

Requirements and Characteristics for Designing Educational Environments that Support E-Learning: An Analysis Based on Educational Quality

متطلبات وخصائص تصميم البيئات التعليمية الداعمة للتعليم الإلكتروني تحليل قائم على جودة التعليم

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ABSTRACT:

This study aimed to analyze the requirements and characteristics of designing educational environments that support e-learning in light of educational quality standards. It did so by establishing the concept theoretically, tracing its development in contemporary educational literature, and analyzing its educational applications. The study adopted an analytical, exploratory approach based on analyzing and synthesizing the results of a set of relevant previous scientific studies and research, without resorting to a field study.

The study's results showed that the success of e-learning is closely linked to the availability of educational environments designed according to comprehensive quality standards, taking into account technological, organizational, and pedagogical dimensions, in a way that ensures learning effectiveness and the achievement of intended outcomes. The results also indicated that rapid digital transformations have generated new requirements that have made e-learning a sustainable strategic option in modern educational systems, rather than merely a temporary alternative to traditional education.

Keywords: E-learning, Educational Environments, Educational Environment Design, Educational Quality, Educational Technology.

الملخص:

هدفت هذه الدراسة إلى تحليل متطلبات وخصائص تصميم البيئات التعليمية الداعمة للتعليم الإلكتروني في ضوء معايير جودة التعليم، وذلك من خلال تأصيل المفهوم نظرياً، وتتبع تطوره في الأدبيات التربوية المعاصرة، وتحليل تطبيقاته التعليمية. اعتمدت الدراسة المنهج التحليلي الاستقصائي القائم على تحليل وتركيب نتائج مجموعة من الدراسات والبحوث العلمية السابقة ذات الصلة، دون اللجوء إلى دراسة ميدانية.

وأظهرت نتائج الدراسة أن نجاح التعليم الإلكتروني يرتبط ارتباطاً وثيقاً بتوافر بيئات تعليمية مصممة وفق معايير جودة شاملة، تراعي الأبعاد التكنولوجية والتنظيمية والبيداغوجية، بما يضمن فاعلية التعلم وتحقيق نواتجه المرجوة. كما بينت النتائج أن التحولات الرقمية المتسارعة أفرزت متطلبات جديدة جعلت من التعليم الإلكتروني خياراً استراتيجياً مستداماً في النظم التعليمية الحديثة، وليس مجرد بديل ظرفي للتعليم التقليدي. كلمات مفتاحية: التعليم الإلكتروني، البيئات التعليمية، تصميم البيئة التعليمية، جودة التعليم، تكنولوجيا التعليم

1- INTRODUCTION

Education has undergone broad digital transformations in recent years. E-learning has become a fundamental pillar of contemporary educational systems—not as a temporary substitute for traditional education, but as a sustainable strategic option that enables flexible and inclusive learning.

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With the expanded use of digital learning platforms and modern educational technologies, the need has emerged to design supportive educational environments that ensure the effective achievement of learning objectives while taking global educational quality standards into account.

Despite this, educational institutions face major challenges, including the absence of an integrated framework that defines the technological, organizational, and pedagogical requirements of digital educational environments, as well as a lack of clarity regarding the core characteristics that make these environments effective and sustainable. The gap between current practical applications and international educational standards highlights the need for a careful study to identify these requirements and characteristics.

This study aims to analyze the requirements and characteristics for designing educational environments that support e-learning in light of educational quality standards, while presenting a systematic perspective that helps improve the design of digital environments and ensure their effectiveness. To achieve this aim, the research adopts an analytical, exploratory methodology based on reviewing contemporary digital educational literature and research, with a focus on deriving the essential requirements and characteristics that ensure an effective and sustainable educational environment.

1-2- The Study Problem and Its Questions

The world is living in an era characterized by rapid changes resulting from scientific and technological development and information technology, which has made the educational process face major challenges, such as the growing volume of information, increasing numbers of students, shortages of teaching competencies, and geographic distances (Al-Muhaya 2002). These transformations have led to the emergence of multiple educational patterns and methods, especially in the field of individualized or self-directed learning, where the learner progresses according to their abilities, experiences, and learning speed. This contributed to the emergence of concepts such as programmed instruction, computer-assisted instruction, and distance education—leading ultimately to e-learning, which relies on modern computer technologies, the global network, and its multimedia tools, including compact discs, educational software, email, virtual classrooms, and discussion forums (Maxwell 1997).

