

RESEARCH ARTICLE	Artificial Intelligence Applications between Theoretical Review and the Difficulty of Implementation: Higher Education Institutions as a Model	
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Abstract		
This research work aims to shed light on the most important applications of artificial intelligence designed to improve the educational process in the higher education sector in its various specializations and branches, especially the literary ones, as well as to address the challenges that hinder the embodiment and implementation of these applications on the ground and the technical and economic difficulties they face, etc., which limit their effectiveness and their role in developing the educational process within this sensitive sector.		
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Introduction

In recent years, the world has witnessed a distinct technological revolution in the field of artificial intelligence, as its effects have appeared in most areas of life. There is hardly any area of our daily lives that is devoid of the use of these applications, whether in medicine, engineering, industry, education, and others.

The university, like other fields, has not been spared from this rapid technological invasion, which has begun to create an important qualitative leap in the performances of all components of the educational process, and in the way they deal with modern technologies, to the point where there has been an increased fear of artificial intelligence with its various applications replacing the professor, and digital programs replacing current curricula and cognitive content.

In light of this, the main question came as follows:

What are the most important applications of artificial intelligence available in higher education, and what are the most important challenges and difficulties that prevent their implementation?

This main question has sub-questions, which are:

- What is artificial intelligence?
- How did it appear and develop?
- What are its characteristics and objectives?
- What is the relationship between artificial intelligence and education in general, and higher education in particular?
- What are its most prominent applications in this field?
- What are the challenges facing its embodiment in this field?

1) What is Artificial Intelligence?

A. The Concept of Artificial Intelligence: It is a branch of computing that deals with intelligent elements, patterns, and applications that interact and interrelate like humans, and can even perform tasks and functions that usually require human intelligence.

It is a term consisting of two words: intelligence and artificial intelligence; intelligence means: "the ability to understand new and changing conditions or situations, i.e. the ability to perceive, understand and learn new conditions or situations. The keys to intelligence are perception, understanding and learning." As for the word artificial, it is related to the verb "to make" or "to fabricate", and the word is applied to: "all things that arise as a result of the activity or action that is done through the fabrication and formation of things, as distinct from things that already exist and are generated naturally without human intervention. On this basis, artificial intelligence generally means the intelligence that is made or fabricated by humans in a machine or computer, and thus artificial intelligence is the science of modern machines."¹

Artificial intelligence has many definitions, including:

Artificial intelligence is defined as: "The efforts of computer-based systems to give them the ability to perform functions that mimic those performed by humans." The human mind in terms of learning languages, completing administrative tasks, the ability to think, learn, understand and apply knowledge. Artificial intelligence is related to multiple fields such as computer science, psychology, mathematics, linguistics and knowledge engineering.²

It is also known as: "The field of computer science concerned with the design of intelligent computer systems, structures that display the characteristics of intelligence in human behavior."³

"Artificial intelligence is a field within computer science focused on imbuing systems with the ability to perform functions associated with human thought processes. This involves developing computational methods that enable systems to reason, learn, and solve problems. AI seeks to create systems capable of intelligent behavior, extending their capabilities to address complex challenges in various domains."⁴

Hence, artificial intelligence is a set of technologies and methods that aim to enable computers with their various systems to perform multiple (intelligent) tasks by analyzing data, deducing patterns, and making appropriate decisions based on that.

Artificial intelligence is an intelligence created and invented by humans who are responsible for giving the computer a set of mechanisms and programming it to perform some tasks that are often described as intelligence and are close to the...There is no human intelligence, such as: the ability to learn, manage business and make decisions, it is a science based on mathematical rules and software that is assembled in computers that simulate human intelligence.

B. The emergence and development of artificial intelligence: The year 1941 is considered the beginning of the information revolution that resulted in the invention of the first electronic computer, as an American research team was able to develop a computer to decode German military messages, and this was during World War II, inventions followed one after the other during the fifties, that is, the term artificial intelligence appeared in 1951, when a doctoral student in the Department of Mathematics at the University of Bremen named Marvin Minsky (1927-2016) invented the first computer that used artificial neural networks, called SNAK.

John McCarty is one of the most prominent pioneers of this stage, as: "His goal was to exchange views and establish a field that was first called artificial intelligence."⁵This was during the Dartmouth University conference (Dartmouth) in the United States of America in the summer of 1956.

