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Providing a Model for Quality Management of E-Learning in Clinical Departments of military medical sciences universities

Leila Vosough BeneKohl[1], Baharak Shirzad Kebria[2*], Fatemeh. Hamidifar[2], Abbas Khorshidi[3]

[1] PhD student, Department of Educational Governance and Human Capital, CT.C., Islamic Azad University, Tehran,Iran.
[2] Associate Professor, Department of Educational Governance and Human Capital, CT.C., Islamic Azad University, Tehran, Iran
[3] Professor, Department of Educational Governance and Human Capital, CT.C., Islamic Azad University, Tehran, Iran

***Corresponding Author:** Baharak Shirzad Kabria, Associate Professor, Department of Educational Governance and Human Capital, CT.C., Islamic Azad University, Tehran, Iran. Email: baharak.shirzadkebria@iau.ac.ir, Phone: +989123475254

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Abstract

Introduction: The present study aimed to design a model for quality e-learning management in clinical departments of military medical sciences universities.

Methods: This research was qualitative method of content analysis. The population included experts and academic professors with experience in e-learning. Using a purposive sampling of the theoretical kind until reaching theoretical saturation, 19 individuals were selected. Data collection tools were semi-structured interviews. Data were analyzed using MAXQDA2020 software.

Results: The findings led to the identification of 5 dimensions, 18 components, and 104 indicators in the form of an emerging model. The dimensions include the standard Dimensions, which are components (teaching-learning management, instructor's professional competence, learner characteristics, educational content, teaching methods, and learner assessment methods). Planning Dimension: Components (analysis, objectives, strategies, resource management). Information Technology Dimension: Components (infrastructure, system design, information systems). Continuous Quality Improvement Dimension: Components (quality control, quality assurance, quality enhancement). Evaluation Dimension: Components (internal evaluation, external evaluation).

Conclusion: This study suggests a five-dimensional model to enhance e-learning quality in military medical universities' clinical departments. It connections pedagogical standards with IT infrastructure and systematic quality processes, addressing gaps in specialized military medical training. The framework emphasizes adaptive technology integration and iterative quality enhancement while ensuring compliance through internal/external evaluation. By offering measurable criteria, it equips institutions to optimize clinical e-learning outcomes.

Keywords: Quality Management, E-Learning, Clinical Departments, Medical Sciences Universities of the Armed Forces.

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Introduction

Clinical environments are critically important because they serve as the primary source of learning and professional identity formation for medical students. However, these environments are characterized by variability and unpredictability, which inevitably impact student education[1]. Integrating electronic technologies into clinical education in medical sciences universities presents opportunities and challenges. While these technologies provide access to various educational materials, facilitate interactive learning environments, and enhance communication between educators and learners, they also come with multiple issues. Technical problems, for instance, can disrupt access to course materials and hinder the learning process. Additionally, assessing the quality of clinical education becomes challenging, as online environments may lack the depth and interaction offered by traditional classroom and real-world clinical settings. The absence of real-world contact and experience in virtual environments can also impede

learners' understanding and application of medical concepts and procedures[2].

One of the persistent issues in clinical education at medical sciences universities is preventing the decline in educational quality and minimizing harm to patients in teaching hospitals. Therefore, improving the quality of medical education has always been a concern for medical education policymakers, and there have been ongoing efforts to address shortcomings in educational programs. The challenges in healthcare and treatment are often linked to the state of medical education, highlighting the need for systematic planning to identify and address existing deficiencies in the educational system. In this context, e-learning can be utilized as a modern and effective approach to enhance the quality of clinical education[2].

There are unique constraints and educational needs in medical sciences universities affiliated with the armed forces, in addition to the common challenges faced by other universities in improving the quality of clinical education. These include the frequent transfer of medical personnel to underserved areas, limited internet access, restrictions on international educational travel, shortages of healthcare personnel, the need to classify information, and the high psychological stress of managing casualties in high-pressure environments[3]. Furthermore, as military equipment has evolved, so has military medicine. With the increasing destructiveness of modern weapons, medical and nursing care has also advanced4. However, medical and nursing personnel face significant risks when operating in CBRN (Chemical, Biological, Radiological, and Nuclear) environments, where they may encounter chemically contaminated or radiation-exposed patients. Since it is not feasible to replicate such high-risk clinical scenarios in traditional hospital settings or to train actual patients, innovative solutions are necessary[3-4].

Therefore, educational planning and the use of various technologies, such as VR (Virtual Reality) and AR (Augmented Reality) glasses, electronic methods, animal and human simulations, artificial intelligence, machine learning, online and virtual clinics, and other e-learning tools, can partially address these challenges [5-7]. These technologies enable learners to practice life-saving interventions in crises outside hospital settings, where diagnostic and treatment resources are limited. Over the years, numerous studies have explored modern e-learning and digital methods in medical sciences universities to enrich and ensure the quality of medical education. Research has shown that e-learning activities and strategies effectively improve the knowledge and skills of physicians and nurses in clinical settings, ultimately enhancing patient care[5].

Despite the diversity of studies evaluating the quality of e-learning in medical sciences, there appears to be a lack of significant research in Iran, particularly in medical sciences universities affiliated with the armed forces[2]. These institutions train committed healthcare professionals with military characteristics and professional competence to provide specialized care in military and national crises. Unlike other disciplines, medical education is a complex field that does not quickly adapt to e-learning. Therefore, this study aims to fill this gap by reviewing published literature, examining existing models, and consulting with experts and faculty in clinical education at armed forces medical sciences universities. The goal is to identify key dimensions and components of e-learning quality and to develop a new conceptual model that helps these universities evaluate and improve the quality of e-learning, particularly in clinical skills training. This study seeks to facilitate the adoption of effective e-learning strategies and policies, ultimately enhancing the quality of clinical education in armed forces medical sciences universities[8-11].

Given the challenges above, this research can guide policymakers and planners in the military, medical sciences, universities, and military healthcare organizations, helping them achieve their missions more effectively. Therefore, the main research question is: What model can be designed for quality management of e-learning in clinical departments of armed forces medical sciences universities?

Methods

The present study was qualitative method of content analysis. The research emphasizes using a three-step process: open coding, axial coding, and selective coding, along with the formation of logical paradigms.

The sample included experts, specialists, and clinical and military medicine professors. Participants comprised faculty members of armed forces medical universities with at least 5 years of experience in teaching e-learning and military medicine courses, as well as specialists in virtual education, medical education, higher education, and educational management with doctoral degrees, and computer engineers with master's degrees and at least 5 years of work experience. The sample size in the qualitative dimension was determined based on theoretical saturation, which was achieved after 19 interviews. Theoretical saturation refers to the point where additional interviews do not yield new information regarding the study model's dimensions, components, or indicators. The interview locations were determined in advance, either in the participants' offices or, if preferred, at the researcher's workplace.

