Hindawi
Education Research International
Volume 2022, Article ID 4211691, 8 pages
https://doi.org/10.1155/2022/4211691

Research Article

Designing, Installing, and Commissioning an Electronic Continuing Medical Education System at Hamadan University of Medical Sciences Integrated with National CME System

Amir Mohammad Salehi,[1] **Mahnaz Khatiban**,[2] **Gita Sangestani**,[3] **Seyedeh Zahra Masoumi**,[3] **Ramin Kahaie**,[4] **Ali Ghaleiha**,[5] **Amin Biglarkhani**,[6] **and Koosha Ashtari**[7]

[1]*Student Research Committee, Hamadan University of Medical Sciences School of Medicine, Hamadan, Iran*
[2]*Mother and Child Care Research Center, Department of Ethics Education Medical Sciences, Department of Medical-Surgical Nursing, School of Nursing and Midwifery, Hamadan University of Medical Sciences, Hamadan, Iran*
[3]*Mother and Child Care Research Center, Hamadan University of Medical Sciences, Hamadan, Iran*
[4]*Continuing Education Office, Hamadan University of Medical Sciences, Hamadan, Iran*
[5]*Research Center for Behavioral and Substance Abuse Disorders, Hamadan University of Medical Sciences, Hamadan, Iran*
[6]*Hamadan University of Medical Sciences, Hamadan, Iran*
[7]*Hamedan University of Technology, Hamadan, Iran*

Correspondence should be addressed to Mahnaz Khatiban; mahnaz.khatiban@gmail.com

Received 6 August 2021; Revised 26 May 2022; Accepted 16 June 2022; Published 5 July 2022

Academic Editor: Bilal Khalid

Electronic learning has changed the continuing medical education (CME) methods. For the first time, we aim to design, install, and launch an electronic CME (e-CME) system at our university, to integrate it with our National Continuing Medical Education Center of the Ministry of Health, to determine its effects on the midwives' knowledge and problem-solving skills in postpartum hemorrhage (PPH), and their satisfaction with the electronic content and attitude toward the e-CME method. First, we designed and installed the learning management system (LMS) and integrated it with the national system. In the second phase, by the census, we applied it to 32 midwives through a quasiexperimental with a single-group pretest-posttest design. So, midwives used the electronic system in all five sessions and completed the research tools such as PPH knowledge, skills in solving problems, satisfaction with the content, and attitude toward e-CME before and after these sessions. Data were analyzed using the SPSS-16 software by the paired *t*-test, Wilcoxon, Friedman's, and Pearson's tests with a 95% confidence level. The levels of midwives' PPH knowledge and problem-solving skills were both significantly improved ($p < 0.05$). The total attitudes toward using e-learning CME for most participants were positive both before and after the intervention. After the intervention, there was a high satisfaction level (4.04 ± 0.16) with the electronic content among participating midwives. The positive results and successful use of e-learning by midwives lead to the achievement of the university's mission of continuing medical education.

1. Introduction

Updating the information and expertise in healthcare systems is important because these groups are in close connection with the promotion of public health. Education in these groups can develop professional abilities and clinical skills. Academic education is not often sufficient to meet the patients' needs, and thus, employees need to have lifelong learning to improve their knowledge, skills, and performance [1, 2]. Using continuing medical education (CME) can enhance the quality of clinical services national and international through appropriate educational strategies.

CME is a part of continuing professional development (CPD), which concentrates on improving the knowledge and skills of healthcare professionals [3]. In several investigations, the CME programs have had positive effects on the health professionals' awareness, practice, knowledge, confidence, performance, and skills, the quality and efficiency of the healthcare system, and the patients' outcomes [4–7]. However, due to some barriers such as increased workload and personal costs, ineffective training delivery methods, and lack of time and funding; incentives for acquiring competencies; training opportunities; organizational support; educational resources; credible information; and personal motivation, in-person attending and taking advantages of the on-the-job educational opportunities is not readily feasible [2, 3, 8]. Therefore, officials and managers should apply technologies to provide CME strategies that are more flexible in time and place, attractive, learner-focused, interactive, further involved in collaboration and communication, and of less cost [9, 10].

Today, advances in technology open new prospects to create online programs to deliver CME with appropriate modifications [11]. The advent and rapid development of information and communication technologies (ICTs), especially the Internet and other related technologies, have created substantial changes in the global learning systems [2, 12]. E-learning refers to the communication and learning activities through computers and networks or via electronic means [11]. The uses of e-learning in education systems have led to the creation of appropriate tools for the virtual CME [6, 13].

