

Artificial Intelligence Governance as an Approach to Enhancing the Quality of E-Learning in the Digital Age

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Abstract

This study aims to highlight the importance of artificial intelligence governance as an approach to enhancing the quality of e-learning amid the accelerating digital transformation. Artificial intelligence has created new opportunities for developing educational practices by supporting intelligent learning systems, personalizing content, analyzing learner data, and improving interaction and assessment. However, the deployment of these technologies remains associated with a range of challenges, particularly those related to transparency, data protection, security, and accountability. This necessitates the adoption of governance frameworks that ensure their prudent and secure use.

The study adopted the descriptive-analytical approach by reviewing the literature and previous studies related to artificial intelligence governance and e-learning, with the aim of analyzing the principles governing the use of these technologies and identifying the requirements for their implementation in the educational environment.

The study concluded that artificial intelligence governance represents a fundamental element in achieving sustainable benefits from its applications in e-learning by promoting transparency, accountability, and digital trust, while ensuring the ethical and responsible use of intelligent technologies. It also emphasized that the success of this approach requires integration between technological advancement, human resource development, and the establishment of supportive regulatory policies, thereby contributing to the development of higher-quality and more effective e-learning.

Keywords: Artificial Intelligence Governance; E-Learning; Digital Transformation; Educational Quality; Intelligent Educational Systems.

Introduction

Today, the world is witnessing rapid digital transformations driven by modern technological developments, requiring educational institutions to redesign their models and methods in line with the demands of the digital age. Artificial intelligence is one of the most prominent of these

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transformations, given the advanced capabilities it offers, which have contributed to the development of the educational process through data analysis, content personalization, support for adaptive learning, and improved interaction within digital learning environments.

E-learning has become one of the most important manifestations of digital transformation in the educational field, evolving from the mere use of digital platforms to the adoption of intelligent educational systems capable of responding to learners' needs and enhancing learning quality. However, the increasing use of artificial intelligence applications raises challenges related to data protection, privacy, transparency, and accountability, making artificial intelligence governance essential to ensuring that these technologies are deployed responsibly and securely.

Artificial intelligence governance consists of a set of principles and regulatory frameworks designed to govern the use of intelligent systems in accordance with standards of transparency, responsibility, security, and digital trust, thereby achieving a balance between benefiting from technological capabilities and preserving human and ethical values. In the field of e-learning, such governance contributes to enhancing the quality of educational practices and ensuring the effective use of artificial intelligence in ways that serve the objectives of educational institutions and meet learners' needs.

Given the importance of this topic, the present study seeks to examine the role of artificial intelligence governance as an approach to enhancing the quality of e-learning in the digital age by analyzing the principles governing its use, identifying its contributions to the development of digital learning environments, and examining the main challenges and requirements for achieving the sustainable and responsible deployment of these technologies.

Amid the rapid digital transformations taking place in the education sector and the new possibilities offered by artificial intelligence applications for reshaping teaching and learning practices, there is a growing need to examine the regulatory and ethical frameworks necessary to ensure that these technologies are deployed responsibly and effectively. In this context, the research problem addressed by this study revolves around the following main question: **To what extent can artificial intelligence governance contribute to enhancing the quality of e-learning in light of the requirements of the digital age?**

This central question gives rise to a set of subsidiary questions, as follows:

- What is meant by artificial intelligence governance, and what are its main principles?
- What is the current state of artificial intelligence use in e-learning?
- How does artificial intelligence governance contribute to improving the quality of e-learning?
- What are the main challenges facing the implementation of artificial intelligence governance in e-learning?
- What requirements are necessary to activate artificial intelligence governance in a manner consistent with the demands of the digital age?

The study is based on the fundamental hypothesis that adopting an integrated framework for artificial intelligence governance, founded on the principles of transparency, accountability, data protection, and the safe and responsible use of intelligent technologies, constitutes a fundamental approach to improving the quality of e-learning and enhancing the effectiveness of its components. This can be achieved by striking a balance between benefiting from the innovative capabilities of artificial intelligence and preserving the educational and ethical values of the learning process.

This study seeks to achieve a number of objectives, most notably analyzing the role of artificial intelligence governance in developing e-learning environments and examining the extent to

which it contributes to improving the quality of the educational process by supporting adaptive learning, personalizing content, and enhancing interaction among the various stakeholders involved in the educational process. It also aims to discuss the main challenges associated with the use of artificial intelligence in education, particularly those related to digital privacy, data security, transparency, and accountability, ultimately identifying the regulatory and educational requirements necessary to ensure the sustainable and reliable use of these technologies.

