Original Article

Pilot Implementation and Evaluation of a Mobile-Based Educational Application to Enhance E-Learning Skills in Faculty Members

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Abstract

Background: E-learning has become an essential element of modern education, significantly enhancing instructional effectiveness. Empowering faculty members through structured e-learning programs is vital for improving their teaching skills, particularly in medical education, where flexibility and digital literacy are increasingly important.

Objectives: This study aimed to implement and evaluate a mobile-based educational program and a specialized e-learning empowerment course for faculty members, focusing on professional development in digital instruction and medical education.

Methods: This quasi-experimental study, employing a design and development approach focused on educational tool creation and pilot evaluation, followed a systematic process. It began with a review of the literature and expert consultations to identify the educational and technical needs of faculty members. A needs assessment questionnaire was administered to 30 purposively selected faculty members. Using the ASSURE instructional design model, the application—including platform design and programming—was developed. A pilot version was tested for two weeks on another group of 30 faculty members. Feedback was collected, and iterative improvements were made. Data were analyzed using SPSS, focusing on user satisfaction and learning outcomes.

Results: Faculty members showed moderate familiarity with instructional design models and limited knowledge of content authoring tools. The participants achieved an average score of 9.8 out of 12 and reported high satisfaction with usability, content quality, and functionality.

Conclusion: The study effectively identified faculty development needs and integrated them into a tailored mobile application. The pilot evaluation indicated high satisfaction and educational impact, offering a promising model for developing future digital tools to support faculty empowerment in higher education.

Keywords: E-Learning; Faculty Members; Application; Empowerment Course; ASSURE Model

Background

The rapid advancement of science and technology in recent decades has introduced significant challenges for educational systems, particularly in the fields of higher education and medical instruction (1). Faculty members, as key agents of academic and scientific development, play a pivotal role in improving the quality of teaching and learning (2). Nevertheless, empowering faculty members continues to be a major challenge within higher education due to the presence of various structural, technical, and pedagogical gaps (3, 4).

A recent study conducted at an Iranian medical university during the COVID-19 pandemic shows that, despite the widespread adoption of online education, substantial challenges persist—most notably insufficient digital proficiency among faculty members, inadequately designed instructional content, and the absence of structured faculty development programs (5).

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Furthermore, the growing complexity of teaching and learning processes as a result of digital transformation calls for a fundamental rethinking of traditional pedagogical practices and the incorporation of innovative educational approaches. These issues are especially pronounced in medical education, where flexible, specialized instructional strategies are essential for effective knowledge and skill development (6). Several studies suggest that emerging educational technologies offer promising solutions for these challenges and can contribute to the enhancement of faculty competence in digital environments, thereby improving the overall quality of education (2, 7). E-learning, in particular, has emerged as an effective strategy by providing an accessible, interactive, and flexible learning environment that facilitates the professional development of faculty members. Due to its advantages, such as ease of access, interactive content delivery, and support for diverse learning preferences, e-learning has become a central component of faculty development programs across various academic contexts (7). The effectiveness of digital education, however, is highly dependent on the systematic and scientific design of teaching and learning processes. A growing body of evidence supports the use of educational technologies that are informed by instructional design models and educational needs assessments, particularly in medical education settings (8, 9).

In this regard, some studies have reported that customized mobile applications can enhance teaching performance and increase user satisfaction when properly designed (9, 10).

One of the most recognized instructional design frameworks is the ASSURE model, which provides a structured, learner-centered approach to planning and implementing technology-based instruction (11). The model outlines specific steps, including learner analysis, objective formulation, media selection, instructional delivery, and outcome evaluation (12). A notable feature of the ASSURE model is its emphasis on individual learner differences and its adaptability to various instructional contexts, making it especially suitable for e-learning in medical education (13).

Given the substantial costs associated with developing e-learning infrastructure and educational software—alongside the time-intensive nature of creating high-quality digital content—leveraging institutional experience and promoting collaboration between the public and private sectors becomes essential. To that end, a scientifically grounded understanding of the components of digital education is necessary, and the process of change must be carefully aligned with both current institutional realities and ideal educational standards in medical training.