2. Literature Review

Numerous learning management systems (LMSs) at varying prices and features worldwide make LMS selection complicated according to the compromise between how well the components fit the needs and the budget available for customizations. Some organizations might prefer to develop them in-house because it is custom-tailored to their needs. However, it may take much longer to implement [14]. An LMS needs and resources on defined standards are web browsing resources, such as synchronous sharing, course planning, course customizing, course managing, course monitoring, instructional designing, presenting information, testing, system operating, installing, authorization, registering, server security, resource monitoring, remote access, and crash recovery; information resources, such as displaying information to instructors, courses and prerequisites, scheduling tables, messaging and notifications, educational content (slides and lecture notes, additional resources, and audio and video files), and loading and exchanging files between educators and learners; search resources and types of interactions, such as discussion boards, chat rooms, wikis, blogs, and the ability to create a portfolio [9, 15].

Positive outcomes of the CME programs have been studied around the world. For example, in Australia, the first dementia-focused CME program improved the GP awareness, practice, knowledge, and confidence [4]. In Malaysia, a CME program for primary healthcare providers could increase their diabetes knowledge, attitudes, skills, and clinical practices [5]. In a systematic review, it is stated that the CME/CPD can be more accessible through distance learning initiatives and the results showed the different effects of the CME strategies on professional recruitment and retention [16]. Experiences of effective outcomes of the electronic CMEs compared with those in traditional methods made the e-CME a strong alternative in these programs [2, 4, 6, 13, 17, 18].

In Iran, the language is Persian, so developing e-CME programs needs more attention to the LMS choice and its customization. Because of the importance of maternal and child healthcare, we also selected midwives as our e-CME study population. At that point, we applied e-CME in the education of postpartum hemorrhage (PPH) to the employed midwives. Thus, there are two main objectives in this study.

(1) Design, install, and launch an LMS at our university for the first time and integrate it with the national CME system. So, the research question was what is the appropriate LMS integrated with the national CME system?

(2) Examine our e-CME program's effects on the users' knowledge, problem-solving skills, satisfaction with the electronic content, and attitude toward e-CME as a new technology. So, the research hypothesis was as follows: participating in the PPH e-CME program will improve the midwives' PPH knowledge, problem-solving skills, satisfaction, and attitude.

3. Methods

This project was held by the Center for Continuing Education at the Hamadan University of Medical Sciences. The Research Ethics Committee at Hamadan University of Medical Sciences approved the proposal (ID : P/16/85/184988) in 2014. All participants signed the consent forms after explaining the aims of the study.

Through this project, according to the library studies and the experts' opinions, requirements of the teaching-learning structure and process included in the system were determined, and based on that, the system was designed and implemented, and finally, its structure and process were evaluated. For this purpose, first, the Committee of Electronic Continuing Medical Education (e-CME) was formed in the University's Continuing Education Office, including the research team and experts in the field of e-learning (three people). This committee held meetings of brainstorming and nominal groups and consults or invites various experts, if necessary, to accomplish the educational design process of the e-CME based on the system model. The project was structured into two major steps.

3.1. Step One. This step included the design, installation, and commissioning of the e-CME system at the university. In this step of productive research, seven phases were defined. The first phase is system analysis.

The e-CME committee examined the possibilities of e-learning software and systems according to the needs of the e-CME and its users. In this phase, the needs and resources on defined standards were acknowledged [9, 15]. In this context, postpartum hemorrhage was chosen as the first topic to launch our e-learning program. The second phase is designing an LMS for continuing e-CME based on the standards. In this phase, according to the results of the previous stage, first, the framework and the general process of the teaching-learning process of the system were determined. The principles and recommendations of the teaching-learning process in e-learning were reviewed, and each that was feasible was included in the system design. Due to the purpose of the LMS, which was supposed to be widely used at the university level, instead of focusing on the production of costly and time-consuming content, the learning process and the web environment were used as a tool to develop problem-solving skills and critical thinking. Based on this, special attention was paid to the high educator-learner interaction and learner guidance. The third phase is launching the LMS at the university. According to the conditions of users, an asynchronized e-learning method was considered. Criteria for learner admission, e-CME schedule, scores, and certificate of qualification were defined accordingly. The ease of working with the system and its graphical features were highly regarded. Finally, all the trends and modules of the system were identified, and call for a request for proposal (RFP) software was prepared. The required rules including the rules of the university's virtual course and the rules for faculty members were prepared. How to evaluate the performance of LMS and professors was also determined. The fourth phase is developing PPH content as an educational package. For this purpose, educational content was determined based on the new relevant literature and then was developed as five training packages, where each package included objectives, pre- and posttest for PPH knowledge assessment, pre- and posttest to measure skills in the PPH problem-solving, and a questionnaire for the assessment of the users' satisfaction level of the PPH electronic contents. A pre- and posttest questionnaire was also designed to determine the participants' attitudes toward e-CME. The fifth phase is the preparation of e-content, which is the conversion of content to multimedia and developing the content management system (CMS) and finally loading the provided educational packages. The sixth phase is the execution of PPH educational programs for midwives. For each participant, the username and password were defined by the researchers. The participants could observe a page containing all the information about the educational course after entering. Thereafter, they received each session's pretests and responded to them. The educational content was offered to them so that they could download the content files or view them online. At the end of each session, they filled out the posttests and the satisfaction questionnaire. They also answered the attitude toward the e-CME questionnaire at the end of all five sessions. The seventh phase is the communication and integration of the established LMS at the University of Medical Sciences with the CME National System for issuing electronic certificates. The Department of Continuing Medical Education in the Health Ministry, where the CME policies and standards are formulated, supported our e-CME. The department also registered our program and acknowledged the program secretaries. By the department associating, after e-CME completion, the e-certificates were to be issued through the system, and the long process of sending paper documents was eliminated.

