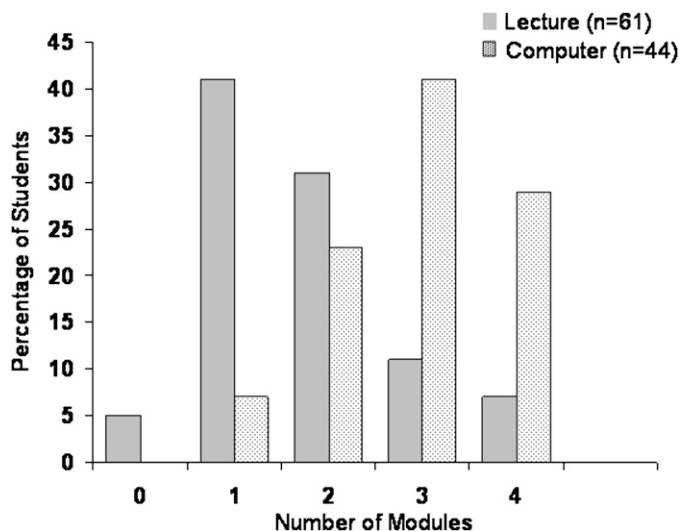


Figure 2. Number of modules the students felt they had adequate time to study ($p < 0.001$).

examination scores and satisfaction was measured through a questionnaire. Similar to our study, there was no significant difference in examination scores, student satisfaction with their learning method, or student perception of their competency in conducting a 12-lead ECG.

In another study utilizing pharmacy students, student performance and satisfaction were compared between interactive, Web-based instruction and traditional lecture-mediated instruction of a pharmacotherapeutics course.⁸ In this study, 21 students self-selected participation in either the Web-based instruction group (12) or the traditional lecture group (9). Student performance was evaluated by examination scores and satisfaction was compiled from student course evaluations. As in our study, examination scores between the 2 groups were similar. However, unlike our study, they found that 7 of the 11 students in the Web-based group would choose traditional lecture instruction, while all 9 of the students in the traditional lecture instruction would choose that method again if given the choice.

Given the curriculum time constraints, innovative techniques may be helpful in teaching pain management. In determining whether CMI is a viable teaching option, we must consider the advantages and disadvantages of both LMI and CMI. Including pain management in traditional lectures has the advantages of students being familiar and comfortable with that teaching style and portable (paper) lecture notes that can be further annotated by the student. However, the disadvantages include heavy and bulky lecture notes that are expensive to produce, large quantities of faculty time needed to create the lecture and lecture notes, elimination of, or shortening of, lecture time for other topics in the lecture series, and an inability to

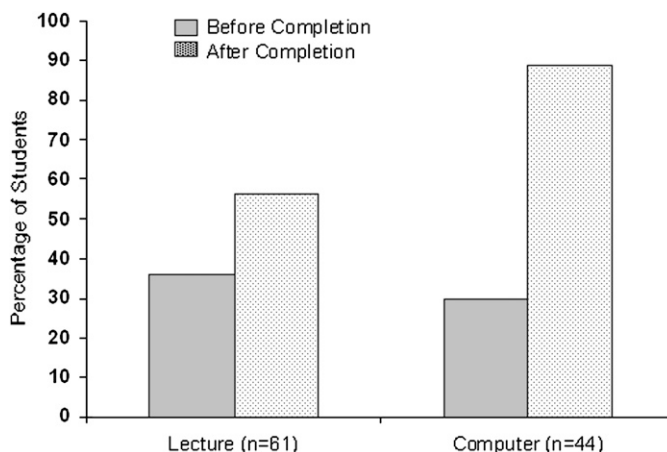


Figure 3. Percent of students whose perception of pain management knowledge was satisfactory to excellent ($p < 0.001$ for both lecture and computer comparisons).

teach at each student's pace and learning style.⁹ A commercially available CD-ROM on pain management is easy for students to use and can include a wide range of multimedia and interactive content.^{9,10} Using CD-ROMs requires less faculty time as the faculty member becomes a facilitator rather than a lecturer.¹⁰ In addition, students are able to access information at their own pace, allowing for an active approach to learning, with the student having greater control.¹⁰ The multimedia and interactive programming takes into account many different learning styles that may increase student concentration and retention. It also may enhance computer literacy, which is an increasingly important professional skill and needed when taking the North American Pharmacist Licensure Examination (NAPLEX).¹⁰ One of the major disadvantages of using a CD-ROM is the inability to update data or fix any errors in the content.¹⁰ Other disadvantages include students being unfamiliar and possibly uncomfortable with a new teaching strategy and the necessity of technical equipment and support to oversee the use of the tutorial.^{9,10} In addition, availability of the program may be limited when using a CAIL due to hours of operation, students in other courses using the laboratory, the need for student monitoring, particularly during examination periods, and to motivate students who are not self-disciplined.

Our study had several limitations. These included the physical environment of the computer laboratory, incomplete demographics, use of a computer-based examination in both groups, and the length of lecture time. The physical environment of the CAIL was a limitation in that it was often noisy and not conducive to learning per student report. This may have affected the students' ability to go through the modules and retain information. In addition,

tion, neither age nor gender was taken into account in the demographics section of the survey instrument. In a study looking at the impact of various student demographic variables on preferences for Web-based versus paper-based learning, an inverse relationship was found between student age and comfort level with computer use. As expected, the younger students felt more comfortable with computer use.¹¹ Also, a greater percentage of male students preferred Web-based case studies and had higher comfort levels with computer use than females.¹¹ As we did not obtain this information in our survey, we were not able to determine whether the groups were equivalent with regard to these aspects. We also used a computer-based examination in both groups, which is inconsistent with traditional lecture instruction. Although there was no difference between groups with regard to examination scores, it could be argued that the CMI group could have been more comfortable with using the computer tutorial versus the LMI group, and that this could have affected the LMI group's performance on the examination.

Finally, the length of lecture was too long. Whereas those in the computer group often left and returned to the CAIL when they wished to complete the modules, the LMI group had to sit through two 3-hour lectures covering all 4 modules. The ideal lecture length to assure student attention to and retention of information is 25-30 minutes.¹² As the lecture length in our study greatly exceeded this time period, it is possible that students would have retained more information and scored higher on examinations if the lecture period had been reduced to 50 minutes.

Although CMI seems to be as effective for teaching pain management as LMI, further studies are needed to determine whether a combination of both CMI and LMI would be more effective for learning than either CMI or LMI alone as has been found in other studies.¹³ The students in the CMI group indicated that they would have benefited from a question-and-answer session with an instructor and comments were made that case studies should go along with each module.

CONCLUSIONS

CMI seems to be at least as effective as LMI in teaching pain management to pharmacy students. In addition, students perceive that efficiency and learning is increased with CMI, making it a viable teaching option.

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