Accordingly, the present study aimed to develop a specialized mobile-based educational application and to conduct its pilot implementation and evaluation, with a specific focus on the digital empowerment of faculty members in medical universities.

Objectives

This study aimed to implement and evaluate a mobile-based educational program and a specialized e-learning empowerment course for faculty members, focusing on professional development in digital instruction and medical education.

Methods

This quasi-experimental research used a design and development approach. The aim was to design, implement, and evaluate a mobile-based educational application to enhance the digital teaching competencies of medical education faculty members during the 2022–2023 academic year. The research process was conducted in five structured stages.

- Needs assessment
- Questionnaire development
- Application design and development
- Pilot implementation
- Evaluation

The instructional framework throughout the study was based on the ASSURE model, which guided the systematic planning, development, and deployment of both content and technology.

Participants

A total of 60 participants were involved across two distinct research phases, with 30 individuals assigned to each phase as independent groups. The sample size of 30 participants per phase was determined according to established methodological guidance and conventions for developmental and pilot studies in medical education (14), ensuring sufficient statistical power for meaningful descriptive analysis and pilot evaluation. The two groups were completely independent, with no overlap between the participants, to prevent bias and maintain the integrity of each research phase.

Expert Interviewees (Needs Assessment Phase): Seven subject-matter experts in e-learning, medical education, and software development were selected via purposive and snowball sampling. These experts participated in in-depth interviews to help identify the core instructional and technical requirements for faculty development.

Questionnaire Respondents (Needs Validation Phase): Based on the expert interviews, a structured checklist was developed and used to inform the creation of a formal needs assessment questionnaire. This questionnaire was distributed to 30 faculty members at Shahid Beheshti University of Medical Sciences, selected through purposive sampling. Inclusion criteria were a minimum of two years of teaching experience and at least a moderate level of digital literacy.

Pilot Implementation Group: A separate group of 30 new faculty members, entirely distinct from those in the previous phases, participated in the pilot phase. These participants were selected using non-random purposive sampling. To ensure consistency and reduce confounding variables, only those who had completed a formal e-learning training course and held a valid completion certificate were invited. After obtaining informed consent, the participants received installation instructions and access credentials for the application.

Data Collection

Multiple qualitative and quantitative methods were used for data collection:

Expert Interviews and Checklist Development

Interviews with the seven selected experts were conducted via phone, email, or in-person meetings. Transcripts were thematically analyzed to identify recurring concepts, which were synthesized into a 44-item checklist of educational and software-related needs.

Questionnaire Construction and Distribution

A 51-item Likert-scale questionnaire was created based on the checklist and structured into three sections:

- Demographic data
- Instructional needs and goals
- Preferences for software features and interface design

The Content Validity Index of the questionnaire was calculated as 0.763, based on evaluations by five university faculty experts. The reliability of the questionnaire was confirmed using Cronbach's alpha (α = 0.742), and its test–retest reliability was assessed using the intraclass correlation coefficient (ICC = 0.993). The questionnaire was distributed electronically to 30 faculty members.

Instructional Design and Application Development

Guided by the ASSURE model, the instructional component was designed with defined objectives, syllabi, interactive learning activities, and multimedia materials (PDFs, videos, audio files). In parallel, the application was developed as a hybrid web-based platform through six technical phases:

- Requirement gathering
- UI/UX design
- Front-end development
- Back-end programming
- Management panel integration
- Final deployment

Pilot Implementation

The mobile application was piloted over a two-week period with the new group of 30 faculty members. The participants interacted with the platform independently and received continuous educational and technical support throughout. Real-time feedback was used to inform iterative improvements to the system.

Data Analysis

Evaluation of the pilot implementation was conducted using two tools:

Learning Assessment: A 12-item multiple-choice exam, aligned with the course syllabus, was developed to assess knowledge acquisition. The test was reviewed by academic experts and demonstrated acceptable reliability (α = 0.75).