3.2. Step Two. The aim of the second step was to determine the effects of the designed e-CME system on the knowledge, skills, attitude, and satisfaction of midwives. This step was performed as a semiexperimental before-and-after study by referring to the only maternity, obstetrics, and gynecology teaching hospital affiliated with the university by the census. Thirty-nine midwives have described the project and its goals. Then, the midwives who had volunteered to participate in the e-CME were invited to participate in this program free of charge. Five instruments were developed for this aim.

(1) The demographic questionnaire included age, type of degree (bachelor's; master's), work experience, and shift work.

(2) For assessing the midwives' PPH knowledge, 64 multiple-choice questions were designed and confirmed by experts. Of 64 questions, the LMS has randomly selected 17 questions for the pretest and 17 questions for the posttest. In this regard, three questions in the first session, four questions in the second session, four questions in the third session, three questions in the fourth session, and three questions in the fifth session were considered the pretests. The participants were supposed to answer the same number of questions for the posttest. Finally, the total PPH knowledge scores were categorized as good (score 13 to 17), moderate (score 9 to 13), poor (score 4 to 9), and very poor (score 0 to 4).

(3) For assessing the participating midwives' skills in solving problems, five cases were developed with the problem covered in each session. Similar to assessing knowledge, 17 questions were presented to the participants with similar pretest and posttest schedules. In this phase, the total midwifes' skill scores were categorized as good (score 13 to 17), moderate (score 9 to 13), poor (score 4 to 9), and very poor (score 0 to 4).

(4) For assessing the midwives' satisfaction with the PPH electronic content, a questionnaire containing ten questions rated on a 6-point Likert scaling method (5 for "excellent" and 0 for "very poor") was designed according to Mazzoleni and colleagues' study [19]. The questionnaire was presented to the participants at the end of each session, and they were asked to answer this question: how successful was the program of this session in terms of each of the raised issues? The total mean score was determined and categorized as excellent (score 4.2 to 5.0), very good (score 3.4 to 4.2), good (score 2.6 to 3.3), moderate

(score 1.6 to 2.5), poor (score 0.8 to 1.5), and very poor (score 0 to 0.7).

(5) For comparing the participants' attitude toward e-CME before and after presenting the designed program, a survey questionnaire was developed with 13 questions scored on a 5-point Likert scaling method (5 for "strongly agreed" and 1 for "strongly disagreed"). The total mean attitude scores of participants were categorized as strongly positive (score 4.2 to 0.5), positive (score 3.4 to 4.1), abstained (score 2.6 to 3.3), negative (score 188 1.8 to 2.5), and strongly negative (score 1.0 to 1.7).

All research tools were based on studies of scientific texts, and ten professors at Shahid Beheshti and Tehran Universities of Medical Sciences approved their face and content validity.

For statistical analysis, results were reported as mean ± standard deviation (SD) for the quantitative variables and percentages for the qualitative variables. The changes in quantitative variables after educational interventions were measured using the paired t-test or the Wilcoxon test. The associations between the quantitative variables were assessed by Pearson's correlation test. p values of 0.05 or less were considered statistically significant. All the statistical analyses were performed using SPSS version 16 (SPSS Inc., Chicago, IL, USA) for Windows.