Then came the stage of maturity and development of this science during the sixties and seventies, where efforts focused on strengthening the field of neural networks.

In 1980, a Japanese company designed the first train. (HITACHI) for Sendai area is working automatically, Other inventions that followed include: a high-focus video camera, a smart TV, and electric washing machines. Artificial intelligence has thus entered the industrial field, which has encouraged researchers to develop it from time to time as a result of competition between economic and commercial institutions.

In the 90s and the early twentieth century artificial intelligence has achieved greater successes, as it has become used in extracting data, medical diagnosis and several other fields. This success is due to several factors, the most important of which are: A: Power of big computers today, and more focus to solve specific problems, create new relationships in the field of artificial intelligence and other fields of work on similar problems, and above all, researchers are increasingly adhering to rigorous mathematical curricula and strict scientific standards."⁶

Let us reach our current era, in which we rely on: "reconsidering previous theories or what is known as gathering knowledge to organize it and use it more accurately in our daily lives."⁷

Finally, we conclude that although this science has not reached the required comprehensiveness, especially in developing countries, it has become one of the necessities that we rely on and need in our daily lives in various fields.

C-Features of Artificial Intelligence: Artificial intelligence has a set of characteristics, including:⁸

- Applying artificial intelligence to devices and machines enables them to plan and analyze problems using logic.
- AI-powered devices can understand and analyze inputs well to deliver outputs that meet user needs with high efficiency.
- Recognizing sounds, speech, and the ability to move objects.
- It enables continuous learning where the learning process is automatic and self-directed without being subject to monitoring or supervision.
- It can process the massive amount of information presented to it.
- It can notice and analyze similar patterns in data more effectively than human brains.
- He can find unfamiliar solutions using his cognitive ability.

Dr. Amani Othmania also added that artificial intelligence provides:

- The ability to deal with ambiguous situations when information is absent.
- The ability to use previous and old experiences and employ them in new situations.
- The ability to respond to new situations and circumstances.⁹

Hence, artificial intelligence, with its various and diverse applications, contributes effectively to helping individuals and even compensating them in many of the difficult situations they face.

D-AI Goals: Artificial intelligence (AI) seeks to understand the nature of intelligence itself by creating computer programs that simulate intelligent behavior. AI systems aim to solve problems or make decisions autonomously, often by identifying the appropriate method through deductive reasoning and analysis of diverse data. Rather than relying solely on pre-programmed instructions, these systems learn and adapt, mimicking aspects of human intelligence to address complex challenges.¹⁰

Artificial intelligence also aims to design software capable of performing tasks that would be considered intelligent if done by a human. This includes the ability to draw logical conclusions. By enabling devices to perform such tasks, AI makes them smarter and more beneficial.¹¹

So artificial intelligence came to help and sometimes to compensate the individual in facing some difficult and complex situations.

E-Artificial intelligence applications: Artificial intelligence applications vary according to their areas of use and the purpose each type serves:

- **Expert systems:** It means: "A computer program designed specifically to model the knowledge of the human expert's ability to solve problems. It is then stored in a database related to the field of specialization so that it can be used later in solving problems. It is: "A computer application for making decisions in real life areas."¹²

These systems are designed for use even without experienced experts, particularly in rare specialties. They aim to incorporate expert knowledge into a system that can, in some ways, replace the need for a human expert and facilitate the transfer of expertise to others. Beyond solving problems faster than a human expert, these systems are significant because they integrate knowledge, information technology, and communication networks. This integration produces expert systems characterized by several key features:

- Preservation and accessibility of rare knowledge: They capture and preserve scarce human knowledge and experience, making it readily available for use in specific fields.
- Rapid, knowledge-based solutions: They provide solutions to complex problems based on expertise in a fraction of the time, and can analyze the problem from multiple perspectives.
- Wider access to expertise: They democratize access to rare human expertise by making it available simultaneously in multiple locations.
- Explainable reasoning: They can explain the rationale behind proposed solutions.

- **Symbolic information processing:** They can handle symbolic information like engineering drawings and extract relevant data. By making expertise more accessible within an organization, these systems empower existing experts to achieve better results, allowing them to focus on other critical activities.