To address the research problem and examine its various dimensions, the study adopted the descriptive-analytical approach, as it is the most appropriate methodology for investigating phenomena associated with digital transformations in the educational field. This approach makes it possible to describe the current state of artificial intelligence applications in e-learning and analyze the principles and mechanisms underlying their governance, as well as to explain the relationship between the adoption of governance frameworks and the quality of digital educational practices. Furthermore, it enables the identification of the opportunities these technologies offer for educational development and the examination of challenges that may limit their effectiveness, thereby contributing to the development of a scientific understanding of the requirements for the rational and responsible use of artificial intelligence within educational institutions in the digital age.

To examine the various dimensions of the research problem comprehensively and answer the research questions, the study was organized into the following main sections:

- **Section One: The Conceptual Framework of Artificial Intelligence Governance and E-Learning Quality in the Digital Age**
- **Section Two: The Contributions of Artificial Intelligence Governance to Enhancing E-Learning Quality**
- **Section Three: Challenges of Implementing Artificial Intelligence in E-Learning**
- **Section Four: Requirements for Developing an Effective Artificial Intelligence Governance Model in E-Learning**

Section One: The Conceptual Framework of Artificial Intelligence Governance and E-Learning Quality in the Digital Age

The rapid transformations taking place in the digital age have brought about a new reality across various sectors, particularly education, which has increasingly relied on modern technologies to develop its methods and improve its outcomes. Artificial intelligence is one of the most prominent of these technologies, given its capabilities to support the development of more interactive and flexible learning environments and enhance the quality of e-learning. However, the deployment of these technologies within the educational system requires the establishment of clear foundations to regulate their use and ensure their effectiveness. This makes artificial intelligence governance a necessary approach to maximizing the benefits of these technologies within a framework of responsibility and transparency. Accordingly, this section examines the conceptual framework of artificial intelligence governance and its relationship with e-learning quality in light of the requirements of the digital age.

First: Artificial Intelligence and Its Applications in the Educational Field

The concept of artificial intelligence dates back to the 1950s, when this field witnessed a significant turning point in **1956** during a scientific workshop organized by **John McCarthy** over a period of two months at Dartmouth College in the United States. It was during this workshop that the term “**artificial intelligence**” was first used to describe a field of research seeking to simulate human intellectual capabilities through machines.

This vision was based on the fundamental assumption that various forms of learning and functions associated with human intelligence could be described with sufficient precision to enable the development of systems capable of simulating them. These included machines' ability to use language, form concepts and abstractions, address complex problems, and continuously improve their performance.²

In this context, **Baker and Smith** broadly define artificial intelligence as a set of computer systems capable of performing cognitive tasks typically associated with human mental abilities, particularly learning and problem-solving. The researchers emphasize that artificial intelligence does not represent a single technology; rather, it refers to a comprehensive framework encompassing a variety of technologies and approaches that enable systems to process information and adapt to different environments. The most prominent of these technologies include:³

- **Machine Learning**, which enables systems to learn from data, identify patterns, and make predictions.
- **Natural Language Processing**, which enables machines to understand, analyze, and interact with human language.
- **Data Mining**, which is used to extract knowledge and patterns from large datasets.
- **Artificial Neural Networks**, which simulate certain mechanisms of the human brain in processing information.
- **Intelligent Algorithms**, which enable the development of solutions capable of performing analysis and making decisions across various contexts.

Artificial intelligence can be defined as a set of technologies and applications that enable machines and computer systems to simulate certain human cognitive abilities, such as perception, reasoning, learning, and decision-making. This field is also associated with the development of intelligent systems capable of interacting with complex environments, processing information, communicating, and performing tasks that typically require a certain level of human intelligence, and which may, in some cases, surpass human capabilities in specific domains.⁴

In the educational field, artificial intelligence is defined as a set of intelligent technologies and systems developed through collaboration among specialists in computer science, data analysis, design, psychology, and educational sciences, with the aim of creating learning environments capable of assisting teachers and supporting learners in developing their knowledge and skills. These systems rely on technologies such as machine learning, which enables machines to analyze data and adapt to users' needs.⁵