4. Results

The e-learning system is designed to deliver asynchronous e-CME courses. Its main points are the interaction between educator and participants and the possibility of preparing and managing the classroom by the teacher. The designed system has the following facilities and specifications: the possibility of preparing the lesson by the teacher, including introducing the course, specifying the time and specifications of the attending classes, introducing the evaluation method, determining the resources, and the possibility of uploading the preferred types of files for the content of the lesson; the possibility of defining the tasks of the steps scheduled by the educators and exchanging files between the learners and the educator until the final approval stage; the possibility of designing tests such as multiple-choice questions or descriptive questions by the educator; the possibility of exchanging messages between educator and learner; the possibility of sending notifications to all or a number of learners by the educator; information of professors and students in the system; online registration for learner entrance exams; online registration for learner entrance exams; reminders of the momentous events; and evaluation of the educator and the course by the participants. A guide form contained lesson plan was prepared to help the educators in the course presentation. Before beginning the e-CME programs, the educators were supposed to develop their course plans and submit them to the CME Office at the university. Finally, we admitted and electronically submitted the midwives ($n = 32$) for PPH-related e-CME. All the midwives completed the e-CME course. Most of the participants were in the age group of 22–28 years (62%) with a bachelor's degree in midwifery (90.7%), one to seven years of work experience (63.4%), and working in the morning shift (51.2%).

The midwives' levels of the PPH knowledge and skills in the PPH problem-solving significantly improved following participation in designed e-CME in different education sessions (Table 1). According to paired t-test, the total mean score for PPH knowledge significantly increased from 8.78 ± 3.10 before educational intervention to 13.03 ± 3.10 after the intervention ($t = -6.06$, $p < 0.001$) (Figure 1). Moreover, a paired t-test showed that the total mean score for skills in PPH problem-solving also significantly increased from 8.88 ± 3.30 to 10.75 ± 1.20 following the application of e-CME learning ($t = -4.46$, $p < 0.001$) (Figure 2). The level of satisfaction with the PPH electronic content ranged from very good to excellent (Table 2).

The total mean score of satisfaction was 4.04 ± 0.16 significantly increased from the first session (4.31 ± 0.47) to the fifth session (4.78 ± 0.42) based on the Friedman's test ($\chi^2 = 45.2$, $p < 0.001$). As shown in Figure 3, the total attitude of most of the participants was positive toward e-CME both before (68.8%) and after (84.4%) the intervention, and even the number of abstained subjects reached zero after the use of e-CME. The mean score for attitudes toward this learning method also significantly increased from 3.20 ± 0.27 before e-learning to 3.77 ± 0.23 after e-learning ($t = -11.82$, $p < 0.001$). Assessing the association between knowledge, attitude, skills, and satisfaction after and before the e-CME learning program (Table 3) showed a direct correlation between midwives' attitudes before and after the program ($r = 0.42$, $p = 0.02$). Moreover, the satisfaction with the PPH electronic content was positively associated with the level of knowledge after education ($r = 0.38$, $p = 0.04$). In this regard, initial knowledge was positively correlated with pretest skills ($r = 0.71$, $p < 0.001$) but adversely associated with posttest skills ($r = -0.41$, $p = 0.02$).

5. Discussion

For designing, installing, and commissioning of e-CME system at the University of Medical Sciences, the related literature and systematic instructional design model were followed [20, 21]. We ordered a customized and suitable LMS for this project. This designed LMS allowed the users to determine the type of content, topics, aims, and the time required to complete the course, references, the course guide, and the method of the tests in the lesson plan. Our designed system was able to provide the possibility of preparing the long-answer and short-answer essay tests, multiple-choice questions, matching quizzes, and rating tests (Likert scaling method). Likert scales are valuable in the social sciences like our study. They belong to a category of psychometric response scales, in which respondents rate their attitudes and opinions [22]. We have applied a systematic approach to the e-CME planning, development, implementation, and evaluation based on the recommendations and standards [9]. This system enabled the educators to provide and load the study resources for individuals

Table 1: Changes in the level of the midwives' PPH knowledge and problem-solving skills in different sessions of the electronic CME ($n = 32$).