Individual interviews were conducted based on the research objectives and questions, with six main questions designed. Additional sub-questions were also asked during the interviews to understand the participants' experiences better. The researcher used guiding questions to ensure the accuracy of their interpretation of the participants' responses. During the sampling process, the researcher analyzed the data to identify gaps filled by gathering additional information from new participants. The interviews focused on collecting opinions on appropriate indicators for determining the components and indicators of quality management in clinical e-learning. The interviews ranged from 35 to 100 minutes, averaging 63 minutes.

To ensure the qualitative validity of the research and the accuracy of the findings, valuable input was sought from clinical faculty members familiar with e-learning in clinical settings and military medicine and specialists in medical education, higher education, virtual education, educational management, and computer engineering.

Data Analysis

Data were analyzed using MAXQDA2020 software. Data analysis was conducted in three stages: open, axial, and selective coding.

Results

The sample included 19 individuals, comprising clinical faculty members and specialists in medical education, higher education, virtual education, and IT engineers from medical sciences universities affiliated with the armed forces.

Summary of Open Coding

779 concepts were extracted and documented during the open coding phase. During the open coding phase, the data was divided into 779 concepts, which were then grouped into broader categories. These categories formed the foundation for identifying the dimensions, components, and indicators of quality management in e-learning for clinical departments. The following steps involved axial coding to establish relationships between categories and selective coding to refine the emerging theory (Table 1).

This systematic approach ensures a comprehensive understanding of the factors influencing the quality of e-learning in clinical settings within armed forces medical sciences universities.

Table 1. Examples of interview coding.

Code-Centric Management	Open Code	Interview Text
Teaching-Learning	Developing Standards for Designing Electronic Clinical Skills Scenarios	The role of students in the quality of e-learning is important, and their interest plays a significant role in how much time they dedicate to learning. However, students often focus on key points and summaries and are not interested in studying entire courses. In reality, students lack motivation for education and acquiring clinical and military medicine skills. To attract students, an educational scenario for military medicine skills should be designed to accurately simulate real battlefield conditions. These scenarios should be operationally practical and enhance students' decision-making skills in crisis situations. Standardized scenarios must be developed for such training. *(Interview 2)*
	Developing Standards for Designing Electronic Clinical Skills Scenarios	Without proper guarantees, there is a lack of control and evaluation in e-learning. E-learning is like a system with inputs, processes, and outputs. After a few years, the outputs are examined to determine whether graduates trained through this approach have made medical errors. Are students who received clinical training through e-learning methods aligned with e-learning standards? Planning is needed to utilize all technologies in clinical training, ensuring that clinical scenarios align with learners' needs and are simulated according to standardized principles. *(Interview 4)*
Professional Competencies of Instructors	Instructors' Ability to Communicate Effectively with Learners	Instructors should place themselves in the learners' shoes when designing electronic educational content to ensure high-quality learning. Interaction and Q&A in electronic content are essential. Effective communication between instructors and learners in an electronic environment enhances the learning process. *(Interview 3)*
	Instructors' Level of Electronic Literacy and Skills	In a traditional classroom, an instructor might teach for 4-5 hours, but students may still not understand how to perform tasks like drawing blood or connecting devices. In augmented reality classes, students easily find answers to their questions in a simulated environment. This electronic environment benefits both instructors and students, provided that the instructor has the necessary electronic literacy and skills to effectively use these tools. *(Interview 15)*
	Instructors' Ability to Clarify Educational Ambiguities and Questions	To provide quality education, students must be assured that instructors are always ready to respond to their educational needs and clarify any ambiguities. Resolving educational ambiguities and answering students' questions in an electronic environment is one of the most important skills an instructor must have to ensure the learning process is effective. *(Interview 7)*
Learner Characteristics	Learners' Ability to Manage E-Learning Activities	When students are given responsibility, they become proactive, seek out cases, and improve their academic and practical skills. We can assign diseases covered in the medical curriculum to students and ask them to create electronic content for those diseases, such as producing videos or simulations. One of the major challenges in e-learning is students' ability to manage their learning activities. In these environments, unlike traditional classrooms, students must attend sessions on time, manage assignments, and access educational resources. If students lack the necessary skills to manage these processes, their learning will be affected. As instructors, we must guide students in developing these abilities by providing clear structures, accessible resources, and simple tools. *(Interview 14)*