Usability and Satisfaction Questionnaire: An 87-item standardized usability questionnaire, based on the Patrick-Crick model, was used to assess the following dimensions:

- System usefulness and efficiency
- Ease of use and learning curve
- User satisfaction and interaction quality
- Interface design, personalization, and error handling

Responses were collected on a 5-point Likert scale.

Statistical Tests

Data were analyzed using IBM SPSS Statistics version 23. Descriptive statistics—including mean, standard deviation, frequency, and percentage—were used to summarize the participants' responses and outcomes. Internal consistency of the instruments was measured using Cronbach's alpha. Test–retest reliability of the needs assessment questionnaire was assessed using Pearson's correlation coefficient. Content validity was examined through expert ratings and calculation of the Content Validity Index.

To compare learning outcomes between the groups, inferential statistical tests were applied. The independent samples t-test was used to examine differences based on gender, and ANOVA was employed to compare academic ranks. A significance level of $p < 0.05$ was considered.

Results

Demographic Characteristics: A total of 30 faculty members participated in the pilot implementation phase. Of them, 18 participants (60%) were female and 12 (40%) were male. The participants had a mean age of 42 ± 7 years and an average of 14 ± 6 years of professional teaching experience. Regarding academic rank, 15 participants (50%) were assistant professors, 11 (36.6%) were associate professors, and four (13.33%) were full professors. In terms of academic specialization, half of the participants (50%) were from clinical sciences and the other half (50%) from basic sciences (Table 1).

Table 1. Demographic Characteristics

Variable	n (%)	Mean (SD)
Gender		
Female	18 (60.0)	
Male	12 (40.0)	
Academic Rank		
Assistant Professor	15 (50.0)	
Associate Professor	11 (36.6)	
Full Professor	4 (13.3)	
Specialization		
Clinical Sciences	15 (50.0)	
Basic Sciences	15 (50.0)	
Age		42 (7)
Teaching Experience (Years)		14 (6)

To evaluate the participants' reactions to the educational application, a comprehensive usability and satisfaction questionnaire was administered following the two-week pilot phase. The instrument was based on the level 1 (reaction) dimension of the Kirkpatrick model and included 87 items across nine thematic sections. The participants responded to each item using a binary format (yes/no), indicating whether the system met their expectations in each specific area (Table 2) (Appendix 1).

Table 2. Mean Positive Response Rates per Domain – Level 1 Reaction (Kirkpatrick Model)

Section	Positive response percentage
Accessibility & New Tech	85.7
Content & System Info	95.7
Ease of Learning	97.7
Ease of Use	96.5
Error Management	86.8
General Reaction	98.2
Satisfaction	100
System Personalization	94.0
Usefulness	100

Findings from the usability and satisfaction evaluation indicate consistently high performance across all assessed domains. The participants reported complete satisfaction (100%) with system usefulness, overall satisfaction, and the integration of multimedia components. Similarly, strong positive responses were observed in areas such as ease of use, ease of learning, content clarity, user interface personalization, and overall interaction with the system. While slightly lower satisfaction levels were noted in domains related to accessibility and error control, the overall results demonstrate a high degree of user approval and reflect substantial alignment between the system's design and established instructional quality standards.

Learning Assessment Results: To assess the effectiveness of the instructional intervention, a post-course learning assessment was administered to the participants following the completion of the pilot program. The assessment comprised 12 multiple-choice questions (maximum possible score = 12), designed to comprehensively evaluate the participants' understanding of the course content. The questions were carefully aligned with the learning objectives and covered a broad range of topics, ensuring content validity and cognitive diversity.

No statistically significant differences were observed in learning outcomes based on gender or academic rank, indicating that both male and female participants, as well as faculty members across different academic ranks, demonstrated similar levels of knowledge acquisition (Table 3).

