

Towards Better Utilization of Artificial Intelligence Technologies in Achieving Quality Educational Processes in Higher Education Institutions - A Situational Analysis with a Forward-Looking Perspective –

نحو استخدام أفضل لتقنيات الذكاء الاصطناعي في تحقيق جودة العملية التعليمية بمؤسسات التعليم العالي – تحليل
للوضع برؤية استشرافية –

Vers une meilleure utilisation des technologies de l'intelligence artificielle pour
améliorer la qualité du processus éducatif dans les établissements d'enseignement
supérieur - Analyse de la situation avec une perspective prospective -

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ملخص:

هدفت هذه الورقة البحثية للتعرف على استخدامات تقنيات الذكاء الاصطناعي في تحقيق جودة العملية التعليمية على مستوى مؤسسات التعليم العالي الجزائرية وذلك من خلال رؤية استشرافية، تبعاً لما يشهده العالم حالياً من تطورات هائلة في جميع المجالات وفي جميع المؤسسات، حيث سعت المؤسسات الجامعية لتطوير العملية التعليمية وتحديث أساليبها والتخلي عن التقليدية المتبعة في طرق التدريس. من خلال العمل على توفير بيئة تنظيمية لتفعيل المستجدات الرقمية الحالية خاصة فيما يتعلق بالتقنيات الحديثة المبنية على الذكاء الاصطناعي كونه تقنية تحاكي تقريباً الذكاء البشري على أداء المهام وتوفير الوقت والجهد والتكلفة كما منحت الدولة الجزائرية عن طريق وزارة التعليم العالي والبحث العلمي أهمية بالغة للاستفادة من تقنيات الذكاء الاصطناعي بالجامعة الجزائرية، ضمن إطار تعميم الرقمنة في القطاع على جميع مستوياته، من خلال تطوير الكفاءات العلمية والقدرات المحلية في مجال الذكاء الاصطناعي، في محاولة لخلق ثقافة الذكاء الاصطناعي، بهدف تحقيق مخرجات تعليمية ذات جودة بالتوازي مع مساهمة التطورات في المجال التعليمي وخاصة الرقمي.

الكلمات المفتاحية: تقنيات الذكاء الاصطناعي، الجودة، العملية التعليمية، مؤسسات التعليم العالي.

Abstract This research paper aims to explore the use of artificial intelligence (AI) technologies in enhancing the quality of the educational process within Algerian higher education institutions through a forward-looking perspective. This is in response to the current monumental developments occurring globally across all sectors and institutions, where universities are striving to improve the educational process, modernize their methods, and move away from traditional teaching practices. The focus is on creating an organizational environment that activates current digital advancements, particularly with respect to modern technologies based on AI, which mimic human intelligence in performing tasks while saving time, effort, and costs. The Algerian government, through the Ministry of Higher Education and Scientific Research, has placed significant importance on leveraging AI technologies within Algerian universities, as part of the broader initiative to digitize the sector at all levels. This involves developing scientific competencies and local capacities in the field of AI, aiming to foster a culture of artificial intelligence to achieve quality educational outcomes that keep pace with advancements in education, particularly in digital domains.

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Keywords: Artificial Intelligence Technologies, Quality, Educational Process, Higher Education Institutions.

Résumé Cette recherche vise à explorer l'utilisation des technologies de l'intelligence artificielle (IA) pour améliorer la qualité du processus éducatif au sein des établissements d'enseignement supérieur algériens à travers une perspective prospective. Cela fait écho aux développements monumentaux actuellement observés à l'échelle mondiale dans tous les secteurs et institutions, où les universités s'efforcent d'améliorer le processus éducatif, de moderniser leurs méthodes et de s'éloigner des pratiques d'enseignement traditionnelles. L'accent est mis sur la création d'un environnement organisationnel qui active les avancées numériques actuelles, en particulier en ce qui concerne les technologies modernes basées sur l'IA, qui imitent l'intelligence humaine dans l'exécution de tâches tout en économisant temps, efforts et coûts. Le gouvernement algérien, par le biais du Ministère de l'Enseignement supérieur et de la Recherche scientifique, accorde une importance significative à l'exploitation des technologies IA au sein des universités algériennes, dans le cadre de l'initiative plus large de numérisation du secteur à tous les niveaux. Cela implique le développement des compétences scientifiques et des capacités locales dans le domaine de l'IA, visant à favoriser une culture de l'intelligence artificielle afin d'atteindre des résultats éducatifs de qualité, en phase avec les avancées dans le domaine de l'éducation, notamment dans les domaines numériques.

Mots clés : Technologies de l'intelligence artificielle, Qualité, Processus éducatif, Établissements d'enseignement supérieur.