Code-Centric Management	Open Code	Interview Text
Educational Content	Alignment of Electronic Educational Content with Organizational Educational Missions	Electronic educational content must align precisely with the needs of military medicine and the educational missions of the university. If the content is practical, valid, and designed to reflect real battlefield conditions, we can enhance students' practical skills and quick decision-making abilities. High-quality educational content that aligns with learners' needs and learning styles can improve outcomes. If we simply repeat the same content in electronic classes as in traditional ones, it will not add much value. *(Interview 16)*
Teaching Methods	Use of Evidence-Based Teaching Methods	Sometimes an instructor speaks in a monotone voice throughout the lecture, which can bore students. Other instructors vary their tone, use case studies, or share personal experiences, especially in military medicine, which makes the material more impactful. In teaching military medicine skills, evidence-based methods are particularly important. These methods lend credibility to the content and teaching approaches and familiarize students with the latest and most effective treatment techniques and protocols. *(Interview 17)*
Assessment Methods	Evaluating Clinical Performance in Simulated Environments	Another important aspect is student assessment, which should not be limited to exams. Currently, global assessments often involve simulations, where students interact with simulated patients and demonstrate the full treatment process, from diagnosis to decision-making. This allows instructors to provide feedback based on the training provided. *(Interview 16)*
Analysis	Impact of Interdisciplinary Education in Electronic Environments	E-learning allows us to easily integrate various concepts using different tools. When applied to military medicine, this approach enables the combination of medical and military skills. Interdisciplinary education can significantly impact students, helping them understand different dimensions of the field and gain practical, cross-disciplinary experience. *(Interview 1)*
Objectives	Active and Responsive E-Learning Environment for Military Medicine Education	The choice of learning tools significantly impacts quality. For example, in teaching suturing, are the tools used by students similar to real skin? How closely do the tools resemble the clinical environment? Tools can range from simple suture pads to advanced simulators or virtual reality. The e-learning environment must make students feel that their needs are always met. In military medicine education, this is crucial because students face unique operational challenges. If the learning environment is designed to allow quick access to information and prompt responses from instructors, it becomes truly effective. *(Interview 10)*
Strategies	Motivating the E-Learning Content Development Team to Create Engaging and Practical Content	To motivate e-learning content development teams to create engaging and practical content, adequate funding and incentives (monetary or non-monetary) should be provided. These incentives boost team morale and encourage innovation. When team members feel their efforts are recognized, they are more likely to collaborate and be creative, ultimately improving the quality of e-learning. *(Interview 1)*
Resource Management	Allocation of Skilled Human Resources	To improve quality, we must first have the necessary expertise in this educational approach. The first step is to have skilled human resources with the required competencies. In clinical centers, especially in military medicine, individuals with expertise in both electronic technologies and the educational and operational needs of the field are essential. Combining expertise and experience allows us to deliver educational content that is both practical and meets students' needs. *(Interview 6)*
Infrastructure	Ensuring Stable Access to Educational Systems	One of the most critical aspects of e-learning in clinical and military medicine education is ensuring uninterrupted access to systems. If a student needs to practice a critical skill or access specific training but the system is down or malfunctioning, their learning process is disrupted. Stable access must allow students to use educational resources at any time, even during operational missions. *(Interview 13)*
System Design	Designing Telemedicine-Based Distance Learning Systems	Electronic educational systems must be purposefully designed to meet the real needs of students and instructors. These systems should deliver content effectively, provide easy access, and facilitate communication. In military medicine education, the importance of such design is amplified. A key need is the design of distance learning systems, especially for war zones and crisis situations. These systems should enable real-time training and consultation for medical teams in the field. For example, a doctor or nurse in an operational area can connect online with a specialist to receive guidance for managing emergencies. Such systems not only improve the quality of education but can also save lives. *(Interview 12)*
Information Systems	Data Security and Protection of Educational Information	In e-learning, technical and managerial infrastructure must be well-prepared to ensure quality education and user confidence. This infrastructure includes everything from designing educational systems to managing data. One of the most critical aspects of e-learning, especially in military medical universities, is information security. Due to the sensitivity of missions and the type of information transmitted, these centers must have a fully secure system. For example, information related to military medicine training or operational plans must not be misused. Systems must protect user privacy and prevent unauthorized information dissemination. *(Interview 11)*
Quality Control	Continuous Monitoring of the Quality of E-Learning in Military Medicine	In e-learning, especially in fields like military medicine with significant challenges, regular monitoring of educational processes is crucial to ensure compliance with standards and achievement of objectives. Continuous monitoring of educational quality is vital in military medicine due to the unique conditions in operational and crisis areas. Content must be regularly evaluated to ensure it is up-to-date and effective. *(Interview 19)*
Quality Improvement	Use of Modern Tools and Advanced Technologies	When students enter the field and realize they lack the skills taught in class, it becomes clear that educational approaches must change. One effective solution is the use of electronic environments combined with virtual reality. For example, in subjects like respiration, topics such as physiology, pathology, and related diseases should be taught separately in virtual environments to help students better understand their connections. These advanced tools increase student engagement in e-learning platforms, fostering deeper and more effective learning. *(Interview 18)*
Internal Evaluation	Evaluating the Quality of E-Learning Processes Through Peer Feedback	To improve the quality of e-learning, it is essential to continuously evaluate the educational process. One of the best methods is peer feedback. These evaluations help us determine whether the content is effectively delivered, whether students are satisfied with teaching methods, and whether online interactions are effective. Peer feedback allows us to identify weaknesses and improve teaching methods. *(Interview 8)*
External Evaluation	Evaluating the Effectiveness of E-Learning in Military Medicine Operational Exercises	One important method for evaluating the performance of students in military medical universities is through operational exercises. These exercises simulate real-life conditions, allowing us to assess how well students perform in emergencies. Effective performance in these exercises indicates the effectiveness of e-learning and students' readiness for real-world situations. *(Interview 9)*

Selective Coding

Selective coding, based on the results of open coding and axial coding, is the main stage of theorizing and presenting a model. In this stage, the core category is systematically linked to other categories, and these relationships are presented within the framework of a narrative. Additionally, categories that require further refinement and development are modified. During this phase, dimensions are formed through the integration of components. The main dimensions represent the central phenomenon of the study. In this stage, which was conducted by experts, a total of 5 dimensions, 18 components, and 104 indicators were finalized for the model of e-learning quality management in clinical groups at medical universities of the armed forces (Table2).

Table 2. Indicators Obtained During the Open Coding Stage.

Row	Indicator
1	Assessing learners' capacity based on educational needs
2	Preparing necessary tools for effective delivery of e-learning in combat medicine skills
3	Developing clear standards for designing e-learning scenarios for combat medicine skills
4	Determining key indicators for evaluating the quality of e-learning in combat medicine skills
5	Instructors' ability to design collaborative learning activities
6	Instructors' ability to clarify learners' doubts and questions
7	Instructors' ability to establish effective communication with learners
8	Instructors' expertise and mastery in teaching specialized skills
9	Instructors' behavioral traits in e-learning environments
10	Instructors' possession of e-skills and digital literacy
11	Learners' responsibility in completing assigned tasks
12	Learners' psychological readiness to face independent learning challenges
13	Learners' ability to manage e-learning activities
14	Learners' possession of e-skills and digital literacy
15	Alignment of e-learning content with credible resources in combat medicine
16	Practicality of e-learning content in teaching combat medicine skills
17	Alignment of e-learning content with educational missions
18	Alignment of e-learning content with learners' educational needs
19	Compatibility of e-teaching methods with learning objectives in combat medicine skills
20	Use of blended teaching methods (e-learning and in-person)
21	Use of group teaching methods in e-learning processes
22	Use of evidence-based teaching methods in e-learning
23	Use of case-based teaching methods in e-learning
24	Use of interactive tools for delivering e-learning content
25	Self-assessment by learners on the quality of e-learning
26	Evaluation of learners' clinical performance in simulated environments
27	Evaluation of learners' clinical performance in real clinical environments (patient care)
28	Periodic evaluation of the quality of e-learning in combat medicine skills
29	Evaluation of combat medicine skills based on theoretical content
30	Learners' interaction in the e-learning process