However, the application of e-learning in many educational institutions has remained limited to partial efforts, without the availability of fundamental requirements related to infrastructure, program design, setting standards, building electronic curricula, training teachers, and preparing students (Al-Khawaldeh 2004)(Al-Basyouni 2001).

Previous studies have shown weak student competencies in using computers and internet technologies, limited teacher training, and inadequate infrastructure (Maxwell 1997) (Al-Muhaya 2002), which reflects a substantial gap between the theoretical requirements for implementing e-learning and the reality of its practice.

Based on the above, the importance of identifying the characteristics and needs of the educational environment that supports e-learning becomes clear, in order to ensure learning effectiveness and develop learners' self-learning skills. This contributes to preparing qualified

learners capable of facing the challenges of the digital age and developing their personality and self-confidence (Al-Khawaldeh 2004).

Accordingly, the research problem can be formulated as follows:

What are the characteristics and requirements of the educational environment necessary to use e-learning effectively?

Sub-Questions: Based on the above problem, the following sub-questions are identified:

- What is the concept of e-learning and what are its theoretical and practical boundaries?
- What are the essential characteristics of an educational environment that supports e-learning?
- What are the basic requirements related to tools, equipment, and electronic curricula?
- What are the teacher's roles and competencies in designing and activating e-learning?

1-3- Research Objectives

This research aims to analyze the requirements and characteristics for designing educational environments that support e-learning in light of educational quality standards by achieving the following sub-objectives:

- Identifying the basic elements and core pillars that contribute to the effective use of e-learning in the educational process.
- Reviewing and analyzing the equipment, tools, and electronic curricula needed to design a supportive digital educational environment.
- Identifying the essential characteristics of an effective educational environment that ensures interaction, flexibility, and adaptation to the needs of the digital learner.
- Clarifying the teacher's roles and competencies in e-learning, including preparing learners for digital skills, self-directed learning, and scientific research.
- Proposing an analytical or conceptual framework that can be relied upon in designing e-learning environments in accordance with modern educational quality standards.

1-4- Research Methodology

This study adopts an analytical, exploratory approach based on analyzing and synthesizing the results of previous studies and scientific research related to the use of computers in education in general and e-learning in particular. The methodology aims to ground the concept theoretically and explore its practical applications through analysis of the literature and scholarly writings, without resorting to a field study or direct analysis of textbook content, thereby ensuring the attainment of precise and reliable scientific results.

1-5- Research Terms

1-5-1- E-Learning

In this study, e-learning refers to a learning approach that uses modern communication technologies—including computers, networks, multimedia, search tools, and virtual classrooms—to

provide an interactive, resource-rich educational environment that enables the learner to study according to their abilities, with access to knowledge at any time and in any place (Al-Far 2002, 15).

1-5-2- Educational Environment Supporting E-Learning

In the context of this study, this environment refers to a set of physical elements, infrastructure, and educational software necessary to support e-learning. This includes computers and their peripherals, networks and communications, virtual spaces, and educational software, which contribute to preparing an effective and interactive learning environment.

1-5-3- Requirements for Using E-Learning

Requirements are defined as the needs and essential competencies necessary to activate e-learning effectively. They include tools, equipment, electronic curricula, and the capabilities required of both the teacher and the learner to ensure the achievement of learning objectives and to provide an integrated digital educational environment.

1-5-4- Educational Quality in Digital Environments

This refers to the extent to which digital educational environments achieve learning objectives effectively, in accordance with internationally recognized educational quality standards. These include technical infrastructure, digital content design, interaction, adaptability, and the teacher's professional competencies, in a way that ensures the sustainability and effectiveness of e-learning (Quality Matters; Excellence Framework; ISO/IEC 40180).

2- The Theoretical and Conceptual Framework of the Study

2-1- The Concept of E-Learning

E-learning is considered an integrated educational system based on the effective use of information and communication technology in the processes of teaching and learning. It does so by providing a digital educational environment rich in computer and internet applications, enabling the learner to access learning resources at any time and in any place, and achieving reciprocal interaction among the parties involved in the educational process (Malhis 2008, 177).