Artificial intelligence in education is no longer limited to the use of conventional computers and software; rather, it has evolved to encompass intelligent systems capable of learning, adapting, and making decisions through the application of technologies such as machine learning, data analysis, and natural language processing. This development has contributed to the emergence of various educational applications covering educational administration, teaching processes, and students' learning experiences. Intelligent systems have thus become capable of providing

² Olaf Zawacki-Richter, Victoria I. Marín, Melissa Bond, and Franziska Gouverneur, "Systematic Review of Research on Artificial Intelligence Applications in Higher Education - Where Are the Educators?" *International Journal of Educational Technology in Higher Education* 16, no. 1 (2019): 39, <https://doi.org/10.1186/s41239-019-0171-0>

³ Zawacki-Richter et al., "Systematic Review of Research on Artificial Intelligence Applications in Higher Education," 4

⁴ Souliham Aizi and Ahmed Salmi, "Applications of Artificial Intelligence in Scientific Research Based on UTAUT Using Structural Equation Modeling," *Daftar Boudaks Journal*, vol. 13, no. 02, 2024, p. 63

⁵ L. Chen, P. Chen, and Z. Lin, "Artificial Intelligence in Education: A Review," *IEEE Access*, vol. 8, pp. 75264–75278, 2020, doi: 10.1109/ACCESS.2020.2988510

personalized educational content, supporting teachers in performing their tasks, and improving learners' interaction with the learning environment.⁶

The applications of artificial intelligence used in e-learning are diverse, varying according to the nature of their functions and roles in supporting the educational process. They offer new opportunities for interacting with learning content and delivering knowledge through more flexible and engaging approaches. The most prominent of these applications include⁷:

1. Intelligent Chatbots (Chatbots):

Also known as digital assistants or intelligent agents, chatbots are programs that simulate human conversations by leveraging artificial intelligence technologies. They can process written text and emojis, convert speech into text and translate it, as well as analyze the information provided and use it to formulate appropriate responses for users.

2. Augmented Reality (Augmented Reality):

Augmented reality is an interactive technology that enables virtual elements, such as text, images, sounds, video clips, and three-dimensional models, to be integrated into the real-world environment, making digital content appear as though it were part of reality. Its use in education helps facilitate the understanding of scientific content and develop analytical and creative skills, while also increasing learners' engagement and enjoyment of the learning process.

3. Virtual Reality (Virtual Reality):

Virtual reality is a technology that enables learners to interact with a virtual environment simulating reality through specialized equipment, such as head-mounted displays and input devices, thereby providing a three-dimensional learning experience. Its importance lies in providing learning opportunities for learners in remote areas, helping overcome certain shortages of teachers and educational resources, and simplifying abstract concepts by transforming them into tangible scenes and images that are easier to understand.

4. Audio Generation Software (Audio Generation):

These are software applications that convert written text into audio recordings that can be used on websites, in digital books, and in online educational programs, thereby providing an additional means of delivering educational content.

5. Expert Systems (Expert Systems):

Expert systems are computer programs designed to simulate human expertise and transfer specialized knowledge into systems capable of performing certain tasks typically carried out by experts. They emerged in the 1980s, and their importance in education has become evident through their contribution to addressing various educational problems, such as balancing labor market requirements with educational curricula, developing and evaluating curricula, and improving teachers' performance.

6. Intelligent Educational Games (Intelligent Educational Games):

Intelligent educational games are among the modern applications of e-learning, combining interaction, enjoyment, and engagement through the use of multimedia in activities designed around specific educational objectives. They contribute to fostering creativity and improving academic achievement. They also enable personalized learning tailored to learners' abilities, needs, and individual differences.

⁶ Lijia Chen, Pingping Chen, and Zhijian Lin, "Artificial Intelligence in Education: A Review," *IEEE Access* 8 (2020): 75265–75270

⁷ Fatima Touahri and Kamel Battouche, "The Application of Artificial Intelligence in E-Learning: Technological Luxury or Educational Necessity," *Qabas Journal of Humanities and Social Studies*, vol. 9, no. 2, 2025, pp. 312–313

The integration of artificial intelligence into education has brought about a significant transformation across various components of the educational process. Its impact is no longer limited to developing the tools and resources used in education but has extended to encompass the roles of both teachers and learners, as well as curriculum design and assessment methods. This transformation has contributed to a shift from traditional educational approaches toward a more flexible and interactive model based on the use of data and intelligent technologies to improve educational practices. This development responds to the demands of the digital age, which has compelled educational institutions to keep pace with technological advances and adapt to learners' needs in an ever-changing digital environment⁸.