Row	Indicator
31	Impact of e-teaching methods on the quality of learning combat medicine skills
32	Impact of interdisciplinary e-learning on improving combat medicine skills
33	Alignment of e-learning content with real battlefield conditions
34	Efficiency of technical infrastructure used in e-learning
35	Alignment of course topics with instructors' expertise in combat medicine
36	Coordination of e-learning course schedules with defined educational objectives
37	Enhancing learners' knowledge and operational skills in combat medicine
38	Creating an active and responsive e-learning environment for combat medicine educational needs
39	Strengthening interdisciplinary interactions in e-learning for combat medicine skills
40	Integration of clinical training programs with combat medicine educational objectives
41	Increasing instructors' responsibility in e-teaching
42	Increasing the motivation of e-content production teams to design content
43	Increasing audience trust in the quality of e-learning in combat medicine
44	Integration of theoretical and practical combat medicine training in e-learning environments
45	Creating learning opportunities in combat medicine through e-learning tools
46	Designing effective team strategies
47	Providing motivational incentives to instructors
48	Employing specialized human resources for designing e-learning content
49	Allocating sufficient time for delivering e-learning courses in combat medicine
50	Securing adequate financial resources for implementing e-learning projects in combat medicine
51	Access to credible information resources for e-learning instruction
52	Providing physical resources to support e-learning processes
53	Access to appropriate technological infrastructure for e-learning instruction
54	Effective distribution of responsibilities in e-learning teams
55	Conducting comprehensive training courses for users
56	Conducting specialized training for content production teams
57	Providing continuous technical support to users in the e-learning process
58	Ensuring stable access to e-learning systems for users
59	Providing necessary facilities and resources for users
60	Creating coordination among different e-learning systems
61	Access to simple guides for training users in using e-learning systems
62	Providing a sufficient number of e-learning systems in clinical environments
63	Designing educational systems using artificial intelligence technology
64	Designing educational systems based on metaverse environments
65	Designing educational systems based on gamification principles and methods
66	Designing intelligent systems based on realistic simulations
67	Designing remote learning systems based on telemedicine

Row	Indicator
68	Designing multidimensional educational systems combining various methods and tools
69	Designing educational systems with simple and clear user interfaces
70	Designing educational systems adhering to international e-learning standards
71	Designing educational systems with continuous update and development capabilities
72	Designing educational systems with data interaction and exchange capabilities
73	Ensuring data security and protection of educational information in e-learning systems
74	Ensuring the preservation and longevity of educational content in e-learning systems
75	Automated evaluation of the effectiveness of the learning process through e-learning systems
76	Ability of e-learning systems to analyze e-learning data
77	Evaluating the performance of e-learning systems before delivery to users
78	Continuous monitoring of the quality of e-learning in combat medicine using regular reports
79	Using standard methods for evaluating learning quality
80	Analyzing key indicators of e-learning quality
81	Establishing specialized committees with periodic meetings
82	Developing comprehensive guidelines for e-learning in combat medicine
83	Designing evaluation checklists for assessing combat medicine skills
84	Coordination among clinical groups to develop integrated policies for e-learning in combat medicine
85	Defining specialized responsibilities for monitoring the quality of e-learning in combat medicine
86	Creating supportive structures to back e-learning processes in combat medicine
87	Establishing executive guarantees to ensure continuous improvement of e-learning quality in combat medicine
88	Strengthening an organizational culture based on continuous improvement of e-learning in combat medicine skills
89	Compatibility of tools and technologies used with combat medicine skills
90	Periodic evaluation of the e-learning process for combat medicine skills
91	Implementing corrective actions based on evaluation results
92	Using advanced tools and technologies in designing and implementing e-learning for combat medicine skills
93	Establishing a specialized e-learning center for combat medicine skills
94	Using collaborative platforms for knowledge and experience exchange in combat medicine skills
95	Continuous updating of e-learning tools using new technologies
96	Improving combat medicine skills through repeated practice in non-realistic environments
97	Evaluating the impact of e-learning on enhancing learners' skills in combat medicine
98	Evaluating the quality of the e-learning process based on learners' feedback and perspectives
99	Evaluating the quality of e-teaching in combat medicine courses from clinical instructors' perspectives
100	Evaluating the quality of the e-learning process through peer feedback
101	Evaluating the suitability and efficiency of e-learning tools using stakeholder feedback
102	Evaluating the effectiveness of e-learning in operational combat medicine exercises from external evaluators' perspectives
103	Evaluating combat medicine skills by specialized external organizations
104	Evaluating operational physicians' feedback on the effectiveness of e-learning in combat medicine

Model Validation

In this stage, the dimensions, components, and indicators constituting the model of e-learning quality management in clinical groups at medical universities of the armed forces were organized into an emerging framework. To validate the model, brainstorming sessions were conducted with 6 experts, and the Delphi technique was applied with 9 experts, resulting in its confirmation (Table 3 and 4).

Table 3. Interview Codes, Components, and Indicators.

Component	Indicator	Interview Code
Teaching-Learning Management	Assessing learners' capacity based on educational needs	Interviews 3, 10, 11, 12
	Preparing necessary tools for effective delivery of e-learning in combat medicine skills	Interviews 1, 2, 6, 7, 8, 10, 11, 13, 17
	Developing clear standards for designing e-learning scenarios for combat medicine skills	Interviews 1, 2, 3, 4, 12
	Determining key indicators for evaluating the quality of e-learning in combat medicine skills	Interviews 2, 5, 9, 10, 12
Instructor Competence	Instructors' ability to design collaborative learning activities	Interviews 1, 14, 16
	Instructors' ability to clarify learners' doubts and questions	Interviews 7, 19
	Instructors' ability to establish effective communication with learners	Interviews 2, 3, 6, 13, 14, 16
	Instructors' expertise and mastery in teaching specialized skills	Interview 16
	Instructors' behavioral traits in e-learning environments	Interviews 1, 16
	Instructors' possession of e-skills and digital literacy	Interviews 1, 2, 3, 5, 6, 12, 13, 14, 15, 17
Learner Characteristics	Learners' responsibility in completing assigned tasks	Interviews 19, 5, 3
	Learners' psychological readiness to face independent learning challenges	Interview 14
	Learners' ability to manage e-learning activities	Interviews 2, 9, 14, 15, 16
	Learners' possession of e-skills and digital literacy	Interviews 2, 15, 17, 18
Educational Content	Alignment of e-learning content with credible resources in combat medicine	Interviews 4, 5, 6, 12, 16
	Practicality of e-learning content in teaching combat medicine skills	Interviews 2, 3, 4, 6, 9, 13, 15, 16
	Alignment of e-learning content with educational missions	Interviews 1, 2, 3, 6
	Alignment of e-learning content with learners' educational needs	Interviews 1, 5, 3, 11
Teaching Methods	Compatibility of e-teaching methods with learning objectives in combat medicine skills	Interviews 2, 3, 9, 13, 14, 16
	Use of blended teaching methods (e-learning and in-person)	Interviews 1, 3, 12
	Use of group teaching methods in e-learning processes	Interviews 1, 2, 3, 5, 6, 7, 14, 15, 17, 18, 19
	Use of evidence-based teaching methods in e-learning	Interviews 1, 2, 5
	Use of case-based teaching methods in e-learning	Interviews 14, 16
	Use of interactive tools for delivering e-learning content	Interviews 13, 15
Learner Evaluation Methods	Self-assessment by learners on the quality of e-learning	Interviews 5, 16
	Evaluation of learners' clinical performance in simulated environments	Interviews 3, 4, 11, 16, 17
	Evaluation of learners' clinical performance in real clinical environments (patient care)	Interviews 2, 3, 5, 6, 8, 10, 11, 13, 14, 17
	Periodic evaluation of the quality of e-learning in combat medicine skills	Interviews 1, 2, 3, 7, 10, 11, 12, 13, 15, 17
	Evaluation of combat medicine skills based on theoretical content	Interview 15

