Instructional Design, Delivery, and Evaluation of Interactive Case-based e-CME Contents

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Abstract

Background and purpose: *Studies have shown the advantages of e-CME programs. Developing case-based e-CME activities, which is a popular format of e-CME programs, is difficult and time-consuming. In this article, we have discussed our experience in designing instructional system for creating case-based e-CME contents.*

Methods: *We designed the instructional system in five steps (i.e., system analysis, design, development, delivery, and evaluation) to create e-contents. We held several sessions with subject experts to analyze the system. Then, we determined the contents' framework and created a plan for faculty members' development and incentives. In the development phase, we held workshops for faculty members and trained e-learning advisors who were to help faculties create contents. Incentives were legitimized. Then, we delivered programs to the learners who would fill a program evaluation questionnaire after completing the study of each program.*

Results: *A total of 20 e-CME programs were developed and delivered to the learners and a total of 3644 learner-programs were studied. The cases rated the programs as 4.56 (SD=0.65) on a 1–5 Likert-type scale.*

Conclusions: *Results showed that the learners rated this learning activity highly. However, we faced some challenges in developing the contents. In future, designing a comprehensive instructional system would help overcome these barriers.*

Keywords: *E-LEARNING, CASE-BASED LEARNING, E-CONTENT, CONTINUINGMEDICAL EDUCATION*

Journal of Medical Education Winter 2015; 14(1):33-8

Introduction

It is believed that continuing medical education (CME) would influence the quality of medical care if appropriate educational methods are used (1). In parallel with the increase in the demand of physicians for CME, information technology (IT) has provided a chance for broader delivery of educational contents (2, 3). Thus, the number of internet-based CME activities has increased significantly (1), and more physicians now receive credits through e-learning activities (1, 4). Reports have shown a 700% increase in the e-CME activities as compared with a 38% growth in the total CME activities between 1998 and 2003. On the other hand, 1400% increase in the number of physicians receiving credit from e-CME has been recorded in comparison with a 64% increase in their number for all CME programs (1). Different studies have addressed the advantages of e-CME programs, such as widespread availability,

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flexibility of training time and place, cost savings (particularly in relation to travel expenses), increased adaptability to learners' styles, the possibility of using multimedia and hyperlinks, permanent access to content, and the possibility of designing case-based interactive scenarios (1, 5-8).

CME e-contents are delivered in different formats, including text only, text and graphics, text and audio, slide and text, slide-audio/video lectures, guideline-based contents, question and answer, and case-based interactive scenarios (9).

Literature shows that case-based learning improves the lifelong learning skills more than other educational strategies and those physicians are satisfied with such a learning activity. However, case-based interactive e-content development is time-consuming and difficult as well as requires careful planning and thinking (10). Indeed, as in any other educational activity, performing a five-step instructional system design (i.e., system analysis, design, development, delivery, and evaluation) would be necessary for e-content development (11). Notably, in e-learning systems, more efforts and costs are required for designing and development of education than for its delivery, which is in contrast to that for traditional education, in which the delivery phase is more prominent (12).

In this article, we have described our experience in developing case-based e-CME contents based on five steps of instructional system designing.

Methods

We performed this study between 2008 and 2010 in the Tehran University of Medical Sciences (TUMS). We designed an instructional system for creating e-CME contents. The following activities were performed:

System analysis. In this phase, we analyzed the learners' needs and preferences, faculty members' capabilities for e-content development, and country's IT facilities. We held 5 sessions with 3 medical education experts, 2 members of the university's CME office, and 6 faculty members who were interested in CME activities. In these sessions, we used the focus-group method to gather members' opinion on each of the above-mentioned items. Participants believed that learners would be interested in case-based contents that focus on their professional requirements. They suggested advising the faculty members to select topics that are relevant to the learners' needs and the level of their knowledge and skill. They emphasized on designing individualized learning paths in cases' scenarios, whenever necessary. The participants declared that the faculty members had no experience of e-content development and focused on providing incentives to e-content developers. From their perspective, we should consider IT infrastructure limitations, especially internet bandwidth, in designing e-content format to allow learners from across the country to access the contents.