Artificial intelligence has thus become a strategic tool for educational development, facilitating a transition from a standardized educational model to more personalized approaches that respond to individual differences among learners and help improve the quality of educational practices.

Second: E-Learning as One of the Pillars of Digital Transformation in Education

E-learning is a modern educational approach that relies on the use of technological tools and electronic media to design, develop, and deliver educational content to learners through various means, such as audio, images, and video, whether in classrooms or through virtual environments. This approach enables effective interaction between learners and educational content, either synchronously or asynchronously, while providing flexibility in terms of time, place, and learning pace to accommodate learners' needs and abilities. It also relies on network technologies, the Internet, cloud computing, and smart devices, thereby facilitating access to and use of information, developing critical thinking, creativity, and communication skills, and supporting the advancement of the educational process in line with the demands of the digital age⁹.

E-learning is also defined as an educational approach aimed at creating an interactive environment rich in applications based on computer and Internet technologies, enabling learners to access learning resources at any time and from any place. It also involves the systematic and purposeful use of electronic systems and computers to support learning processes and enhance their effectiveness.¹⁰

Specialists classify e-learning into three main types, as follows:¹¹

- **Synchronous E-Learning:** This refers to an educational approach that relies on network and digital communication technologies to exchange educational content between teachers and learners in real time. This is achieved through virtual classrooms, instant messaging, audio and video conferencing, and electronic whiteboards. This type of e-learning is characterized by the ability of learners to receive immediate feedback from teachers, thereby enhancing interaction and participation throughout the educational process.
- **Asynchronous E-Learning:** This approach makes educational content available to learners at times and in places that suit their circumstances and needs, without requiring teachers and learners to be present simultaneously. It involves the use of email, educational platforms, discussion groups, file sharing, interactive videos, and digital discs. One of its main advantages is that it gives learners greater flexibility in organizing their learning process and enables them to revisit educational content whenever necessary.

⁸ Amal Mohamed Haidar, "Artificial Intelligence as an Approach to Reshaping the Future of Education in the Era of Digital Transformation," *Research and Education Journal*, National Institute for Research in Education, University of Tripoli, Lebanon, vol. 16, no. 01, 2026, p. 82

⁹ Mohamed Zerghoun and Toufik Obeidi, "E-Learning at Algerian Universities Between the Imperative of Digital Transformation and Implementation Challenges," *Algerian Journal of Public Finance*, vol. 15, no. 02, 2025, p. 334

¹⁰ Ourida Khouni and Halim Azzaz, "Digital Education as an Alternative to Traditional Education: A Reading in Concept and Importance," *Journal of Human and Social Sciences*, vol. 11, no. 2, 2026, p. 533

¹¹ Mohamed Zerghoun and Toufik Obeidi, "E-Learning at Algerian Universities Between the Imperative of Digital Transformation and Implementation Challenges," *Algerian Journal of Public Finance*, vol. 15, no. 02, 2025, pp. 336, 339

- **Blended Learning:** This approach combines traditional face-to-face instruction with e-learning by integrating various digital media and technologies with in-person interaction between teachers and students. It aims to benefit from the advantages of both approaches by providing flexibility in learning and contributing to the development of learners' cognitive, skill-based, and affective competencies while maintaining human relationships within the educational process. It also makes it possible to overcome some difficulties associated with limited technological resources, particularly in educational environments with limited resources.

Blended learning takes various forms, as it may involve combining different online technological media, diverse learning methods and strategies, or educational technology with traditional teaching. It may also integrate individual learning with collaborative learning. Furthermore, it relies on both synchronous and asynchronous communication tools, including face-to-face instruction, printed and electronic educational materials, online learning, digital collaborative learning, electronic knowledge management, and mobile learning.

There are several models for implementing blended learning, among the most prominent of which is the **Rotation Model**, which involves learners moving between different learning stations that combine e-learning and traditional instruction. This model includes station rotation, lab rotation, individual rotation, and the flipped classroom. Another model is the **Self-Blended Model**, which allows students to select certain online courses while continuing to study other courses through traditional methods. In addition, the **Flex Model** is based primarily on online learning, with direct support from the teacher provided according to learners' needs. The **Enriched Virtual Model**, meanwhile, combines e-learning with face-to-face learning experiences to enhance understanding and practical application and provide opportunities for direct interaction.