Component	Indicator	Interview Code
Analysis	Learners' interaction in the e-learning process	Interviews 1, 3, 6, 7, 13
	Impact of e-teaching methods on the quality of learning combat medicine skills	Interviews 1, 3
	Impact of interdisciplinary e-learning on improving combat medicine skills	Interviews 1, 13, 15
	Alignment of e-learning content with real battlefield conditions	Interviews 1, 3, 15
	Efficiency of technical infrastructure used in e-learning	Interviews 3, 4, 7, 10, 13, 14, 15, 17
	Alignment of course topics with instructors' expertise in combat medicine	Interviews 3, 16
Objectives	Coordination of e-learning course schedules with defined educational objectives	Interviews 2, 14, 16, 17
	Enhancing learners' knowledge and operational skills in combat medicine	Interviews 1, 15, 19
	Creating an active and responsive e-learning environment for combat medicine educational needs	Interviews 13, 14
	Strengthening interdisciplinary interactions in e-learning for combat medicine skills	Interviews 13, 15
	Integration of clinical training programs with combat medicine educational objectives	Interviews 1, 2, 3, 4, 5, 7, 9, 11, 12, 13, 14, 15
Strategies	Increasing instructors' responsibility in e-teaching	Interviews 2, 5, 15
	Increasing the motivation of e-content production teams to design content	Interviews 1, 13, 15
	Increasing audience trust in the quality of e-learning in combat medicine	Interviews 2, 5, 6, 9, 13, 15
	Integration of theoretical and practical combat medicine training in e-learning environments	Interviews 1, 15
	Creating learning opportunities in combat medicine through e-learning tools	Interviews 3, 4, 5, 6, 7, 12, 13, 14, 15, 17
	Designing effective team strategies	Interviews 1, 6
Resource Management	Providing motivational incentives to instructors	Interviews 1, 2, 3, 5, 6, 9, 11, 12, 13, 14, 16, 17
	Employing specialized human resources for designing e-learning content	Interviews 1, 2, 3, 5, 6, 9, 11, 12, 13, 14, 16, 17
	Allocating sufficient time for delivering e-learning courses in combat medicine	Interviews 1, 15
	Securing adequate financial resources for implementing e-learning projects in combat medicine	Interviews 1, 2, 3, 8, 13, 14
	Access to credible information resources for e-learning instruction	Interviews 1, 3
	Providing physical resources to support e-learning processes	Interviews 1, 2, 3, 13, 15
	Access to appropriate technological infrastructure for e-learning instruction	Interviews 1, 11, 13, 14, 17, 19
	Effective distribution of responsibilities in e-learning teams	Interviews 6, 13
Infrastructure	Conducting comprehensive training courses for users	Interviews 3, 5, 13, 15
	Conducting specialized training for content production teams	Interviews 1, 2, 6
	Providing continuous technical support to users in the e-learning process	Interviews 1, 2, 7, 13, 15
	Ensuring stable access to e-learning systems for users	Interviews 2, 3, 4, 6, 7, 11, 13, 15
	Providing necessary facilities and resources for users	Interviews 1, 2, 3, 6, 7, 12, 13, 14, 15
	Creating coordination among different e-learning systems	Interviews 13, 15, 19
	Access to simple guides for training users in using e-learning systems	Interviews 1, 2, 3, 6, 7, 13, 15, 19
	Providing a sufficient number of e-learning systems in clinical environments	Interviews 3, 10, 12

Component	Indicator	Interview Code
System Design	Designing educational systems using artificial intelligence technology	Brainstorming
	Designing educational systems based on metaverse environments	Brainstorming
	Designing educational systems based on gamification principles and methods	Interviews 4, 5, 6, 12
	Designing intelligent systems based on realistic simulations	Interviews 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 14, 15
	Designing remote learning systems based on telemedicine	Brainstorming
	Designing multidimensional educational systems combining various methods and tools	Interview 12
	Designing educational systems with simple and clear user interfaces	Interviews 3, 4, 6, 7, 11, 12
	Designing educational systems adhering to international e-learning standards	Interviews 2, 3, 6, 7, 8, 10, 11, 12, 13, 15, 16
	Designing educational systems with continuous update and development capabilities	Interviews 1, 2, 6, 7, 8, 10, 12
	Designing educational systems with data interaction and exchange capabilities	Interviews 6, 7, 12
Information Systems	Ensuring data security and protection of educational information in e-learning systems	Interviews 2, 3, 6, 7, 14
	Ensuring the preservation and longevity of educational content in e-learning systems	Interviews 1, 6, 7, 15
	Automated evaluation of the effectiveness of the learning process through e-learning systems	Interviews 3, 5, 6, 7, 8, 12, 14
	Ability of e-learning systems to analyze e-learning data	Interviews 1, 2, 3, 4, 5, 6, 9, 10, 16, 17
	Evaluating the performance of e-learning systems before delivery to users	Interviews 1, 3, 6, 7
Quality Control	Continuous monitoring of the quality of e-learning in combat medicine using regular reports	Interviews 6, 7, 8, 10, 13, 14
	Using standard methods for evaluating learning quality	Interview 10
	Analyzing key indicators of e-learning quality	Interviews 5, 10
	Establishing specialized committees with periodic meetings	Interviews 8, 10
	Developing comprehensive guidelines for e-learning in combat medicine	Interviews 1, 2, 7, 11, 12, 15
	Designing evaluation checklists for assessing combat medicine skills	Interviews 10, 14
	Coordination among clinical groups to develop integrated policies for e-learning in combat medicine	Interviews 11, 13, 15, 17
	Defining specialized responsibilities for monitoring the quality of e-learning in combat medicine	Interview 8
Quality Assurance	Creating supportive structures to back e-learning processes in combat medicine	Brainstorming
	Establishing executive guarantees to ensure continuous improvement of e-learning quality in combat medicine	Interviews 1, 2, 3, 5, 8, 9, 11, 12, 15
	Strengthening an organizational culture based on continuous improvement of e-learning in combat medicine skills	Interviews 9, 11, 12, 13, 17
	Compatibility of tools and technologies used with combat medicine skills	Interview 4
	Periodic evaluation of the e-learning process for combat medicine skills	Interview 10
	Implementing corrective actions based on evaluation results	Interviews 8, 10, 13, 16, 17
Quality Enhancement	Using advanced tools and technologies in designing and implementing e-learning for combat medicine skills	Interviews 1, 2, 3, 6, 13, 14, 15, 16
	Establishing a specialized e-learning center for combat medicine skills	Interviews 1, 2, 6, 7, 8, 17
	Using collaborative platforms for knowledge and experience exchange in combat medicine skills	Interview 13
	Continuous updating of e-learning tools using new technologies	Interviews 5, 6, 7, 15
	Improving combat medicine skills through repeated practice in non-realistic environments	Interviews 1, 2, 6, 7, 12, 15
Internal Evaluation	Evaluating the impact of e-learning on enhancing learners' skills in combat medicine	Interviews 14, 16
	Evaluating the quality of the e-learning process based on learners' feedback and perspectives	Interviews 1, 4, 9, 17
	Evaluating the quality of e-teaching in combat medicine courses from clinical instructors' perspectives	Interviews 2, 3, 9, 10
	Evaluating the quality of the e-learning process through peer feedback	Interviews 6, 11
	Evaluating the suitability and efficiency of e-learning tools using stakeholder feedback	Interviews 10, 14
External Evaluation	Evaluating the effectiveness of e-learning in operational combat medicine exercises from external evaluators' perspectives	Interviews 1, 15
	Evaluating combat medicine skills by specialized external organizations	Interviews 1, 15, 17
	Evaluating operational physicians' feedback on the effectiveness of e-learning in combat medicine	Interviews 2, 8, 10