However, TUMS possessed an operating e-CME site with related Learning Management System (LMS) and Learning Content Management System (LCMS). We assessed their capabilities to support different kinds of contents.

Design. In this phase, we designed the learning-teaching framework of e-CME contents. Case-based scenarios were selected as the preferred learning strategy. Regarding IT infrastructure of the country and the learners' access to the internet, we decided to develop text-based interactive contents. We prepared a plan for faculty development and incentives. These incentives included the financial and non-financial ones. For non-financial incentives, we proposed to allocate credits for scholarship in teaching for the faculty members' promotion. We decided to deliver the contents via TUMS' e-CME site.

Development. Initially, we precisely determined the contents' framework and developed a stepwise operational template and a guideline for content development. This template and guideline helped the content authors to develop their scenario in a Microsoft office word format. We organized a one-day workshop titled "Interactive case-

based e-CME content development". Table 1 displays the workshop topics. We announced 3 workshops, in which 140 faculty members participated. As e-content development was a new and time-consuming task for faculty members, we trained 5 e-learning advisors to help them. The advisors were general practitioners (freshly graduated) who were interested in e-learning activities. They were thoroughly briefed on their tasks in order to successfully act as a facilitator and advisor for e-content development. On the other hand, TUMS' Educational Council legitimately approved e-content developers' incentives.

Implementation. The workshop participants developed 28 e-CME contents. Of these, 20 contents were consistent with the study framework, 6 were non case-based, and 2 were not designed in an interactive format. Only 2 contents were created without any e-learning advisors help. In fact, e-learning advisors played a significant role in developing other contents. Each scenario began with a study guide including the title, authors' information, target audience information, CME credit, expiry date, objectives, and a brief introduction. In each program, a case was introduced, followed by a multiple choice question. The learners were given feedback based on their response to these questions. This question and answer pattern continued until the end of the scenario. Whenever reasonable, the learners experienced different individualized learning paths, based on their responses to the questions. Whenever necessary, pictures, graphs, audios, videos, guidelines, and presentations were developed and attached to the content. We provided supportive facilities for content developers to prepare these educational materials. Learners' evaluation was based on their performance in answering the questions in an interactive scenario. The learners, who did not get the minimum required score, were able to restudy the program.

We paid precise attention to the intellectual property rights and copyright issues. Authors had to indicate the references or obtain permission for copyrighted educational materials and contents. In addition, they had to indicate their content references at the end of the program. On the other hand, the intellectual property of faculty members and e-learning advisors was reserved as well.

We reviewed the contents in the university's e-CME committee, which comprised of the director of e-CME office, a representative from the university CME office, 2 e-learning experts, and 2 faculty members to propose programs credits and audiences. Next, we applied for programs' CME credits to the Office of Continuing Education for Health Personnel of Ministry of Health and Medical Education. They performed a peer review process to approve the credits and then deliver the contents through TUMS' e-CME site.

Evaluation. We designed a program evaluation questionnaire that the learners filled online after completing the study of each program. This program gathered the learners' opinions on e-CME programs. Filling the questionnaire was obligatory for gaining CME credits. The questionnaire consisted of 5 evaluative statements that were scored on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The statements were as follows: "the program achieved its predetermined objectives", "the program was relevant to your professional needs", "the program helped you to improve your professional performance", "the program content was fluent", and "the program's scenario and its learning steps were reasonable". At the end of the questionnaire, two close-ended questions were included about the difficulty of the program with score ranging on a 5-point Likert scale (very hard, hard, moderate, easy, and very easy; scoring 5–1, respectively) and the amount of the time spent for studying the program (less than 1 h, 1–3 h, 3–5 h, 5–7 h, and >7 h).

The questionnaire was validated by 10 e-learning and medical education experts. An exploratory principal component analysis yielded to one factor, which accounted for 74% of the variance. All items displayed

loadings above 0.90 on the factor. The questionnaire had a high degree of internal consistency (Cronbach's alpha=0.95). The data were processed in SPSS 15.0.