Accordingly, e-learning, in its various forms and applications, represents a significant transformation in contemporary educational practices, as it enables the diversification of learning methods, increases flexibility, and facilitates the use of technology to achieve educational objectives that align with the demands of the digital age.

E-learning contributes to ensuring the continuity of the educational process by providing flexible learning environments that are not constrained by time or place, allowing learners to continue acquiring knowledge and skills under different circumstances. It also helps broaden access to knowledge resources by making digital educational content and resources available through online platforms, enabling learners to benefit from them at any time and from different locations. Furthermore, e-learning helps address the demands of learning in the modern digital environment by employing technological tools and developing learning methods in line with accelerating digital transformations. In doing so, it enhances learner autonomy and the ability to interact with educational content and construct knowledge in a more flexible and effective manner.

Third: Artificial Intelligence Governance: Concept and Importance in the Educational Environment

Artificial intelligence governance refers to a set of frameworks, rules, and standards that regulate the deployment of artificial intelligence (AI) technologies and ensure their responsible use, thereby ensuring that the decisions they produce do not conflict with the principles of transparency, fairness, and respect for human rights. Governance also encompasses oversight and monitoring mechanisms designed to manage potential risks, such as algorithmic bias, privacy violations, and the misuse of these technologies, while promoting innovation and strengthening trust in artificial intelligence applications.¹²[i]

¹² Ismail Fridjat, "Governance of the Use of Artificial Intelligence," *Journal of Rights and Freedoms*, vol. 13, no. 02, 2025, p. 413

It is also defined as an integrated system of rules, policies, and practices that regulates the deployment of artificial intelligence technologies within educational institutions, ensuring that their use aligns with institutional visions and strategic objectives and that they are utilized in a responsible, safe, and sustainable manner.¹³[ii]

Artificial intelligence governance is based on a set of principles, including the following:

- **Transparency:** Transparency is one of the most prominent principles of artificial intelligence governance. It requires AI systems to disclose how they operate and make decisions in order to ensure trust and credibility.
- **Accountability and Responsibility:** Artificial intelligence governance requires the establishment of clear and effective mechanisms for accountability regarding decisions and actions resulting from the use of these technologies, particularly when they have a direct impact on individuals and communities. These mechanisms should include legal and administrative frameworks that ensure continuous oversight and promote the responsible use of artificial intelligence, thereby reducing potential risks and ensuring that its applications comply with the principles of transparency, fairness, and rights protection.
- **Data Management:** Artificial intelligence governance involves managing data effectively to ensure the protection of personal and sensitive information and to verify that data are used in accordance with applicable laws and standards.¹⁴[iii]

Accordingly, artificial intelligence governance should not be viewed merely as a set of regulatory restrictions, but rather as an integrated framework aimed at guiding the development and use of this technology in a responsible manner. This perspective emphasizes that the future success of artificial intelligence governance depends on its ability to combine risk preparedness, regulatory flexibility, and international cooperation, thereby maximizing potential benefits and minimizing possible adverse effects.

Artificial intelligence governance is becoming increasingly important as a comprehensive global strategic imperative, providing a necessary framework for ensuring that these technologies are deployed in ways that serve the interests of individuals, institutions, communities, and states. Governance is not limited to regulating the use of artificial intelligence; it also contributes to directing it toward achieving sustainable human value and promoting innovation in a responsible and safe manner. From this perspective, human beings constitute a central consideration in shaping the future of advanced technologies. This necessitates the adoption of sound approaches grounded in awareness and responsibility, while maintaining a balance between technological development and the protection of individual, societal, and national interests, thus ensuring that these considerations are incorporated into future development priorities.