Table 4. Dimensions, Components, and Indicators.

Dimension	Component	Indicator
Standards	Teaching-Learning Management	Assessing learners' capacity based on educational needs
		Preparing necessary tools for effective delivery of e-learning in combat medicine skills
		Developing clear standards for designing e-learning scenarios for combat medicine skills
		Determining key indicators for evaluating the quality of e-learning in combat medicine skills
	Instructor Competence	Instructors' ability to design collaborative learning activities
		Instructors' ability to clarify learners' doubts and questions
		Instructors' ability to establish effective communication with learners
		Instructors' expertise and mastery in teaching specialized skills
		Instructors' behavioral traits in e-learning environments
		Instructors' possession of e-skills and digital literacy
	Learner Characteristics	Learners' responsibility in completing assigned tasks
		Learners' psychological readiness to face independent learning challenges
		Learners' ability to manage e-learning activities
		Learners' possession of e-skills and digital literacy
	Educational Content	Alignment of e-learning content with credible resources in combat medicine
		Practicality of e-learning content in teaching combat medicine skills
		Alignment of e-learning content with educational missions
		Alignment of e-learning content with learners' educational needs
	Teaching Methods	Compatibility of e-teaching methods with learning objectives in combat medicine skills
		Use of blended teaching methods (e-learning and in-person)
		Use of group teaching methods in e-learning processes
		Use of evidence-based teaching methods in e-learning
		Use of case-based teaching methods in e-learning
		Use of interactive tools for delivering e-learning content
	Learner Evaluation Methods	Self-assessment by learners on the quality of e-learning
		Evaluation of learners' clinical performance in simulated environments
		Evaluation of learners' clinical performance in real clinical environments (patient care)
		Periodic evaluation of the quality of e-learning in combat medicine skills
		Evaluation of combat medicine skills based on theoretical content
Planning	Analysis	Learners' interaction in the e-learning process
		Impact of e-teaching methods on the quality of learning combat medicine skills
		Impact of interdisciplinary e-learning on improving combat medicine skills
		Alignment of e-learning content with real battlefield conditions
		Efficiency of technical infrastructure used in e-learning
	Objectives	Alignment of course topics with instructors' expertise in combat medicine
		Coordination of e-learning course schedules with defined educational objectives
		Enhancing learners' knowledge and operational skills in combat medicine
		Creating an active and responsive e-learning environment for combat medicine educational needs
		Strengthening interdisciplinary interactions in e-learning for combat medicine skills

Dimension	Component	Indicator
	Strategies	Integration of clinical training programs with combat medicine educational objectives
		Increasing instructors' responsibility in e-teaching
		Increasing the motivation of e-content production teams to design content
		Increasing audience trust in the quality of e-learning in combat medicine
		Integration of theoretical and practical combat medicine training in e-learning environments
		Creating learning opportunities in combat medicine through e-learning tools
	Resource Management	Designing effective team strategies
		Providing motivational incentives to instructors
		Employing specialized human resources for designing e-learning content
		Allocating sufficient time for delivering e-learning courses in combat medicine
		Securing adequate financial resources for implementing e-learning projects in combat medicine
		Access to credible information resources for e-learning instruction
		Providing physical resources to support e-learning processes
Information Technology	Infrastructure	Access to appropriate technological infrastructure for e-learning instruction
		Effective distribution of responsibilities in e-learning teams
		Conducting comprehensive training courses for users
		Conducting specialized training for content production teams
		Providing continuous technical support to users in the e-learning process
		Ensuring stable access to e-learning systems for users
		Providing necessary facilities and resources for users
		Creating coordination among different e-learning systems
		Access to simple guides for training users in using e-learning systems
		Providing a sufficient number of e-learning systems in clinical environments
	System Design	Designing educational systems using artificial intelligence technology
		Designing educational systems based on metaverse environments
		Designing educational systems based on gamification principles and methods
		Designing intelligent systems based on realistic simulations
		Designing remote learning systems based on telemedicine
		Designing multidimensional educational systems combining various methods and tools
		Designing educational systems with simple and clear user interfaces
		Designing educational systems adhering to international e-learning standards
		Designing educational systems with continuous update and development capabilities
	Information Systems	Designing educational systems with data interaction and exchange capabilities
		Ensuring data security and protection of educational information in e-learning systems
		Ensuring the preservation and longevity of educational content in e-learning systems
		Automated evaluation of the effectiveness of the learning process through e-learning systems
		Ability of e-learning systems to analyze e-learning data

