A COMPARISON OF INTERNET-BASED LEARNING AND TRADITIONAL CLASSROOM LECTURE TO LEARN CPR FOR CONTINUING MEDICAL EDUCATION

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ABSTRACT

The purpose of this study was to compare the satisfaction and effectiveness of Internet-based learning (IBL) and traditional classroom lecture (TCL) for continuing medical education (CME) programs by comparing final resuscitation exam results of physicians who received the newest cardiopulmonary resuscitation (CPR) curriculum guidelines training either by traditional or by an Internet-based CME. A randomized two-group pretest-posttest quasi-experimental design was used. Postgraduate general physician trainees of Iran medical schools were participated. Two methods were compared for teaching the newest curriculum guidelines of the American Heart Association: lecture method in which the teacher follows a Power point presentation with linear layout, and with interactive self-assessment and Scenario-based learning, feedback, multimedia with linear and nonlinear layout with the same power point presentation as lecture in terms of text and photography. The data on final CPR exam grades, collected both groups trained physicians, were obtained for a total of 80 physicians in 2011. An independent sample t-test analysis indicated that participants in the IBL format reported significantly higher mean ratings for this format (62.5 ±2.32) than TCL format (54.6±2.18) (p=.001). There were no significant differences between the two groups in cognitive gains (p<0.05). well-designed IBL content can be effective or a supplement component to CME.

Keywords: **Internet-based learning, Traditional classroom lecture, continuing Medical Education, Cardiopulmonary Resuscitation.**

INTRODUCTION

Cardiovascular diseases in the developed countries account for 50% of the mortality rate and are the principal causes of death (Faghihi SH., Farokhinia F., 2003).

These numbers are often lowered by life savings interventions, such as cardiopulmonary resuscitation (CPR). Recognizing the importance of CPR in saving lives, the European Office of the World Health Organization advised countries to step up their activities to address the provision of adequate training and education for medical students and staff (Garcia-Barbero M, Caturla-Such J., 1999). When teaching CPR, one may choose from 'traditional' and newly developed methods to train medical professionals live saving techniques (Creutzfeldt et al, 2008; Hopstock, 2008; Isbye et al, 2008).

One of these non-conventional teaching methods is 'Internet based learning' (IBL). IBL education has proliferated rapidly since the advent of the World Wide Web in 1991(Ruiz JG et al, 2006). Key features of IBL over other instructional method include environments: interactivity, global accessibility, availability of online resources, learner controlled pace, convenience, nondiscrimination, cost effectiveness, collaborative learning, online evaluations and etc. Although the benefits of a web-based education, many of the web-based training programs are poorly designed and do not fully exploit the possibilities of the medium. (Friedman; Schulz et al, 1997). Thus, participants neglect the learning media which could be of great benefit to them. Although internet can be a great advantage, it can turn into a considerable waste of time and resources, if the nature of educational processes and the capabilities of educational technologies are not adequately considered while designing a tutoring system (Kinshuk, 1997). Physicians require skills of assessment for cardiac arrest and need to initiate Basic life support (BLS), involving maintaining respiration and circulation for the casualty until emergency services, or advanced life support services, arrive. Basic life support is also an important skill for many health-care professionals and the BLS electronic program can facilitate inter-professional teaching and learning (DoH, 2000; UKCC, 1999) in a variety of settings, such as skill laboratories, clinical practice settings and the users' own home. To address these problems in teaching of medical instrumentation, a generic, IBL, an interactive learning environment, scenario-based learning experience, and self-directed learning that incorporated well-established guidelines for recognizing the newest CPR curriculum guidelines have developed. Three main objectives guided the development of the learning material:

- **providing access to the material on the Internet,**
- **teaching the topics in an interactive manner, and**
- **implementing independent, extendable materials.**

Therefore, the main aim of this paper was a comparison of IBL and TCL to learn the newest CPR curriculum guidelines for CME. The paper is concerned with the comparison of final CPR exam scores and overall program satisfaction of physicians who either attended traditional classroom or Internet-based CME in 2011.

METHODS

Participants

A quasi-experimental study was conducted on 80 general physicians in November 2011. The participants enrolling in the program by the calling of Kermanshah university of medical sciences and health services (convenience sampling) and then randomly assigned to experimental (n=40) and control (n=40) in two groups and were unaware that two teaching methods were compared during the programs. It should be noted that the physicians initially had the same level of CPR theoretical knowledge based on their past theoretical experience in Universities curriculum.