Introduction:

E-learning represents a modern revolution in educational methods and the delivery of information to learners. It utilizes modern communication tools such as computers, networks, and multimedia, including audio, video, graphics, search mechanisms, and library access, to deliver information effectively, with minimal effort and maximum benefit.

E-learning is one of the fastest-growing fields due to scientific and technological developments and the increasing demand for integrating technology in education. This success is attributed to developers of advanced educational and scientific technologies, which encompass educational methods and practices. The absence of these resources can hinder an instructor's ability to convey knowledge effectively, even if they possess scientific competence or professional expertise in their field (Subhi et al., 2021, p. 12). In this context, a study conducted by Nasira Al-Baraka confirmed that AI, as a modern technological approach, has indeed contributed to enhancing e-learning in higher education by analyzing student data and predicting their performance (Al-Baraka, 2024, pp. 79-92). Consequently, the strategies employed in teaching and learning using artificial intelligence (AI) can be seen as processes that involve the use and application of various AI technologies. This is foundational for developing educational programs capable of interacting with learners and closely mimicking their abilities in various educational contexts, thereby enhancing learners' skills and facilitating quick achievement of educational objectives. This is in addition to improving the learner's leadership level through self-learning by following the dialogic and educational steps of the subject matter, ultimately leading to self-assessment and self-awareness of their knowledge level.

Currently, an active dynamic in the educational process is centered on expanding the use of modern technological strategies through the improvement of the cognitive connection between teachers and students within an interactive educational framework. Some studies indicate the influence of educational video as a digital educational tool in increasing student engagement in educational

practices, particularly in computational practices, showing that video technology significantly contributes to enhancing problem-solving skills (Urhan, 2024, p. 117).

Regarding the role of artificial intelligence in education, it is crucial to focus on various methods that enable us to utilize AI in preparing educational programs. Consequently, AI has become a strategy widely adopted across nearly all fields, particularly in education. This was confirmed by the study conducted by Kebdani and Baddan (2021), which indicated that the use of AI applications in Algerian higher education institutions has become a priority currently, with an emphasis of 81% amidst economic, social, and scientific conditions.

Thus, national higher education institutions are currently striving to keep pace with the technological and digital information revolution in education. This aligns with the ministry's continuous efforts to implement and generalize such technologies, focusing on developing educational methods and strategies while abandoning traditional teaching approaches. Therefore, all universities aim to achieve a modern digital educational quality, characterized by high-quality educational outputs and the provision of an organizational environment conducive to activating various artificial intelligence techniques, as it offers time, effort, cost efficiency, and is regarded as a contemporary teaching approach.

1. Understanding Artificial Intelligence:

The concept of artificial intelligence refers to technological capabilities designed to develop systems and programs capable of performing tasks reminiscent of human intelligence. AI relies on technologies such as machine learning, data analysis, and artificial neural networks to enable artificial systems to comprehend information and make intelligent decisions (Zidan, 2020, p. 390).

Artificial intelligence has been defined as the science capable of building machines that perform tasks requiring human intelligence. According to David Afore and Edward Feigenbaum, AI is a branch of computer science aimed at designing intelligent systems that exhibit behaviors characteristic of human intelligence. Martin Wyke defines it as the capability of machines to perform tasks that necessitate human-like intelligence, such as logical reasoning, learning, and adaptability. Patterson describes it as a field within computer science that focuses on studying and constructing computational systems exhibiting certain forms of intelligence, which are capable of drawing significant inferences regarding specific problems and understanding natural languages or perceiving stimuli, among other functions that typically require human intelligence.

From these definitions, it can be stated that artificial intelligence is a domain of computer science concerned with creating technological systems that possess the ability to learn, think, and make decisions in a way that resembles human beings, including capabilities like image and text recognition, interpretation, and decision-making based on available data.

2. Digital Transformation:

Digital transformation refers to the changes brought about by digital technology that affect all aspects of human life. It can be defined as the use of technology to enhance performance or access for organizations, utilizing digital advancements such as analytics, mobility, social media, and smart devices, while also improving the use of traditional techniques like enterprise resource planning, and altering customer relationships and internal processes.

3. Methods of Artificial Intelligence:

Search and Mining: Utilizing algorithms and computational methods to explore and mine solutions for problems and discover new knowledge.

Machine Learning: Developing models and systems that benefit from past data and experiences to enhance their performance over time.

Automated Reasoning: Using logical rules and algorithms to infer information and make logical decisions.

Natural Language Processing: Developing systems capable of understanding and producing natural language similarly to humans.

Computer Vision: Developing techniques that enable computers to understand and analyze images and videos.