Section Two: Contributions of Artificial Intelligence Governance to Enhancing the Quality of E-Learning

Artificial intelligence has become one of the fundamental components in the development of e-learning environments, particularly with the growing spread of generative artificial intelligence applications, which have opened up new possibilities for content production, learner data analysis, and support for teaching and assessment processes. However, realizing genuine educational value from these applications depends not merely on possessing modern technologies, but also on establishing a governance framework that guides their use and ensures their alignment with educational objectives and the ethical dimensions of the educational process. In this context, UNESCO emphasizes that the integration of artificial intelligence into

¹³ Messaouda Touamdia and Bachir Amara, "Artificial Intelligence Governance as a Mechanism for Enhancing E-Learning," *Journal of Money and Business Economics*, vol. 08, no. 02, 2024, p. 451

¹⁴ Loulouth bint Saleh Al-Farraj, "Enabling Artificial Intelligence to Enhance Smart Governance and Improve the Efficiency of Higher Education Management," *Journal of Human Sciences at the University of Hail*, vol. 02, no. 30, 2026, p. 103

education should be based on the principles of responsibility, transparency, and respect for learners' rights, thereby enabling its potential to be harnessed while managing the associated risks.

One of the most important contributions of artificial intelligence governance is improving the quality and ensuring the reliability of digital educational content. Regulatory frameworks help establish standards for evaluating content generated by intelligent systems and verifying its accuracy and suitability for the educational context. As artificial intelligence tools become increasingly used to develop educational resources and provide assistance to learners, the need for monitoring mechanisms becomes essential to ensure that digital outputs support learning rather than serve as a source of inaccurate or inappropriate information¹⁵

Governance also contributes to strengthening teachers' roles and developing their teaching practices within the e-learning environment. Artificial intelligence should not be viewed as a substitute for teachers, but rather as a tool that enables them to perform their duties more efficiently. It helps analyze students' performance, identify learning difficulties, and develop activities and content that correspond to learners' needs. It can also reduce some administrative burdens associated with grading and monitoring, allowing teachers to devote more time to the creative and interactive aspects of the educational process.

The importance of governance is also evident in supporting personalized learning and improving the learner experience. Artificial intelligence applications can analyze learning patterns and user behavior to provide educational content and learning pathways that are better suited to learners' abilities and needs. Studies have shown that AI-based educational systems rely on analytical models of learners, knowledge, and instruction to improve interaction and provide learning experiences that better accommodate individual differences among students.

Furthermore, protecting learners' data and ensuring the security of the digital educational environment constitute key areas highlighting the importance of artificial intelligence governance. The reliance of intelligent educational platforms on collecting and analyzing large volumes of data necessitates the establishment of clear rules governing how such data are used and protected, thereby strengthening learners' and educational institutions' trust in these technologies. In this regard, UNESCO emphasizes the need to consider privacy and responsibility when using artificial intelligence in education and research

Governance also helps promote fairness and mitigate the risks of algorithmic bias, as intelligent systems may sometimes reflect biases present in the data on which they rely. Therefore, establishing mechanisms for continuous monitoring and evaluation helps ensure a fairer use of these tools while taking into account the diversity of learners' needs and circumstances

The effectiveness of artificial intelligence governance is not limited to the technological dimension; it is also linked to preparing the organizational and institutional environment required for the transition to e-learning. The success of digital education requires not only the provision of technological resources but also appropriate legislation, the training and preparation of those involved in the educational process, and greater awareness of the use of modern technologies. These requirements help ensure the sustainability and effectiveness of digital transformation.¹⁶

Accordingly, artificial intelligence governance can be regarded as a central factor in enhancing the quality of e-learning, as it provides a framework for moving beyond the mere use of technology toward its strategic deployment in support of educational objectives. It contributes to striking a balance between harnessing the capabilities of artificial intelligence to improve teaching

¹⁵ UNESCO, *Guidance for Generative AI in Education and Research* (Paris: United Nations Educational, Scientific and Cultural Organization, 2023)

¹⁶ Sara Khaldi, "The Role of Artificial Intelligence Applications in Developing and Improving E-Learning in Higher Education Institutions," *Ara'a Journal of Economic and Administrative Studies*, vol. 07, no. 01, 2025, p. 74

and learning and ensuring its responsible use in ways that preserve the quality of the educational process and the rights of all stakeholders involved

Section Three: Challenges of Implementing Artificial Intelligence in E-Learning

Despite the potential of artificial intelligence to develop e-learning and improve its practices, its integration into the educational environment is not without challenges that may limit the effectiveness of its use and the achievement of its intended objectives. These challenges are not confined to the technical aspects associated with the use of digital tools and systems; they also extend to ethical, pedagogical, and organizational dimensions, which interact with one another and require educational institutions to address them in an integrated manner. The most significant of these challenges can be highlighted as follows:¹⁷[i]

At the ethical level, ensuring academic integrity and the credibility of online assessment emerges as one of the most prominent challenges, particularly given the rapid development of generative artificial intelligence tools and their increasing use by learners, which raises concerns about their potential use for cheating and academic plagiarism. These developments also raise questions about the extent to which traditional assessment methods can accurately and fairly measure learners' actual academic achievement. Additional concerns relate to the protection of personal data and learners' privacy, particularly when digital monitoring systems and identity verification technologies are used during online examinations.