The term e-learning is used to refer to multiple learning modes, such as online learning, virtual learning, and digital learning, where educational content is delivered through electronic networks in a way that allows it to be integrated with learning resources outside the framework of the traditional classroom (Mahsoun 2003, 15). It is also viewed as a form of flexible and open learning that depends on the use of computers and their software, whether within closed networks or via the internet (Abd al-Mun'im 2003, 25).

Al-Mousa emphasizes that e-learning is based on using modern communication mechanisms and their multimedia tools, which contributes to delivering knowledge with less effort and in a shorter time, whether inside the classroom or at a distance. On this basis, e-learning can be regarded as a comprehensive framework that integrates digital technologies in their various forms to support the educational process in all its components (Al-Mousa, 2002, p. 16).

2-2- The Educational Environment Necessary for Using E-Learning

The success of education in general, and e-learning in particular, is linked to the quality of the educational environment in which learning takes place. This environment plays a central role in achieving learning objectives, alongside the curriculum, the teacher, and modern teaching strategies that focus on making the learner the محور of the educational process. The importance of the educational environment increases in e-learning because it requires technical, pedagogical, and organizational preparation that ensures interaction, motivation, and a sense of safety and comfort for the learner (Al-Sawa'I, 2005, p. 09).

2-3- The Concept of the Electronic Educational Environment

The educational environment is defined as the set of physical, instructional, and administrative conditions within which learning takes place. It includes the design of the space, equipment, educational resources, as well as the rules that regulate learners' behavior and their interaction (Salama 2005, p. 27).

In the context of e-learning, the educational environment is defined as the physical equipment—computers and their peripherals—along with educational software and the infrastructure of networks and communications required to support digital learning (Al-Harbi 2006, 82).

2-4- Characteristics of a Positive Educational Environment in E-Learning

A positive electronic educational environment is characterized by several features, most notably that it is attractive and safe; it encourages individual and collaborative learning and enhances interaction between learners and the teacher; it relies on the teacher's role as a guide and facilitator; and it also depends on learners' self-management and self-discipline (Al-Ashhab 2002, 52-53).

2-5- Requirements of the Educational Environment for E-Learning

An educational environment that supports e-learning requires both material and human requirements. Material requirements include technical infrastructure (servers, teacher and learner workstations, educational software, and internet networks). Human requirements include training teachers and learners in the skills needed to use digital technologies, in a way that ensures the effectiveness and quality of the educational process.

2-6- Educational Quality in Digital Environments

Educational quality in digital environments is one of the most important indicators of the effectiveness of e-learning. It refers to the extent to which the digital environment can achieve learning objectives according to internationally recognized educational quality standards. This quality includes all elements of the educational process, including digital content, interaction between the teacher and the learner, technical infrastructure, and the competencies of teachers and students (Quality Matters, 2020).

Researchers indicate that a high-quality digital environment is characterized by the following:

- The availability of reliable and effective technical infrastructure, including servers, internet networks, workstations, and educational software, ensuring continuity and smooth delivery of education .
- Designing digital content according to clear pedagogical standards so that the content is diverse, interactive, and adaptable to learners' different needs .
- Enhancing interaction and participation between teachers and learners and among learners themselves, which supports collaborative learning and develops critical thinking skills .
- Continuous evaluation of the effectiveness of digital learning through tools for measuring academic performance, immediate feedback, and monitoring educational progress .
- Developing the competencies of teachers and learners in using educational technology, which strengthens self-directed learning and sustainable knowledge attainment .

The literature indicates that educational quality in digital environments is not limited to the availability of technology; it also relates to integrating technology with well-planned instructional strategies, appropriate content, and a motivating and safe learning environment, thereby achieving effective and sustainable learning .

3- Tools, Software, and Equipment Required for E-Learning

3-1- Educational Tools

E-learning relies on a set of modern digital tools that enable interaction and flexible learning. According to (Al-Harbi 2006), these tools can be classified as follows:

- Synchronous Learning Tools: These enable direct communication between teachers and learners at the same time, such as text chat, video and audio conferences, the interactive whiteboard, and educational satellite programs.
- Asynchronous Learning Tools: These enable communication without requiring all parties to be present at the same time. They include email, the World Wide Web, discussion groups, file exchange, interactive video, and compact discs (CDs) (Al-Harbi 2006, 35-36).

Other educational tools also include the institution's intranet, CDs used to store digital curricula, and interactive software that supports distance learning (Abdallah, 2007).