Session	Mean score (before intervention)	Mean score (after intervention)	p value
PPH knowledge			
Session 1	1.78 ± 1.00	2.38 ± 0.75	0.008
Session 2	1.53 ± 1.11	3.00 ± 1.05	<0.001
Session 3	2.31 ± 1.23	2.91 ± 1.00	0.036
Session 4	1.84 ± 0.99	2.75 ± 0.44	<0.001
Session 5	1.31 ± 0.74	2.00 ± 0.84	0.004
PPH problem-solving skills			
Session 1	1.94 ± 0.76	2.31 ± 0.64	0.029
Session 2	1.00 ± 0.76	1.84 ± 0.37	<0.001
Session 3	1.38 ± 0.66	1.94 ± 0.25	<0.001
Session 4	1.84 ± 0.99	2.66 ± 0.48	0.002
Session 5	1.72 ± 1.28	2.19 ± 0.54	0.046
Attitude	3.20 ± 0.27	3.77 ± 0.23	$p < 0.001$

PPH: postpartum hemorrhage; CME: continuing medical education.

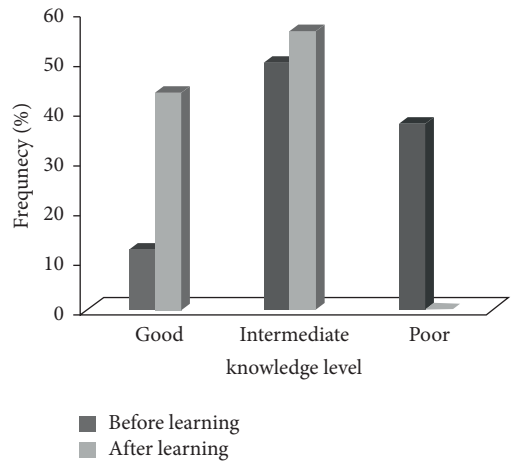

Figure 1: The total mean score of the midwives' PPH knowledge following electronic continuing medical education compared with before that.

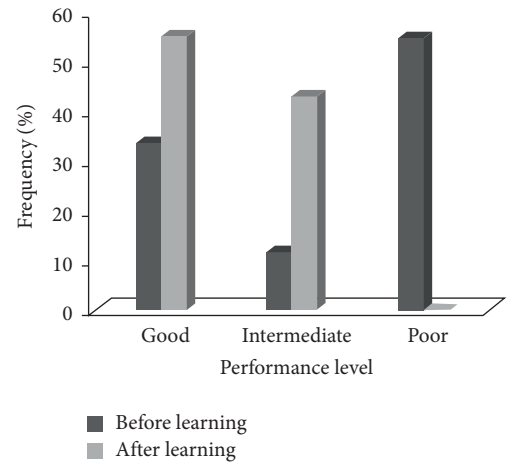

Figure 2: The total mean score of the midwives' skills in problem-solving following electronic continuing medical education compared with before that.

Table 2: The midwives' satisfaction level with the content of electronic CME after participating in different education sessions ($n = 32$).

Session	Excellent number (%)	Very good number (%)	Mean ± SD
Session 1	10 (15.6)	22 (34.4)	3.98 ± 0.19
Session 2	4 (6.2)	28 (43.8)	3.86 ± 0.20
Session 3	14 (21.9)	18 (28.1)	3.99 ± 0.21
Session 4	20 (31.2)	12 (18.8)	4.12 ± 0.24
Session 5	25 (39.1)	7 (10.9)	4.21 ± 0.27
Total	73 (45.6)	87 (54.4)	4.04 ± 0.16

CME: continuing medical education.

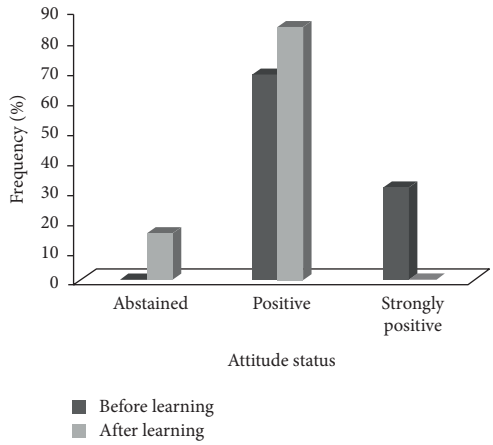

Figure 3: The status of the midwives' attitude toward electronic continuing medical education before and after the intervention.

containing books, slides, or other files. Furthermore, our e-CME followed the Andragogy approach or Knowles' Adult Learning Theory based on a self-directed, independent learning method for adults who can actively control their learning process [23]. We have attempted to design a simple system so that educators can prepare their lesson plans with the most straightforward online tools and health professionals need a few technology skills as well. Our finding stands with the fact that educational programs can provide

Table 3: Correlations between the scores of midwives' PPH knowledge and problem-solving skills and attitude before and after electronic CME learning.