The instructional: A program designed and burned it onto a CD-ROM, and deployed with web-based learning portal on Learning Management System (LMS) to deliver the training program. Design of the Internet based CME was based on review of online learning tutorials and resources and mainly on principles of self-directed learning. This program format was not scheduled so participants could start and finish at any time. To track compliance with the training, all participants were authenticated through their number and secure password against our Human Resources (HR) database. The database also helped us assign participants to base on their profiles. Once the entire program was designed and tested, the physicians informed through our university on internet. The program was accessible from any of the networked computers at the various facilities in Iran.

Instrument

The data were collected from a pretest, posttest, a questionnaire for demographic information and another questionnaire for post-course satisfaction survey. The demographic information included the variables gender, age, marital status, years of experience and ability to use computers.

The traditional classroom lecture Method. This training entailed teaching a group of 40 physicians in a lecture format. A full' time professor with considerable experience in the subject and whose teaching skills are recognized throughout the university presented the lecture. This professor was blinded about the other program. The professor had 6 hours to lecture using the content developed for the Internet Based CME material only in terms of text and photography.

The Internet Based CME Method. This training involved a group of 40 physicians. The material was tutorial created to the newest curriculum guidelines. The internet based CME was power point presentation that incorporated photography, video, text, narrative and animation which permitted some interaction with the material. The Internet based CME started with a brief explanation on how to navigate the course. Then it was organized into three sections: section I presented the objectives and utility of the instruction. Section II was organized on an explanation of the CPR algorithm. And section III was a simple simulation which included examples and Scenario-based with feedback and a review of course material. This section presents realistic scenarios portrayed through video footage, photographs and animations alongside essential text. The pre- and post-test results were automatically uploaded to the learning management system of university into a protected account, to be accessed by the researcher and module leaders responsible for CPR testing.

Testing Instrument: Knowledge was measured by an instructor-developed 20 item multiple-choice test based on articles published in journals and books, as well as on content specialist teaching experience. The knowledge assessment was intended to measure participants' general knowledge of the subject matter covered in the program. The test was used as pre and post with items presented in similar order. Using the pre-test, participants can check their knowledge and identify individual learning needs. For each correct answer, the score was '1', unanswered items were considered incorrect and for each incorrect answer the score was '0'. Sum of the scores were converted to a percentage of the possible total score. Acceptance criteria for passing program were determined score of 70 out of 100. At the beginning of the sessions, pretest exams and at the end of the sessions, immediately, posttest exams were taken from the two groups.

The entire questionnaire was pilot tested with a small group of physicians from academic and clinical setting to identify missing or ambiguous items and to ensure clarity. These data were not included within the final data set for analysis. Content validity analysis was examined using three content experts. Coefficient above .70 is considered adequate. Results indicated a reliability Coefficient of .73.

After finishing the training, the posttest and a post-course satisfaction survey with TCL was a paper and pencil test, while the Internet Based CME group took the same test and a post-course satisfaction with Internet based CME on the computer. The differences between the pre- and post-test scores were considered as their learning outcome.

The post-course satisfaction survey was comprised two questioners of 15 evaluative statements rated along the questions were based on a five-point Likert scale, with the scale ranging from strongly disagree (1) to strongly agree (5) and was used to measure overall participants' satisfaction to program after completion of traditional and Internet based CME. These questioners were appropriated with the two training methods and were designed to evaluate several areas, including: the quality of program; satisfaction with content, interaction; suitability of the program registration fee; the design of test questions with regard to the educational content provided; Which of traditional or virtual methods would they preferred for future CME, why? And so on. At the end of post-course satisfaction questioner, an open-ended comment section enabled participants to include information that was not covered by the survey questions. The Cronbach's α coefficient was 91%.

The first 40 Internet based CME survey respondents were used to pilot our instrument. It should be noted that the time spent studying was measured based on self-reported for participants in the IBL group. Participants were required to complete post-assessments to receive CME credit.

Data and Analysis

After collecting all data from the assessments, statistical analysis was performed using SPSS Version 11.