Dimension	Component	Indicator
Continuous Improvement	Quality Control	Evaluating the performance of e-learning systems before delivery to users
		Continuous monitoring of the quality of e-learning in combat medicine using regular reports
		Using standard methods for evaluating learning quality
		Analyzing key indicators of e-learning quality
		Establishing specialized committees with periodic meetings
		Developing comprehensive guidelines for e-learning in combat medicine
		Designing evaluation checklists for assessing combat medicine skills
		Coordination among clinical groups to develop integrated policies for e-learning in combat medicine
	Quality Assurance	Defining specialized responsibilities for monitoring the quality of e-learning in combat medicine
		Creating supportive structures to back e-learning processes in combat medicine
		Establishing executive guarantees to ensure continuous improvement of e-learning quality in combat medicine
		Strengthening an organizational culture based on continuous improvement of e-learning in combat medicine skills
		Compatibility of tools and technologies used with combat medicine skills
		Periodic evaluation of the e-learning process for combat medicine skills
	Quality Enhancement	Implementing corrective actions based on evaluation results
		Using advanced tools and technologies in designing and implementing e-learning for combat medicine skills
		Establishing a specialized e-learning center for combat medicine skills
		Using collaborative platforms for knowledge and experience exchange in combat medicine skills
		Continuous updating of e-learning tools using new technologies
		Improving combat medicine skills through repeated practice in non-realistic environments
Evaluation	Internal Evaluation	Evaluating the impact of e-learning on enhancing learners' skills in combat medicine
		Evaluating the quality of the e-learning process based on learners' feedback and perspectives
		Evaluating the quality of e-teaching in combat medicine courses from clinical instructors' perspectives
		Evaluating the quality of the e-learning process through peer feedback
		Evaluating the suitability and efficiency of e-learning tools using stakeholder feedback
	External Evaluation	Evaluating the effectiveness of e-learning in operational combat medicine exercises from external evaluators' perspectives
		Evaluating combat medicine skills by specialized external organizations
		Evaluating operational physicians' feedback on the effectiveness of e-learning in combat medicine

Emerging Model of E-Learning Quality Management in Clinical Groups at Medical Universities of the Armed Forces

The emerging model of e-learning quality management in clinical groups at medical universities of the armed forces, developed using a qualitative approach, is as follows. Experts validated this model, which consists of 5 dimensions, 18 components, and 104 indicators (Table 4).

In the Standards Dimension, the components of Teaching-Learning Management and Educational Content had the highest importance, with an average score of 7. In contrast, the component Learner Evaluation Methods had the lowest importance, with an average score of 6.2. In the Planning Dimension, the component Analysis had the highest importance, with an average score of 6.9. In contrast, strategy and resource management components had the lowest importance, with an average score of 6.5. In the Information Technology Dimension, the component Infrastructure had the highest importance, with an average score of 7.

In contrast, the information systems component had the lowest importance, with an average score of 6.3. In the Continuous Improvement Dimension, the Quality Control and Quality Assurance components had the highest importance, with an average score of 6.9. In contrast, the component Quality Enhancement had the lowest importance, with an average score of 6. In the Evaluation Dimension, the component Internal Evaluation had the highest importance, with an average score of 6.8. In contrast, the component External Evaluation had the lowest importance, with an average score of 6.7 (Table 5).

Table 5. Arithmetic Mean of Experts' Opinions by Priority.

Dimension	Component	Importance Percentage
Standards	Teaching-Learning Management	7%
	Educational Content	7%
	Instructor Competence	6.8%
	Learner Characteristics	6.6%
	Teaching Methods	6.6%
	Learner Evaluation Methods	6.2%
Planning	Analysis	6.9%
	Objectives	6.8%
	Strategies	6.5%
	Resource Management	6.5%
Information Technology	Infrastructure	7%
	System Design	6.7%
	Information Systems	6.7%
Continuous Improvement	Quality Control	6.9%
	Quality Assurance	6.9%
	Quality Enhancement	6%
Evaluation	External Evaluation	6.8%
	Internal Evaluation	6.7%

Discussion

The e-learning quality management model is a critical tool for developing specialized skills among clinical groups at medical universities of the armed forces, particularly in wartime conditions 12-15. It aims to strengthen managerial, operational, and therapeutic skills, ultimately improving educational standards, enhancing clinical skills, and preparing healthcare professionals for battlefield challenges. The model consists of five dimensions, each with specific components and indicators:

Standard Dimension: Includes six components (e.g., teaching-learning management, educational content) and 29 indicators. Key factors include evaluating learners' capacity, providing necessary equipment, and aligning content with military medicine needs. Planning Dimension: Comprises four components (e.g., analysis, resource management) and 25 indicators. It focuses on assessing interaction, interdisciplinary training, and aligning content with battlefield needs. Information Technology Dimension: Contains three components (e.g., infrastructure, system design) and 23 indicators. Emphasizes the importance of technical infrastructure and advanced tools like VR and AI. Continuous Quality Improvement Dimension: Consists of three components (e.g., quality control, quality assurance) and 19 indicators. Highlights the need for ongoing monitoring and improvement. Evaluation Dimension: Includes two components (internal and external evaluation) and eight indicators. Focuses on assessing learning outcomes and program effectiveness. Key findings emphasize the importance of instructors' expertise, learners' readiness, and content alignment with real-world needs. Effective planning, robust technical infrastructure, and continuous evaluation are essential for enhancing e-learning quality. Additionally, interdisciplinary collaboration, evidence-based teaching methods, and interactive tools significantly improve learning experiences.

The information technology dimension in e-learning quality management for clinical and military medicine focuses on leveraging modern technologies to enhance educational systems, provide technical support, and ensure data security and content quality. Key aspects include technical infrastructure, which establishes stable access to e-learning systems and resources, which is critical for the success of military medicine training in electronic environments. Training and Support: Comprehensive training programs for users and content production teams are essential to empower individuals in using systems and designing practical content. Simple, accessible user guides further facilitate the learning process. Advanced Technologies: Integrating technologies like artificial intelligence, the metaverse, gaming, and realistic simulations enhances interactions, creates active learning experiences, and enables the analysis of complex scenarios in clinical and military medicine training. System Compatibility: Ensuring compatibility between e-learning systems and enabling seamless data exchange across platforms is vital for improving efficiency and preventing technical issues.

The continuous quality improvement dimension in e-learning for military medicine focuses on enhancing educational quality through organizational and managerial processes. Key actions include monitoring quality via standardized evaluations, analyzing learner satisfaction and progress, and holding periodic committee meetings to review and improve quality. Developing guidelines and checklists, as well as coordinating among clinical groups, are essential. This dimension also involves defining roles and responsibilities for quality management, establishing supportive structures, and ensuring executive guarantees for improvement. Aligning tools and technologies with military medicine skills, periodic evaluations, and corrective actions based on results are crucial. Advanced technologies, student-centered educational policies, and collaborative platforms for knowledge exchange further enhance the learning experience. Creating a specialized e-learning center, updating tools with new technologies, and practicing skills in simulated environments prepare learners for real-world challenges. These measures collectively improve the quality of e-learning in military medicine, ensuring adequate training and better clinical and military performance.