Deep Learning: Employing artificial neural networks to learn and comprehend complex representations of data, permitting artificial intelligence to achieve diverse and effective applications in fields such as medical diagnosis, machine translation, and big data analysis (Zidan, 2020, pp. 391-392).

4. Characteristics of Artificial Intelligence:

Artificial intelligence possesses several characteristics:

It can be used to solve some problems in the absence of complete information.

It has the capability of thinking and perception and the ability to acquire knowledge and apply it.

It can learn and understand from past experiences.

It utilizes previous experiences and employs them in new situations.

It has the ability to respond quickly to new situations and circumstances.

It deals with difficult and complex cases.

It can handle ambiguous situations in the absence of information.

It has the capacity for visualization and creativity and the ability to perceive and understand visual matters.

5. Importance of Artificial Intelligence in Higher Education:

Experts unanimously agree on the significance of artificial intelligence in education in the 21st century due to its numerous advantages, including:

The ability to learn (Machine Learning), organize and understand sciences (Knowledge Representation), analyze language (NLP), understand sound (Speech Recognition), comprehend and analyze images and videos (Computer Vision), solve problems creatively, engage socially and emotionally, control robots, and exhibit general intelligence (AGI), encompassing all of the above.

Explaining academic subjects and providing immediate feedback on answers.

Offering academic advice to students regarding the best departments to join in college or study subjects that align with their cognitive abilities.

Reaching a large number of students, making classrooms accessible to everyone, especially if they speak different languages or suffer from hearing disabilities (Rizq, 2021, p. 574).

6. Importance of Using Artificial Intelligence in Scientific Research:

The contribution of artificial intelligence to our daily lives has noticeably increased over time, permeating various fields of human endeavor. This intelligence is evolving and possesses vast potential, extending its benefits beyond technology and engineering to applications in sciences and mathematics, particularly in the social aspect. AI enhances social stability and bridges the digital gaps

that appear, facilitating access to an inclusive society. The world has recently witnessed applications of artificial intelligence that were once thought to be purely fictional, manifesting in many life aspects, such as medicine and public health, as well as in various other fields.

This status of artificial intelligence qualifies it to be an important driver, especially in education, by meeting the requirements of the labor market and providing specialists with diverse expertise to develop programs and policies aimed at improving high-quality outputs that fulfill set goals and enhance the quality of services offered. Numerous experiences have confirmed the importance of enhancing artificial intelligence and demonstrated the significance of promoting its use widely and sustainably. It is crucial for stakeholders in AI applications—from designers and developers to users to evaluate these applications transparently and impartially during real use to determine whether artificial intelligence fully meets the required expectations from one side, while its system design aligns with current transformative efforts.

In this context, UNESCO and the United Nations Educational, Scientific and Cultural Organization established a digital repository accessible via the internet connected to artificial intelligence and other essential education sources related to digital skills, providing educational services and training aimed at enhancing artificial intelligence skills. This initiative facilitates the preparation of competent trainers and offers coordinated resources that are freely accessible, reaching a global level. The goal of artificial intelligence is to develop systems based upon it. Thanks to technological advancements, the learning and education sectors have witnessed significant changes in recent years, with intelligence potentially matching or surpassing human intelligence (Abdul Razak Ali and Taha Yassin, 2020, p. 265).

7. Artificial Intelligence Strategy in Achieving Quality Education in Higher Education Institutions:

In recent years, Algeria has sought to develop smart technologies, especially in the higher education sector, by establishing specialized higher schools dedicated solely to artificial intelligence. Recently, the Minister of Higher Education and Scientific Research, Kamel Bedraï, inaugurated the Higher School of Artificial Intelligence in Algiers and the Artificial Intelligence House at the University of Algiers 2. Furthermore, state-of-the-art technologies have been introduced into laboratories and research centers, reflecting Algeria's significant interest in such strategies within the educational process to improve the quality of outcomes.

In the same context, the Minister oversaw the launch of the Year of Artificial Intelligence in 2023, aiming to generalize this technology across various institutions within the sector. He emphasized that artificial intelligence would be utilized in three main areas: teaching artificial intelligence, learning artificial intelligence, and preparing with artificial intelligence, which will involve training experts in the field. Numerous studies and research at the national level have also concluded the necessity of providing artificial intelligence applications in higher education and scientific research institutions, given the quality in teaching and high scientific efficiency these applications offer (Jaqrif, 2024, pp. 469-458).

- Benefits of AI Applications:

Smart applications enable learners to break free from a one-size-fits-all teaching approach. For example, smart learning applications and diverse educational platforms are now aligned with each student according to their interests, inclinations, needs, and capabilities.