Table 3. Learning Assessment by Gender and Academic Rank

Variable	Participants	Mean (SD)	p-value
Gender			0.07
Female	12	9.70 (0.60)	
Male	18	9.90 (0.07)	
Academic Rank			0.22
Assistant Professor	15	9.80 (0.50)	
Associate Professor	11	9.70 (0.60)	
Full Professor	4	9.90 (0.40)	

The mean score across the participants was 9.8 ± 0.5, suggesting a relatively high level of knowledge acquisition. This result implies that the educational content delivered through multimedia formats within the application effectively supported conceptual understanding and retention. The observed performance underscores the effectiveness of the instructional design approach, guided by the ASSURE model, in fostering learner engagement and ensuring the achievement of educational outcomes.

These findings provide preliminary evidence of the instructional efficacy of the mobile-based training intervention and validate its potential for use in broader faculty development initiatives.

Discussion

The findings of this study demonstrated that learning outcomes and user satisfaction following participation in the mobile-based training program were remarkably high, with response rates nearing 100% across multiple dimensions. In particular, the usability and satisfaction questionnaire revealed consistently high ratings across all domains. The participants reported full satisfaction with overall usefulness, multimedia content, general reaction, and ease of learning. These results affirm the system's effectiveness in meeting educational expectations and supporting digital teaching competencies.

Such outcomes align with the pedagogical principles of the ASSURE instructional design model, especially in its emphasis on learner analysis, media selection, and continuous evaluation. The high ratings in domains such as ease of navigation, content clarity, and user interface personalization reflect the successful implementation of the "Select Methods, Media, and Materials" and "Utilize Media and Materials" phases. Notably, satisfaction with the system's ability to deliver engaging multimedia content further underscores the relevance of multimodal strategies in faculty development programs.

These results are consistent with those reported by Elmaiah et al. (15), who found that during the COVID-19 pandemic, user demand for mobile applications was highest in the categories of healthcare, gaming, and education. Their analysis included app attributes such as name, category, cost, size, latest version, connectivity requirements, download statistics, user satisfaction, and developer intent—all of which resonate with the current study's focus on educational app design and evaluation.

Our results further highlight the need to emphasize training in instructional design models, e-teaching methods, and digital assessment tools when developing e-learning courses for medical faculty. These observations are in line with the findings of Karimi et al. (16), who emphasized the importance of addressing faculty members' design-related needs in professional development initiatives. Similarly, Serafraz et al. (2) reported that digital learning environments contribute significantly to improving the overall quality of higher education.

The current findings are also supported by Naderi et al. (17), who demonstrated the effectiveness of mobile learning in enhancing time and resource management, initiative, and student engagement. Zarrati et al. (18) found that learners using digital tools—including computers and smartphones—exhibited stronger long-term vocabulary retention. Likewise, Chase et al. (19) showed that medical students exposed to mobile-based learning achieved significantly higher academic outcomes compared to those in traditional instruction. Allahi et al. (20) reported that mobile-enriched learning environments had a positive effect on motivation, engagement, and academic performance among students with visual impairments. Shan et al. (21) further supported the role of mobile applications as effective educational tools in managing chronic diseases such as diabetes mellitus. Matook et al. (1) emphasized the importance of mobile technologies in clinical education, particularly when integrated with appropriate infrastructure and institutional support. Additionally, Motahari et al. (22) demonstrated that smartphone-based triage training improved emergency nurses' decision-making accuracy, aligning with the current study's conclusions.

These findings collectively suggest that mobile technologies are playing an increasingly critical role in the evolution of education. As new concepts, strategies, and methods emerge, mobile-based learning offers unique opportunities to enrich instructional delivery, support faculty development, and enhance learner engagement. A key strength of this study lies in its comprehensive needs assessment and the development of a tailored application by experts in e-learning, medical education, and instructional technology. By addressing specific professional development needs, this intervention provides a novel and practical model for faculty empowerment in digital education.

One limitation of this study was the limited availability of faculty members, which constrained access for interviews, survey participation, and pilot implementation. Due to time constraints and scheduling challenges, not all interviews and questionnaires could be conducted in person. As a result, some interviews were conducted by phone, and the questionnaires were distributed electronically. While these approaches allowed for broader participation, they may have influenced the depth of engagement and the richness of qualitative insights obtained.