Quantitative variables are shown as mean ± SD and qualitative variables as frequency and percentage. Statistical tests appropriate to the type variable were included Levene's test to compare the variances of two groups before the independent t-test; independent t-test to compare mean scores of quantitative variables such as learning scores, age, and etc. between experimental and control groups; paired t-test to compare pretest and posttest in each group; Chi-square test to compare the distribution of qualitative variables such as marital status, gender, years of experience and ability of using computers between the two groups.

The P-value < 0.05 was considered significant.

RESULTS

As noted earlier, in this quasi-experimental study, subjects were randomly allocated into two groups. 40 subjects participated in IBL format and 40 others participated in TCL format. Demographic information statistic for each group is provided in table 1. There was no significant difference in variables included gender, age, years of experience, marital status, and the ability to use computers between the two groups.

Table: 1
Distribution of characteristics in two groups of subject

variable		Group 1	Group 2	P. Value
Age *		33.65±3.68	33.25±3.98	0.988
years of experience*		7.53±3.65	7.50±3.83	0.912
Marital Status	Married Single	28(70%) 12(30%)	30(75%) 10(25%)	0.251
Gender	Female male	16(40%) 24(60%)	19(47.5%) 21(52.5%)	0.457
the ability to use computers	medium Professional	35(87.5%) 5(12.5%)	33(82.5%) 7(17.5%)	0.392

*years

Table: 2 summarizes the overall mean pre and post knowledge assessment scores. Participants in the TCL group reported an overall mean pre-knowledge score of 68.5 ± 5.68 and a post-knowledge score of 83.12 ± 5.84. Participants in the IBL group reported an overall mean pre-knowledge score of 67.87 ± 5.41 and a post-knowledge score of 85.5 ± 5.16. A paired samples t-test analyses indicated a significant pre to post-knowledge increase ($p \leq 0.001$) for both program group at the $P < 0.05$ probability level.

Table: 2
Comparison of mean average (±SD) learning in two groups

Variable	Pre-test	Post-test	P-value
Group 1	68.5±5.68*	83.12±5.84*	0.001
Group 2	67.87±5.41*	85.5±5.16*	0.001

*standard deviation

Table: 3 summarizes the results of an independent samples t-test comparing the pre and post-knowledge assessment results and satisfaction ratings across the two groups. There was no significant difference in pre and post-knowledge assessment results between the two groups ($p > 0.05$).

All of the two groups' respondents completed the satisfaction survey. The satisfaction ratings suggest respondents were very satisfied with the IBL format. An independent t-test analysis indicated that participants in the IBL format reported significantly higher mean ratings for this format (62.5 ±2.32) than TCL format (54.6±2.18) (p=.001).

Table: 3
Independent samples t-test comparing the pre and post-knowledge assessment results and satisfaction ratings across the two formats

Variable	Group 1	Group 2	P-value
Pre-test	68.5±5.68*	67.87±5.41*	0.616
Post-test	83.12±5.84*	85.5±5.16*	0.58
Satisfaction	54.6±2.18*	62.5±2.32*	0.001

*standard deviation

The mean time for Internet based CME group was 145 minutes ranging from 125 minutes to 182 minutes. The time required for IBL included pretest, provide educational content to the participants until the end of learning, and post-tests performed by each participant with self-pace learning. While the time required for the traditional classroom lecture based on the written CME course design was 6 hours.

DISCUSSION

The purpose of this study was to conduct a comparison of IBL and TCL to learning CPR for CME on satisfaction and knowledge outcomes. The results suggested that CPR physicians-learners could independently learn the newest CPR curriculum guidelines using IBL materials. Participants in the IBL format reported significantly higher mean satisfaction ratings. This finding compares favorably with some previous research testing BLS learning following traditional classroom instruction, where significant improvement in theoretical knowledge has been seen (O'Donnell and Skinner, 1993; Moule and Knight, 1997; Badger and Rawstorne, 1998). These finding are consistent too within the Edwards and Hannah (1985) Previous research has evaluated the use of computer-assisted learning in BLS instruction for lay persons, found no difference in learning when compared with traditional teaching methods. Branas et al (2000) reported that a group of Spanish medical students using a CD-ROM learnt "Advanced Life Support" theory at least as well as those students attending a lecture. The majority of studies report that while Internet based CME may be as effective as TCL; it is not superior to TCL as found in the present study (Kim et al, 2002; Engum et al, 2003; Schmidt et al, 1991; Sanford et al, 1996).