		Satisfaction	Skills after	Skills before	Knowledge after	Knowledge before	Attitude after
Attitude before	r	0.28	−0.01	0.03	−0.24	0.15	0.42
	p	0.13	0.98	0.87	0.18	0.41	0.02
Attitude after	r	−0.05	−0.03	−0.08	−0.09	−0.024	
	p	0.79	0.89	0.69	0.64	0.19	
Knowledge before	r	0.15	−0.41	0.71	−0.04		
	p	0.43	0.02	<0.001	0.83		
Knowledge after	r	0.38	−0.33	−0.004			
	p	0.04	0.07	0.98			
Skills before	r	0.181	−0.170				
	p	0.32	0.35				
Skills after	r	0.062					
	p	0.74					

CME : continuing medical education.

through distance CMEs and interactive video technology to health professionals [24]. A well-designed asynchronous online education method can be effective and appropriate for participants, and adequate support and technological infrastructure are as crucial as the quality of education for online learners [25].

The beneficial effects of our e-CME system on improving midwives' PPH knowledge, skills in PPH problem-solving, attitude to e-CME, and satisfaction with the PPH electronic content showed that a well-designed online course can be easily presented in the CME programs. Given that a successful CME should improve the participants' knowledge, practice, attitude, and professional behaviors [1], our e-CME can be considered a successful program. Along with our results, most of the included studies in a scoping review of the interprofessional online learning for primary healthcare reported that e-learning courses had positive outcomes such as advancement in participants' attitudes, perceptions, knowledge, and skills [26]. Moreover, results of a scoping review of six studies showed that, in continuing professional development programs, both Internet-based and non-Internet-based technology approaches enhanced healthcare professionals' knowledge, skills, and attitudes [3].

Improving the midwives' knowledge after the PPH e-CME course was in line with another study, where registered nurses' knowledge significantly improved after using an electronically delivered learning module (EDLM) [27]. Learners engaging with a CME course integrating live, online, and digital content had higher increases in knowledge with less educational time-consuming [2]. Moreover, 30-hour online learning with two face-to-face five-hour sessions on evidence-based practice improved the Spanish registered nurses' knowledge and skills [28].

Furthermore, our e-CME system had positive effects on midwives' skills in problem-solving, Thai. et al showed that applying an online CME integrated into a face-to-face program was able to enhance the clinical knowledge and problem-solving skills of Vietnamese family doctors [29]. In Iran, an e-learning course comparable to the traditional method resulted in adequate nurses' skills in nursing care documentation [17]. Moreover, in an e-learning method in Taiwan, all nurses could pass care skills examinations similar to nurses who participated in the presence programs [18].

Moreover, employing the e-learning system led to additional participants' satisfaction with the e-CME program about postpartum hemorrhage. Our LMS improved participants' attitudes to the e-CME compared with the baseline assessment, and thus, it can become one of the primary choices for midwives to continue learning. In the Southeast United States, an online CME on HIV enhanced the primary care providers' HIV-related knowledge and attitudes [30]. The health professionals' attitudes toward e-learning in CPD programs were equivalent to face-to-face CPD programs [3]. These findings were also confirmed by previous researchers that considered satisfaction as the result of the evaluation of e-learning methods. In this regard, Mazzoleni et al. showed a high level of the doctors' satisfaction with CME e-learning in occupational medicine in Italy [19]. Weber and Lennon also showed similar satisfaction levels with e-learning and traditional learning methods [31]. Curran et al. also indicated the successful effects of two internet-based CME methods of "scheduled group training format" and "demand-based format" on knowledge, attitude, satisfaction, and self-confidence [16]. Most of the new registered nurses enrolled in an online continuing education program were satisfied with the first national online nursing bachelor's degree program. So, the authors concluded that the well-designed asynchronous online education methods are effective and appropriate for registered nurses [25].

5.1. Limitations. The limitation of this study was due to the low-speed Internet, scanty PCs at the hospital, and lack of the users' technology skills among the midwives. It has been confirmed that the main barriers to the acceptance of e-learning programs are inadequate technology equipment and lack of skill [32]. The study design did not include a

follow-up measurement of knowledge retention, which can be considered one of the goals of CME.

6. Conclusion

This study has provided details of an LMS development for e-CME and its application for professionals at the University of Medical Sciences. Our e-CME system demonstrated the positive effects on the participating midwives' PPH knowledge and problem-solving skills, attitude to e-CME, and satisfaction with the PPH electronic content. This system was the first e-CME system management among the type-I Medical Universities in Iran. By linking to the National CME System in the Ministry of Health, our university turned into one of the few Medical Universities in Iran that could present electronic certification to the participants. Through our LMS, the teachers can efficiently provide a wide range of scientific topics for enthusiasts over the country. Our study has provided valuable details that should be considered when developing an e-CME program for professionals. For the involvement to work efficiently, CME courses must be well designed and based on needs, suitable educational theories, interactive, accessible, and affordable. Further studies are needed to evaluate the changes in current CME courses to electronic conditions and outcomes of the e-CME programs.