3-2- Equipment and Infrastructure

A digital educational environment requires physical, technical, and human resources to ensure the effectiveness of e-learning. These include (Al-Farra 2003, 16-17) (Al-Qaddah 2002, 12-13):

- Infrastructure: Laboratories and workshops equipped with necessary devices, internal networks and an internet connection line, suitable furniture, and supportive electrical systems.
- Technical Devices: Computers for the teacher and learner, servers, printers, cameras, microphones, and interactive displays.
- Digital Resources: The electronic library, programmed instructional materials, CDs, and diverse educational software.
- Human Resources: Technical resource teachers responsible for training teachers to use technology and integrate it into curricula.

- Communication Networks: Linking computers within the school (LAN) and connecting them to the internet to facilitate interaction among learners, teachers, and digital resources.

These elements confirm that the success of e-learning depends on the availability of appropriate tools, strong infrastructure, and effective human support to ensure an integrated and effective educational environment.

4- Curricula and Programs Required for E-Learning

4-1- Core Programs

For educational institutions to adopt e-learning, two main systems are required:

- Learning Management System (LMS): This system helps manage, track, and assess all learning activities. It enables enrollment, course scheduling, content delivery, monitoring learner performance, facilitating communication among learners, and administering tests (Al-Mousa and Al-Mubarak 2005, 274).
- Learning Content Management System (LCMS): This system focuses on creating, developing, and managing educational content. It allows importing content, segmenting it, integrating it, and reusing it in ways that suit the needs of learners and instructional designers (Al-Harbi 2006).

LMS and LCMS are complementary systems: the first manages the learning process, while the second manages content. They can be integrated to ensure a comprehensive educational environment.

4-2- Examples of E-Learning Programs

E-learning platforms vary between open-source and commercial solutions. Notable examples include:

- Moodle: An open-source learning management system that supports both large and small educational institutions, known for its flexibility and multilingual capabilities.
- Claroline / Dokeos: An open-source system that enables the creation of interactive content and communication between learners and trainers.
- ATutor: A fast, easy-to-install system that complies with international standards such as SCORM and IMS.
- WebCT and Blackboard: Commercial systems that provide an integrated, multi-tool learning environment, supporting both distance and live instruction.
- Local Systems: Such as the Majd system for managing the electronic classroom, which provides learning management and virtual classroom functions in Arabic and is compatible with e-learning standards (Khan, 2005) (Al-Harbi, 2006).

4-3- Characteristics of a Successful E-Learning Teacher

The teacher plays a central role as a mediator of learning and should possess the following characteristics (Al-Harbi 2006) (Al-Ghamdi 2003):

- Conviction in the success and effectiveness of e-learning compared to traditional education.
- Practical expertise in the curriculum subject matter and the ability to address real educational issues.

- Strong interpersonal communication skills and the ability to gain students' trust in the virtual environment.
- Technical competence in using computers, the internet, and different educational software.
- Strong writing skills for effective communication within virtual classrooms.

4-4- Requirements for Teacher Preparation and Training

Preparing teachers for e-learning requires training in:

- Using multimedia: Preparing slides, working with Excel and Access files, and integrating images, video, and audio .
- Using the internet: Browsing, searching, and creating and uploading educational websites.
- General competencies: Including pedagogical knowledge, designing instructional strategies, managing instructional situations, using educational devices and software, maintaining resources, and community service (Salem 2004, 260).

5- Analysis of Electronic Educational Environments in Light of Educational Quality Standards

5-1- Aligning Requirements with Quality Standards

Analyzing electronic environments requires matching their components with international quality standards. This includes the clarity of learning objectives, the efficiency of hardware and software, the appropriateness of content, teacher–student interaction, and support for collaborative learning (Al-Harbi 2006) (Salem 2004). This analysis makes it possible to verify that the educational environment provides an integrated and effective learning experience.

5-2- Gap and Challenge Analysis

Challenges include scarcity of technical resources, weak teacher training, limited student interaction, and the lack of integration between content management systems and learning management systems (LMS and LCMS) (Al-Farra 2003) (Al-Mousa and Al-Mubarak 2005). Gap analysis highlights the difference between the current situation and optimal requirements for educational quality, thereby identifying priorities for development and improvement.