Results

As discussed earlier, we delivered 20 e-CME programs via TUMS' e-CME site. A total of 487 learners studied the programs within a 4-month period, of which 33.2% (162) learners were women and 66.8% (325) were men. Approximately, one-third of the learners (32.4%) lived in Tehran. Each learner selected and studied some of the delivered 20 e-CME programs. The number of learners studying each program ranged from 100 to 376. In total, 3644 learner-programs (study's cases) were studied and their program evaluation questionnaires were filled. As filling the questionnaire was obligatory for gaining CME credits, no data was missed.

About 37.7% (1118) cases, 58.2% (2121), and 11.1% (405) evaluated programs as "hard or very hard", "moderate", and "easy or very easy", respectively. A total of 95.9% cases spend <3 h for studying the programs.

The mean of the cases' ratings for five evaluative statements of the questionnaire was 4.56 (SD=0.65) on the 1-5 Likert-type scale. A total of 91.3% cases rated the statements as "strongly agree" or "agree". Table 2 shows the frequency distribution and the ratings scores of responses to each statement.

Discussion

In this study, we created, delivered, and evaluated case-based e-CME contents. Our results showed that the learners highly rated this type of learning activity. Other studies have shown the same results and the learners were satisfied with electronic problem-based learning (10). Participants in this study believed that studying these contents helped them improve their professional practice. Participants of the internet-based CME activities in some other studies have reported the same concept (8).

We faced some challenges in this study. The faculty members were unfamiliar with

Table 1. Topics of interactive case-based e-CME content development workshop.

Sections	Subjects
	Workshop's objectives and participants expectations
Section 1:	History and definition of distance learning and e-learning
Introduction	E-learning in medical education
	Copyright issues in e-learning
	E-CME in the world and Iran
Section 2:	E-CME content types
E-CME	Interactive e-contents
	case-based e-content
Section 3:	Introducing TUMS' e-CME site
Developing e-CME	Introducing content development guideline and template
contents	Developing a sample content

Table 2. Frequency distribution and ratings scores of responses to each statement in the e-CME evaluation questionnaire (n=3644).

Evaluative statement	Strongly agree		Agree		Undecided		Disagree		Strongly disagree		Mean score* (SD)
	No.	%	No.	%	No.	%	No.	%	No.	%	
The program achieved its predetermined objectives	2556	70.1	980	26.9	79	2.2	20	0.5	9	0.2	4.66 (0.57)
The program was relevant to your professional needs	2453	67.3	966	26.5	170	4.7	42	1.2	13	0.4	4.60 (0.67)
The program helped you to improve your professional performance	2224	61.0	1123	30.9	223	6.1	54	1.5	20	0.5	4.50 (0.73)
The program content was fluent	2421	66.4	979	26.9	182	5.0	53	1.5	9	0.2	4.58 (0.68)
The program's scenario and its learning steps were reasonable	2186	60.0	1032	28.3	309	8.5	94	2.6	23	0.6	4.44 (0.80)

* Mean scores are based on a 5-point Likert scale.

interactive e-content development and the present study was their first experience. On the other hand, creating e-cases is a difficult and time-consuming process (10). Holding training workshops was a solution to this problem. Literature focuses on the need of faculty members for information and guidance to perform e-learning activities (13) and hold training workshops (10, 14). However, our experience showed that it was not sufficient. We received only 2 contents from the workshop participants, probably because the faculty members were busy and did not have sufficient time to spend on content development. In fact, training the e-learning advisors was a key factor that helped overcome this challenge. On the other hand, the university had to provide incentives for e-content developers. Legitimately providing these incentives was another point of strength of this study, which was considered important in the literature as well (13).

In the literature, intellectual property right is considered as a barrier for performing e-learning activities by faculty members. E-content developers like to keep their rights reserved (13). We therefore paid much attention to copyright issues. Content author's names and affiliations were indicated in the program study guide. In addition, they received a certificate for e-content development. On the other hand, they followed copyright rules for their educational materials.

We focused on developing interactive case-based contents and providing proper feedbacks to learners. Creating such scenarios is a time-consuming and difficult process that needs great efforts for both authors and instructional designers. However, evidence suggests that interactivity and feedback improves the learning outcomes of e-learners (15). Thus, performing a comprehensive instructional system design helped us overcome barriers and create e-CME contents that the learners rated highly.

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