At the technical level, the main difficulties include technical failures, incompatibility between systems and equipment, and limited access to educational platforms. These factors may hinder the effective use of modern technologies in distance-learning environments. Related to these difficulties are financial and organizational challenges concerning the need to provide the resources and capabilities required to operate and maintain digital systems and ensure their continued and efficient use.

At the pedagogical level, the rapid development of artificial intelligence necessitates reconsidering existing teaching and assessment practices to ensure that they are suited to the nature and requirements of the digital environment. In this context, a major challenge lies in training teachers and course designers and developing their competencies in using artificial intelligence tools, alongside improving teaching methods, assessment approaches, and evaluation criteria to ensure alignment between educational objectives and the technologies employed. Simply making these tools available is not sufficient to guarantee their effectiveness unless their use is accompanied by appropriate pedagogical planning that takes learners' needs into account and preserves the quality of learning outcomes.

Section Four: Requirements for Developing an Effective Artificial Intelligence Governance Model in E-Learning

Developing an effective artificial intelligence governance model in e-learning requires the adoption of an integrated framework based on the principles of regulation, transparency, and accountability. A risk-based approach is one of the fundamental pillars of this model, as it makes it possible to determine the level of impact of intelligent systems used in the educational environment, particularly those associated with assessing learners' performance, analyzing their data, or providing recommendations that may influence their educational pathways.¹⁸

The importance of enhancing transparency and the explainability of decisions generated by artificial intelligence systems is also evident, as this ensures that all relevant stakeholders,

¹⁷ Omar Oulad Ebrahim, Abderrahim El Mhouti, and Mostafa Allaoui, "Assessing Distance Learning in a Digital Environment in the Era of Artificial Intelligence: Systematic Review," *Journal of Educators Online* (2026): 22–28, <https://eric.ed.gov/?id=EJ1499134>

¹⁸ European Union. (2024). *Artificial Intelligence Act: Regulation Laying Down Harmonised Rules on Artificial Intelligence (Artificial Intelligence Act)*. European Parliament and Council of the European Union

including learners, teachers, and administrators, can understand how these systems operate and recognize their limitations. This requirement extends beyond the technical dimension to include effective human oversight that defines responsibilities and prevents complete reliance on automated decisions, while providing clear mechanisms for review and correction when necessary.

Furthermore, data governance constitutes a fundamental pillar in the successful implementation of artificial intelligence applications in e-learning. This involves ensuring the quality and protection of the data used and respecting learners' privacy. Data integrity and accuracy are essential conditions for reducing errors and biases that may affect the outputs of intelligent systems.¹⁹

Keeping pace with the rapid development of artificial intelligence in e-learning also requires reconsidering curricula, teaching methods, assessment approaches, and evaluation criteria to facilitate a transition from traditional pedagogical alignment to technological and pedagogical alignment consistent with the requirements of the modern digital environment. Educational institutions must also fulfill their role by providing the training and resources necessary to enable teachers and course designers to develop their assessment practices and adapt them to these developments. At the same time, developers of educational technologies and artificial intelligence tools must take pedagogical and ethical requirements into account when designing these tools. Comprehensive assessment approaches and academic integrity policies should also be adopted, taking into consideration the diversity of artificial intelligence applications rather than focusing exclusively on language models²⁰

Developing an effective artificial intelligence governance model in e-learning also requires integrated strategies that include improving digital infrastructure, training teachers and equipping them with the skills needed to deploy these technologies, and establishing flexible educational policies that support innovation. These strategies must also address ethical considerations and ensure the responsible use of artificial intelligence, thereby enhancing e-learning quality and responding to the demands of the digital age²¹

Accordingly, effective artificial intelligence governance in e-learning should not focus solely on technical aspects; rather, it should encompass an integrated system of policies and procedures combining risk management, accountability, transparency, and rights protection. This integration contributes to the responsible and sustainable use of artificial intelligence, thereby enhancing educational quality and maintaining public trust in intelligent technologies.