Data Availability

The data are available upon request from the corresponding author.

Conflicts of Interest

All authors have no conflicts of interest to declare.

Authors' Contributions

All the authors read and approved the manuscript. They are certain that the manuscript represents honest work.

Acknowledgments

The authors thank the Research and Technology Council of Hamadan University of Medical Sciences and Mother and Child Care Research Center and all midwives participating in this project. Thanks are due to the Vice-Chancellor of the Research and Technology at Hamadan Medical Sciences (ID number: P/16/35/9/9).

References

[1] L. VanNieuwenborg, M. Goossens, J. De Lepeleire, and B. Schoenmakers, "Continuing medical education for general practitioners: a practice format," *Postgraduate Medical Journal*, vol. 92, no. 1086, pp. 217–222, 2016.

[2] M. W. Cullen, J. B. Geske, N. S. Anavekar et al., "Reinvigorating continuing medical education: meeting the challenges of the digital age," *Mayo Clinic Proceedings*, vol. 94, no. 12, pp. 2501–2509, 2019.

[3] J. L. Ngenzi, R. E. Scott, and M. Mars, "Information and communication technology to enhance continuing professional development (CPD) and continuing medical education (CME) for Rwanda: a scoping review of reviews," *BMC Medical Education*, vol. 21, no. 1, 2021.

[4] A. N. Casey, M. M. Islam, H. Schütze et al., "GP awareness, practice, knowledge and confidence: evaluation of the first nation-wide dementia-focused continuing medical education program in Australia," *BMC Family Practice*, vol. 21, no. 1, p. 104, 2020.

[5] S. C. Lim, F. I. Mustapha, J. Aagaard-Hansen, M. Calopietro, T. Aris, and U. Bjerre-Christensen, "Impact of continuing medical education for primary healthcare providers in Malaysia on diabetes knowledge, attitudes, skills and clinical practices," *Medical Education Online*, vol. 25, no. 1, Article ID 1710330, 2020.

[6] S. Setia, J. C. Tay, Y. C. Chia, and K. Subramaniam, "Massive open online courses (MOOCs) for continuing medical education—why and how?" *Advances in Medical Education and Practice*, vol. 10, pp. 805–812, 2019.

[7] S. S. Johnson, C. Cummins, A. Paiva, and J. J. Brown, "Measuring effectiveness of continuing medical education using the transtheoretical model of behavior change," *CE Measure*, vol. 6, no. 3, pp. 32–40, 2012.

[8] D. Lakai, K. Jayaratne, G. E. Moore, and M. Kistler, "Barriers and effective educational strategies to develop Extension Agents' professional competencies," *Journal of Extension*, vol. 50, no. 4, 2012.

[9] K. M. Scott, L. Baur, and J. Barrett, "Evidence-based principles for using technology-enhanced learning in the continuing professional development of health professionals," *Journal of Continuing Education in the Health Professions*, vol. 37, no. 1, pp. 61–66, 2017.

[10] L. Hendrickx and C. Winters, "Access to continuing education for critical care nurses in rural or remote settings," *Critical Care Nurse*, vol. 37, no. 2, pp. 66–71, 2017.

[11] S. K. Praharaj and S. Ameen, "The relevance of telemedicine in continuing medical education," *Indian Journal of Psychological Medicine*, vol. 42, 2020.

[12] B. M. Abubakar and B. B. Hassan, "Strategies for developing an e-learning curriculum for library and information science (LIS) schools in the Muslim world: meeting the expectations in the digital age," *International Journal of Humanities and Social Science*, vol. 3, no. 1, pp. 163–171, 2013.

[13] M. B. Benedict and D. Bradley, "A peek at the revised nursing professional development: scope and standards of practice," *The Journal of Continuing Education in Nursing*, vol. 41, no. 5, pp. 195-196, 2010.

[14] F. Hanfland, "Strategies for transition to e-learning," *The eLearning Guild's Handbook of E-Learning Strategy 20*, The eLearning Guild, Santa Rosa, CA, USA, 2007.

[15] R. Ellaway and K. Masters, "AMEE Guide 32: e-Learning in medical education Part 1: learning, teaching and assessment," *Medical Teacher*, vol. 30, no. 5, pp. 455–473, 2008.