The evaluation dimension in e-learning for military medicine focuses on effectively assessing the impact, quality of learning processes, and training effectiveness. This dimension includes various indicators for evaluating the quality of learning, teaching, and educational tools, which are continuously used to improve and enhance learners' clinical and military medicine skills. The evaluation of the impact of e-learning on improving learners' skills in military medicine is conducted from various perspectives, including internal and external assessment.

Internal evaluation involves gathering feedback from learners about the quality of the e-learning and teaching process. This can be achieved through peer reviews, clinical instructors' assessments of e-learning teaching quality, and evaluations of the relevance and efficiency of educational tools. Conversely, external evaluation involves assessments by specialized institutions, external organizations, and independent evaluators. These evaluations typically assess the effectiveness of e-learning in operational exercises and gather feedback from

graduates and operational physicians regarding the efficacy and quality of training. This data collection helps analyze and evaluate the extent to which educational objectives are met in enhancing military medicine skills.
Given the importance of feedback from various stakeholders and evaluators, this process leads to the continuous improvement and optimization of e-learning programs in clinical and military medicine training. These evaluations not only measure the impact of training on learners but also contribute to improving the quality of educational tools and aligning them with the real needs of military medicine training.

In summary, these measures collectively enhance the learning experience and improve the effectiveness of e-learning in clinical and military medicine, contributing to creating a comprehensive and effective e-learning system that meets the educational needs of this field.
What is the priority of the components and indicators of the mentioned model?

In the qualitative section of the research, a researcher-made questionnaire was developed based on theoretical foundations and semi-structured interviews, using three coding techniques: open, axial, and selective. This questionnaire was distributed among nine experts in the field of e-learning for clinical skills and military medicine to validate the "Model of E-Learning Quality Management in Clinical Groups at the Medical Universities of the Armed Forces." To answer the above question, a seven-point Likert scale was used, where respondents could express their opinions on a scale from 1 to 7, with 1 indicating the minimum importance and 7 indicating the maximum importance of each indicator. The results derived from the experts' average scores stated that In the standard dimension, the components of teaching-learning management and educational content had the highest importance. In contrast, the learner assessment methods had the lowest importance. In the planning dimension, the analysis component had the highest importance, while the strategies and resource management components had the lowest importance. In the information technology dimension, the infrastructure component had the highest importance, while the information systems component had the lowest importance. In the continuous quality improvement dimension, quality control and quality assurance components had the highest importance, while the quality enhancement component had the lowest importance. The internal evaluation component had the highest importance in the evaluation dimension, while the external evaluation component had the lowest importance.

In the standard dimension, the components of teaching-learning management and educational content held the highest importance. This finding aligns with the study by Ghanbari et al. (2019), which emphasized the importance of content quality in managing the quality of e-learning in clinical groups, consistent with the present research[16].

In the information technology dimension, the infrastructure component held the highest importance. This finding is consistent with studies by Mutua Mulu et al. (2023)[17], Ardakani et al. (2017)[18], and Shahhosseini et al. (2015)[19], which also emphasized the importance of infrastructure in managing the quality of e-learning in clinical groups, aligning with the present research. Additionally, studies by Biernbach et al. (2024)[20], Groves et al. (2023)[21], Gan et al. (2023)[22], Kato et al. (2022)[23], and Sheng et al. (2022)[24] highlighted the importance of designing multi-dimensional systems integrating virtual reality (VR), which is in line with the current study. Furthermore, studies by Chen et al. (2024)[25], and Kim et al. (2023)[26] emphasized the significance of designing systems using artificial intelligence, which also aligns with the present research.

In the continuous quality improvement dimension, the components of quality control and quality assurance held the highest importance. This finding aligns with study by Masengu et al. (2023)[27], which also emphasized the importance of quality assurance in managing the quality of e-learning in clinical groups, consistent with the present research.

What is the Model of E-Learning Quality Management in Clinical Groups at the Medical Universities of the Armed Forces?

The emerging model of e-learning quality management in clinical groups at the medical universities of the armed forces, validated by experts in the qualitative phase, is as follows. This model consists of five dimensions, eighteen components, and one hundred and four indicators, the details of which have been thoroughly addressed in the sub-questions.

Conclusion

The emerging model of e-learning quality management in clinical groups at medical universities of the armed forces, validated by experts, consists of 5 dimensions, 18 components, and 104 indicators. This model provides a comprehensive framework for improving the quality of e-learning in clinical education, particularly in combat medicine and military healthcare.

Based on the results of this study and the emphasis on the importance of e-learning quality management in clinical groups at medical universities of the armed forces,

it is recommended that the Ministry of Health, Treatment, and Medical Education, as well as educational policymakers in the armed forces, adopt the proposed strategies to enhance the quality of e-learning. This will contribute to the continuous improvement of academic standards and better preparation of healthcare professionals for complex challenges in clinical and battlefield settings.

Highlights

What Is Already Known?
Despite the diversity of studies evaluating the quality of e-learning in medical sciences, there appears to be a lack of significant research in medical sciences universities affiliated with the armed forces.

What Does This Study Add?
The study developed a comprehensive model for educators and policymakers to quality management of e-learning in clinical departments, which can serve as a framework for improving the quality of e-learning in medical sciences universities of the armed forces by offering measurable criteria for both internal and external evaluation.

Ethical Considerations:

The Islamic Azad University, Central Tehran Branch, granted written permission and ethical approval (IR.IAU.CTB.REC.1403.250) to conduct the research.
- Informed consent was obtained from all participants.
- The confidentiality of participants' information was maintained.
- Participants were free to withdraw from the study at any time.
- Ethical principles were adhered to when the research results were published.

Authors' Contributions

Concepts and design: Leila Vosoug BeneKohl, Baharak Shirzad Kebria; Data gathering: Leila Vosoug BeneKohl, Baharak Shirzad Kebria; Writing of paper: Leila Vosoug BeneKohl, Baharak Shirzad Kebria, Fatemeh. Hamidifar, Abbas Khorshidi; Editing and final approving: Leila Vosoug BeneKohl, Baharak Shirzad Kebria, Fatemeh. Hamidifar, Abbas Khorshidi.

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Conflicts of Interest

We declare that there is no any conflict of interest.

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Consent For Publication

The authors agree with the publication.

Ethics approval

The Ethical Committee of Islamic Azad University, Tehran, Iran, approved the protocol of this study. (Ethical code: IR.IAU.CTB.REC.1403.250)

The extent of AI use

None

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