Conclusion

The use of artificial intelligence in e-learning has become one of the most prominent manifestations of the digital transformation taking place in the education sector, given the opportunities its applications offer for developing educational content, personalizing learning pathways, improving interaction and assessment, and responding to learners' diverse needs. However, benefiting from these opportunities cannot be achieved merely by integrating intelligent technologies into educational platforms; rather, it depends on institutions' ability to establish an organizational and pedagogical environment that ensures their appropriate use and directs them toward achieving the intended educational objectives.

In light of the issues examined throughout the different sections of this study, it is evident that artificial intelligence governance represents an important approach to enhancing the quality of e-

¹⁹ European Union, *Artificial Intelligence Act*, 2024.

²⁰ Oulad Ebrahim, El Mhouti, and Allaoui, "Assessing Distance Learning in a Digital Environment," 28.

²¹ Amal Mohamed Haidar, "Artificial Intelligence as an Approach to Reshaping the Future of Education in the Era of Digital Transformation," *Research and Education Journal*, National Institute for Research in Education, University of Tripoli, Lebanon, vol. 16, no. 01, 2026, p. 95.

learning, as it provides principles and mechanisms that help regulate the use of intelligent systems, strengthen transparency and accountability, protect learners' data, and mitigate risks associated with algorithmic bias and the misuse of technology. The effectiveness of such governance also depends on its ability to strike a balance between the requirements of technological development and pedagogical and ethical considerations, while ensuring continued human oversight of decisions that may affect learners' educational pathways.

Furthermore, the challenges associated with implementing artificial intelligence in e-learning, whether related to assessment credibility and academic integrity, technical and financial difficulties, or the need to develop the competencies of teachers and course designers, demonstrate that the transition toward intelligent education should not be reduced to acquiring modern tools and software. Instead, it requires the adoption of a comprehensive institutional vision based on advance planning, clearly defined responsibilities, risk management, and continuous assessment of the extent to which these applications are appropriate for educational objectives.

Accordingly, the genuine contribution of artificial intelligence governance to e-learning quality lies in moving from unregulated technological use toward informed and responsible institutional deployment, in which technology serves as a means of improving learning rather than an end in itself. The success of this approach remains dependent on integration among regulatory frameworks, digital readiness, human resource development, and the preservation of the human dimension of the educational process. Such integration makes it possible to build a more reliable and flexible e-learning environment that is better equipped to adapt to future transformations.

Building on the theoretical and analytical examination of the study topic, and in light of the challenges and requirements discussed, a number of recommendations can be proposed to support artificial intelligence governance and enhance e-learning quality, as follows:

- Establish a clear institutional framework for artificial intelligence governance in educational institutions that defines the rules governing the use of intelligent applications and the responsibilities of relevant stakeholders, ensuring alignment with educational objectives and ethical standards.
- Strengthen data protection and digital privacy by adopting clear policies regulating the collection, processing, and storage of learners' data, while ensuring transparency regarding how such data are used and which parties are authorized to access them.
- Invest in human resource development by organizing ongoing training programs for teachers, course designers, and administrative staff, enabling them to use artificial intelligence applications effectively and with an informed understanding of their limitations and risks.
- Develop the digital infrastructure of educational institutions and provide the technical and financial resources necessary to ensure the continuous operation of intelligent systems, while taking into account disparities in digital capabilities among institutions and learners.
- Reconsider teaching methods and online assessment practices in line with developments brought about by generative artificial intelligence, while establishing clear rules governing its use in completing learning activities, assignments, and examinations in order to preserve academic integrity and the credibility of learning outcomes.
- Adopt periodic evaluation mechanisms for artificial intelligence applications before their integration into the educational environment and throughout their use, in order to verify the quality, accuracy, and suitability of their outputs and identify potential risks associated with algorithmic bias or unfair automated decisions, while ensuring the possibility of review and human intervention when necessary.

- Encourage future empirical studies to measure the level of adoption of artificial intelligence governance within higher education institutions and investigate the impact of implementing its mechanisms on e-learning quality from the perspectives of teachers, students, and administrative staff.

Ultimately, the future challenge lies not merely in the extent to which artificial intelligence applications become widespread within educational institutions, but also in how they are managed and directed to serve educational quality, protect learners' rights, and make technological innovation a driving force for educational development within a framework of trust, responsibility, and sustainability.

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