[16] V. Curran, L. Rourke, and P. Snow, "A framework for enhancing continuing medical education for rural physicians: a summary of the literature," *Medical Teacher*, vol. 32, no. 11, pp. e501–e508, 2010.

[17] A. Abbaszadeh, H. Sabeghi, F. Borhani, and A. Heydari, "A comparative study on effect of e-learning and instructor-led methods on nurses' documentation competency," *Iranian Journal of Nursing and Midwifery Research*, vol. 16, no. 3, pp. 235–243, 2011.

[18] W. Y. Chang, S. T. Hsiao Sheen, P. C. Chang, and P. H. Lee, "Developing an e-learning education programme for staff nurses: processes and outcomes," *Nurse Education Today*, vol. 28, no. 7, pp. 822–828, 2008.

[19] M. Mazzoleni, P. Baiardi, I. Giorgi, G. Franchi, R. Marconi, and M. Cortesi, "Assessing users' satisfaction through perception of usefulness and ease of use in the daily interaction with a hospital information system," *Proceedings of the AMIA Annual Fall Symposium*, American Medical Informatics Association, 1996.

[20] L. Linnenbrink-Garcia, E. A. Patall, and R. Pekrun, "Adaptive motivation and emotion in education: research and principles for instructional design," *Policy Insights from the Behavioral and Brain Sciences*, vol. 3, no. 2, pp. 228–236, 2016.

[21] Y. Bergstrom-Lynch, "LibGuides by design: using instructional design principles and user-centered studies to develop best practices," *Public Services Quarterly*, vol. 15, no. 3, pp. 205–223, 2019.

[22] J. T. Croasmun and L. Ostrom, "Using likert-type scales in the social sciences," *Journal of Adult Education*, vol. 40, no. 1, pp. 19–22, 2011.

[23] M. A. A. Mamun, G. Lawrie, and T. Wright, "Instructional design of scaffolded online learning modules for self-directed and inquiry-based learning environments," *Computers and Education*, vol. 144, Article ID 103695, 2020.

[24] A. B. Bynum, C. A. Irwin, and B. Cohen, "Satisfaction with a distance continuing education program for health professionals," *Telemedicine and e-Health*, vol. 16, no. 7, pp. 776–786, 2010.

[25] S. Karaman, S. Kucuk, and M. Aydemir, "Evaluation of an online continuing education program from the perspective of new graduate nurses," *Nurse Education Today*, vol. 34, no. 5, pp. 836–841, 2014.

[26] S. Reeves, S. Fletcher, C. McLoughlin, A. Yim, and K. D. Patel, "Interprofessional online learning for primary healthcare: findings from a scoping review," *BMJ Open*, vol. 7, no. 8, Article ID e016872, 2017.

[27] S. Schilinski, S. D. Hellier, and T. W. Cline, "Evaluation of an electronically delivered learning module intended for continuing education of practicing registered nurses: a pretest-posttest longitudinal study," *The Journal of Continuing Education in Nursing*, vol. 50, no. 7, pp. 331–336, 2019.

[28] A. J. Ramos-Morcillo, S. Fernández-Salazar, M. Ruzafa-Martínez, and R. Del-Pino-Casado, "Effectiveness of a brief, basic evidence-based practice course for clinical nurses," *Worldviews on Evidence-Based Nursing*, vol. 12, no. 4, pp. 199–207, 2015.

[29] T. T. N. Thai, K. T. Nguyen, T. T. Pham, P. M. Nguyen, and A. Derese, "Can combined online and face-to-face continuing medical education improve the clinical knowledge and skills of family doctors in Vietnam? A cluster randomised controlled trial," *Tropical Medicine and International Health*, vol. 25, no. 4, pp. 388–396, 2020.

[30] K. D. Henny, C. C. Duke, and M. Y. Sutton, "Uptake of online HIV-related continuing medical education training among primary care providers in Southeast United States, 2017-2018," *AIDS Care*, vol. 33, no. 12, pp. 1515–1524, 2021.

[31] J. M. Weber and R. Lennon, "Multi-course comparison of traditional versus web-based course delivery systems," *The Journal of Educators Online*, vol. 4, no. 2, 2007.

[32] S. Childs, E. Blenkinsopp, A. Hall, and G. Walton, "Effective e-learning for health professionals and students—barriers and their solutions. A systematic review of the literature—findings from the HeXL project," *Health Information and Libraries Journal*, vol. 22, pp. 20–32, 2005.