5-3- Determinants of Educational Effectiveness

The effectiveness of e-learning is determined by multiple factors: teacher competence, content quality, infrastructure support, student interaction, and continuous assessment methods (Al-Ghamdi 2003) (Khan 2005). These determinants form measurable indicators that contribute to improving educational quality and overall effectiveness.

6- A Proposed Conceptual Framework for Designing Supportive Educational Environments

6-1- Rationale for Building the Framework

The proposed framework aims to achieve integration among the technical, pedagogical, and administrative requirements of the electronic environment and to overcome the gaps identified in the

preceding analysis, ensuring a motivating, safe, and interactive educational environment (Al-Harbi 2006).

6-2- Framework Components and Their Relationships

The framework includes:

- The Digital Teacher: A trainer and learning guide who possesses technical and pedagogical competencies.
- The Active Learner: A participant in self-directed and collaborative learning, capable of using electronic resources efficiently.
- Educational Content: Integrated, multimedia-rich, customizable, and reusable.
- Infrastructure: Devices, networks, software, electronic libraries, and virtual laboratories.
- Assessment and Support Mechanisms: Performance monitoring, continuous assessment, and technical support (Salem 2004) (Al-Farra 2003).

6-3- Institutional Implementation Mechanisms

- Establish training centers for teachers on the use of digital tools.
- Develop LCMS content repositories linked to the curriculum.
- Enhance student interaction through synchronous and asynchronous learning tools.
- Develop policies to ensure quality and periodically monitor performance.
- Integrate learning management systems (LMS) with content management systems (LCMS) to facilitate tracking and improve outcomes (Al-Harbi 2006).

7- Discussion

7-1- Interpreting the Results in Light of the Theoretical Framework

The analysis results reflect that integration among technical, pedagogical, and administrative components leads to a more effective educational environment. Student performance and the achievement of educational objectives are directly linked to the quality of tools, teacher competence, and the extent of infrastructure support (Al-Mousa and Al-Mubarak 2005).

7-2- Comparison with Findings from Previous Studies

The findings are consistent with what (Al-Harbi 2006) and (Salem 2004) indicated regarding the importance of integrating LMS with LCMS and raising teacher competence. At the same time, the present study highlights the design of an integrated framework that systematically links technical, pedagogical, and administrative requirements in a way not presented in earlier studies.

7-3- The Study's Scholarly Contribution

- Presenting an integrated conceptual framework for designing electronic educational environments.
- Identifying determinants of educational effectiveness according to educational quality standards.

- Providing a scientific foundation for educational institutions to adopt modern approaches that enhance the quality of digital learning.

8- Conclusion and Recommendations

8-1- Scientific Conclusions

The study showed that educational quality in digital environments depends on integration among technical, pedagogical, and administrative components, and that weakness in any one of these components reduces learning effectiveness.

- The analysis showed that e-learning tools and learning and content management software form the backbone of the digital educational environment, directly affecting student interaction, teacher efficiency, and the achievement of educational objectives.
- Examining gaps between the current situation and quality standards revealed key weaknesses such as limited teacher training, weak student interaction, and lack of integration between learning and content management systems, which negatively affects academic performance and the effectiveness of digital education.
- The proposed conceptual framework presented a systematic and integrated mechanism for designing supportive educational environments that connects content, teacher, learner, infrastructure, and assessment, thereby providing a more effective and sustainable educational environment.

8-2- Recommendations for Educational Decision-Makers

- Develop digital infrastructure in schools and universities, including computers, networks, electronic libraries, and electronic laboratories.
- Raise teachers' competence through specialized training programs in the use of digital tools and e-teaching strategies, with a focus on interaction and remote communication skills.
- Adopt learning management systems (LMS) and learning content management systems (LCMS) and integrate them to ensure performance tracking, content management, and effective achievement of learning objectives.
- Enhance student interaction using synchronous and asynchronous learning tools, and develop continuous assessment methods to ensure academic progress.
- Adopt digital education quality standards as a foundation for designing electronic curricula and programs, while continuously monitoring and improving performance.

8-3- Future Research Directions

- Study the impact of integrating artificial intelligence into e-learning systems on learning quality and student interaction.
- Investigate adaptive learning and its impact on improving learning outcomes in digital environments.
- Evaluate the effectiveness of the proposed framework in different educational institutions and link it to academic performance indicators.

- Develop digital quality measurement standards for educational software in ways that align with the needs of the learner, the teacher, and the educational institution.

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