Participants in the IBL group required 40.2% less time to learn the content than the TCL group. the 59.8 % time saved by participants in this study higher than the 24% time reported by Kinney et al (1997). The above outcomes demonstrated that in this study, IBL produced as good result in cognitive gain than TCL nearly in one third of the time. This finding indicated that Participants in this study using IBL and multimedia needed less time for reading and learning than TCL method. Hulsman et al. (2002) noted that their CBT course on communication skills for medical specialists was given over three hours rather than the conventional two or three days. Kulik (1994) found time reductions of 34 percent in 17 studies of CBT use in higher education and a 24 percent time reduction in 15 studies of adult education.

This result suggests that participants in the IBL group with less time spent learning can learn much better than the TCL group. It also shows that IBL content with well-designed can be effective or a supplement component to CME. Given that participants in CME programs in developing countries and in Iran to participate in a program spend 6-8 hours a day but in IBL, especially with CD-ROMs it takes time to learn maximum two or three hours and the learners can set their own time and place to learn. Thus, not only will save learners time and money but also save the costs of running these courses for educational institutions. On the other hand, e-learning content easily updates by faculty members and can pay their other academic duties. Additionally, Use of IBL material prior to TCL could result in reduced lecture time, increased learner satisfaction to participate during instruction. The IBL material used in this study had enough interactive and multimedia features. Software that integrates text, photography, sound, video and animation may be particularly more effective for some learner's with learning styles and differences. Such a learning material can help physicians to learn content as demonstrated in this study.

There is little research reporting learner satisfaction in the use of multi-media technology (Woo et al 2000), though these findings seem to support the existing body of knowledge. The participants welcomed the student-centered approach to learning offered by the program, as previously reported by Green et al (2000) and Moule and Gilchrist (2001), and they have valued the opportunity to learn at home (Bradshaw and Dale, 1999). Overall course satisfaction was good with IBL (4.16 on a scale of 1 to 5) and 65% preferring IBL over TCL. Our findings directly show that IBL may provide more efficient and more appealing learning experiences than similar TCL.

Our study disproves this notion and shows that health care professionals at all levels of education can be equally satisfied with IBL if it is designed and tailored to their job profile. In addition to time savings and enhanced 24-hour access to courses, IBL can also yield a good return on investment (ROI). We utilized existing internal resources to train physicians spread across different Location systems which helped us keep our development and delivery costs to a minimum.

Although other institutions may require additional resources and expense, IBL can still prove to be cost-effective when compared to traditional learning methods. Other studies suggest that web-based training can reduce up to 70% of employers' training budgets by eliminating employee travel from offsite locations, cost of updating printed materials, and reducing the amount of time that employees spend overall in the training activity (Knebel E., 2001; Bishop, 2007).

CONCLUSIONS

A primary limitation of this exploratory study is related to generalization. This was a study of the use of particular Internet-based learning technologies, delivery methods and learning approaches. As well, the subject matter of the courses was related to a very specific CME clinical area.

The results must be viewed and interpreted in this context. A useful area for further research would also be to explore how "blended approaches" to Internet-based CME delivery, combining both asynchronous and synchronous formats, might be used effectively. It would also be beneficial for future studies to examine the effect of participation in differing Internet-based formats on subsequent physician practices and behavior.

The CPR program does appear to have supported a self-directed learning approach to learning across the IBL group of participants, was well received by participants and is viewed as a viable resource for delivering CPR knowledge. The research has also identified the importance of ensuring that learning resources can be delivered efficiently and used effectively by participants. It has identified additionally, further development opportunities for Higher Education, with consistent requests across the groups for similar resources to be made available in the other medical disciplines.

Participants valued and satisfied the flexibility and usability of the resource, particularly the self-testing, presentation of visual images, and the video clips which helped participants to identify with the realities of CPR situations.

They felt a sense of control over the timing and pace of their own learning. Students did not identify any limitations to their learning.

Therefore, IBL is at least as good as other teaching formats, but we need to produce well-designed materials and to engage participants with this teaching method.

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Declaration of Interest:
There is no conflict of interest in this study.

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