Conclusion

This study highlights the importance of mobile learning in medical education and the expanding role of e-learning as a core component of instructional innovation. As a symbol of technology integration in education, e-learning aligns with foundational values such as learner-centeredness, active and interactive learning, multimedia-based instruction, and lifelong learning.

The findings of this research revealed a high level of educational need among faculty members in the domain of e-learning. Throughout the study, the participants' expectations, preferences, and priorities regarding the app's features and content were systematically assessed and incorporated into the application. Evaluation results indicated that the participants achieved acceptable levels of learning and expressed overall satisfaction with the mobile-based course.

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Conflict of interests: There is no conflict of interest.

Ethical approval: The present research is the result of the ethical code IR.SBMU.SME.REC.1398.037, approved by Shahid Beheshti University of Medical Sciences of Iran. The purpose of the study was explained to the participants, and they were assured that the information would remain confidential. Participation in the study was voluntary, and they could withdraw from the study at any time. Informed consent was obtained from all the participants involved in the study. The present study was carried out in compliance with relevant guidelines and regulations.

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Appendix 1. Applicability Table

Questions	Yes	No	Total
	n (%)		
Questions of the first part: the usefulness of the system			
The system helps me be more effective and productive.	30 (100)	0 (0)	30 (100)
The system helps to increase the effectiveness of my work activities.	30 (100)	0 (0)	30 (100)
The system is useful and valuable.	30 (100)	0 (0)	30 (100)
Questions of the Second part: ease of use			
The system is easy and simple to use.	28 (96.5)	1 (3.5)	29 (100)
Using the system is simple (uncomplicated).	28 (96.5)	1 (3.5)	29 (100)
Questions of the third part: ease of learning			
I learned how to use the system very quickly.	29 (100)	0 (0)	29 (100)
I simply memorized how to use the system.	28 (96.5)	1 (3.5)	29 (100)
User training and learning for system users is easy.	28 (96.5)	1 (3.5)	29 (100)
Questions of the fourth part: satisfaction			
I am satisfied with the system.	28 (100)	0 (0)	28 (100)
I recommend the system to friends.	28 (100)	0 (0)	28 (100)
Questions of the Fifth part: content output, corrections and system information			
The letters are readable on the screen.	28 (100)	0 (0)	28 (100)
Important operations and tasks are highlighted.	25 (86.2)	4 (13.8)	29 (100)
Organization of information on the screen is convenient.	28 (96.5)	1 (3.5)	29 (100)
The order and sequence of access to multiple pages is appropriate.	29 (100)	0 (0)	29 (100)
Questions of the sixth part: personalization of the user environment and other system capabilities			
The processing and interactive speed of the system is favorable.	26 (92.8)	2 (7.1)	28 (100)
The reliability of the system is desirable.	27 (96.4)	1 (3.6)	28 (100)
The ability to correct system user errors is desirable.	26 (92.8)	2 (7.1)	28 (100)
Questions of the seventh part: error management and control by the user			
In any state of the system, the user can return to the previous state.	26 (92.8)	2 (7.1)	28 (100)
Warnings and feedback are provided on time.	25 (89.2)	3 (10.8)	28 (100)
The system has provided facilities for more user control (such as Style Sheet).	22 (78.5)	6 (21.5)	28 (100)
Questions of the eighth section: general applicability and new interaction technologies			
The difference in users' vision (depth, contrast, color blindness, etc.) is considered in the interaction of the system with the user.	24 (85.7)	4 (14.3)	28 (100)
The auditory difference of the users is considered in the interaction of the system with the user.	26 (92.8)	2 (7.1)	28 (100)
The difference in users' sense of touch is taken into account in the interaction of the system with the user.	21 (75.0)	7 (25.0)	28 (100)
The personality differences of users in terms of response to stimuli (introversion or extraversion, emotional or reasoning) are considered in the interaction of the system with the user.	(25)89.2	(3)10.8	28 (100)
Questions of the ninth part: General reaction to the system			
General applicability and new interaction technologies (it is great)	27 (96.4)	1 (3.6)	28 (100)
General applicability and new interaction technologies (it is easy)	28 (100)	0 (0)	28 (100)