There is an opportunity for self-learning and development through AI programs, such as logic education, self-correction, and self-programming.

Establishing an organized knowledge database allows information to be stored efficiently, facilitating access to books or other information sources.

- Among the AI applications that can benefit the educational process, we mention:

Curriculum and Course Planning: Educators use AI to design educational courses for students, aimed at improving their results and aligning with their requirements. Prominent examples include ChatGPT, which can generate lesson plans upon receiving questions and information about the desired topic.

- Task Management and Automation: Through AI applications that employ machine learning algorithms, instructors can automate manual processes, reducing their workload and saving time and effort. Activities such as assignment assessment, exam grading, report preparation, and others are automated.

- Smart Content: Various companies and digital platforms are currently focusing on creating smart content by transforming educational books into smart books closely related to the educational process. Currently, efforts are underway to create smart content from digital guides to textbooks. For instance, Inc Technologies Content, a company specializing in AI development for educational processes, has developed a set of smart content services for secondary and post-secondary education, utilizing AI techniques to disseminate textbook content through a guide called the Smart Study Guide, which includes chapter summaries, practice tests, and multiple-choice questions. Summaries are specifically highlighted for each chapter, archived into a digital collection, and made available on Amazon. Other companies are creating complete smart content platforms. For example, Learning Netex allows teachers to design digital curricula and content across devices, incorporating multimedia like video and audio, as well as self-assessment or online assessments. They provide a dedicated educational cloud platform tailored for modern workplaces, enabling employers to design specialized educational systems with applications, simulations, virtual courses, self-assessments, video conferencing, and other tools (Yahya, 2020, pp. 300-301).

8- Challenges Facing the Use of Artificial Intelligence in Higher Education:

Both Al-Qarni (2012) and Sahtout (2012) highlight several challenges in applying artificial intelligence (AI) within educational institutions in Algerian higher education, among which are the following:

- Lack of specialized personnel.
- Inadequate infrastructure in terms of wireless communications, computers, and software.
- The need for retraining teachers and trainers and developing their traditional skills to align with learning technologies and computer usage.
- Prolonged reading from screens can cause eye strain.
- Smartphones could facilitate cheating.
- There is an advantage for professionals adept in technology over other students.
- Designing and preparing programs and content (Zrouqi & Falteh, 2020, p. 07).
- AI remains an emerging technology that is not yet widely disseminated globally, especially in developing countries, leading to limited use in education. This represents the most significant challenge facing AI aimed at education, stemming from a deeply rooted belief in the importance of traditional schooling based on physical presence and conventional assessments, coupled with a shortage of specialists in developing such smart programs and

platforms. Other challenges that hinder the effective deployment of AI applications in enhancing the educational process include:

- Lack of a clear and organized policy for implementing AI in teaching and learning processes.
- Unawareness of successful experiments in using AI technologies that might promote their application.
- Absence of a clear vision and strategy to ensure the integration of AI applications in teacher training programs.
- Increased teaching burdens on educators, hindering the application of AI technologies.
- A noticeable deficiency in employing AI technologies, as some view it skeptically due to the perception that machines cannot replace human capabilities, reflecting a narrow understanding of the potential for technology.
- Deep-seated beliefs among educational stakeholders that AI technologies are difficult to use and require more effort and time.
- Resistance to change within the educational process, especially regarding digitization and AI technologies, is a prevalent issue among many involved, clinging only to traditional, classical methods.
- Weak infrastructure and technological support for implementing AI technologies (Baha, 2024, p. 123).
- High financial costs associated with these technologies, along with the need for high-quality devices and software, requiring large datasets and the creation of learning and operational algorithms.
- Ongoing curriculum improvement and student preparation.
- Inequity in opportunities to apply AI technologies, potentially leading to an educational gap.
- Some learners' lack of response to and interaction with AI technologies, coupled with their weak problem-solving skills when using AI tools, necessitating intensive training on how to use such software and devices.

Conclusion:

Undoubtedly, one of the critical areas where artificial intelligence is being applied is in education in general, and higher education and scientific research in particular, within Algerian universities. AI technologies have permeated various institutes, universities, and educational institutions, gradually being used to convey scientific knowledge and acquire skills in a new and innovative manner. We are now witnessing contemporary concepts and new educational methods, such as digital education, e-learning, and smart education. The integration of artificial intelligence in education and scientific research has become a strategic necessity for universities, particularly concerning e-learning, enabling both educators and students to engage with and benefit from the technological advancements in the educational field. This fosters improvement in their levels and educational outcomes to achieve a high-quality educational process that aligns with the developments in technology. Thus, it can be asserted that AI technologies have indeed proven their effectiveness in the field through the changes observed in scientific research.

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