These systems were created to help specialists and save time. Their fields are diverse, including: medicine, geology, chemistry, and others.

Neural networks are systems designed to simulate the way the human brain works. They consist of a large number of interconnected processing units, often called neurons or nodes. These units are simple computational elements that, like neurons, store both practical knowledge and experimental information, making it accessible to the user. Neural networks are inspired by the human central nervous system and represent a generalization of mathematical models used to describe neurological processes. In essence, they aim to teach computers a mechanism for thinking.

Robot: Robot technology is considered one of the most advanced artificial intelligence technologies, in terms of applications that provide solutions to problems. It is an electro-mechanical machine that receives commands from a computer attached to it, and performs certain tasks. Artificial intelligence in this field gives the robot the ability to move and understand the environment around it.

- **Natural Language Processing:** It is defined as: "The automatic processing of text written in natural human languages (Arabic, English, French, Chinese, etc.) instead of artificial languages such as programming languages. The purpose of this processing is to try to understand the text. Some call it computational linguistics or natural language engineering."¹³

Natural language processing, then, starts from data containing information organized in a computerized manner, to obtain sentences that are understandable to humans, because the goal in the field of natural language processing is: "to make communication between the computer and the human take place in a natural way, i.e. using human language such as the Arabic language."¹⁴

This is why the field of natural languages is classified under the specialization of computer science and artificial intelligence, and the applications related to this field are considered among the most difficult applications of artificial intelligence.

2) **Higher Education and Artificial Intelligence:** Higher education importance is increasingly growing in most developed and developing societies alike, as university education is the pinnacle of the educational pyramid. Its importance is not limited to being the last stage of the educational system only, but its importance also lies in being one of the vital and effective sectors that contribute to the growth of the national economy and the development of human resources, as it is one of the most important pillars for increasing comprehensive development, due to its role in preparing the intellectual, scientific and professional frameworks that make up society, in addition to its fundamental role in accessing, developing and using knowledge, conducting scientific research and serving society.

Higher education institutions in Algeria are currently facing many challenges. On the one hand, they are trying to keep pace with global scientific and digital developments, which require a review of education and learning systems. On the other hand, they are also under the obligation of raising the efficiency of their members, including students, professors, and administrative systems. This is done by adopting what is called the e-learning system, using artificial intelligence applications, and improving educational quality.

Although artificial intelligence has been introduced to education technologies for some time, its growth was very slow, until the global pandemic emerged in late 2019 and radically changed the education landscape in Algeria, as artificial intelligence applications and technologies became an essential part of the educational process.

The relationship between AI and education includes three areas: learning about AI, preparing for AI, which means enabling citizens to understand its impact on their lives, and the third area is learning with AI, which includes AI-powered tools in classrooms and educational institutions in general, and universities in particular, allowing students to access information faster.

A/ Enhancing the Educational Process Using Applications of Artificial Intelligence in Higher Education:

While artificial intelligence plays a significant role in many fields, its impact on modern education is even more critical. AI has become an essential component that cannot be overlooked, as numerous studies have confirmed its importance in scientific research. The advantages of AI applications in education are substantial, with the most notable being:

Improvement in decision making process: In their pursuit of suitable decisions, managers often seek vast amounts of data and information related to the problems they face. This abundance of information can overwhelm the human mind, especially when dealing with complex and precise data. To address this challenge, many turn to artificial intelligence (AI)

decision-making systems. These advanced systems help in developing modern solutions where information is stored in a main database, similar to how the human brain retains knowledge from learning and daily experiences.

Specialized programs are then developed to enable the computer to process this data logically and effectively, aiding in problem-solving during decision-making crises. Scientists have made progress in developing small models of AI systems, though these models are still undergoing refinement and testing, with updates made on a daily basis.

Improving the quality of education: Quality is considered one of the basic terms in the stream of modern educational terminology such as: quality of teaching, quality of management, and quality of education, the concept of which is a multi-dimensional concept as it includes: “all learning functions and activities such as curricula, educational programs, scientific research, buildings and facilities, tools, provision of services, etc.”¹⁵

It is also known as: “A comprehensive and continuous method of developing performance that includes all areas of educational work. It is an administrative process that achieves the goals of both the labor market and students.”¹⁶

So, the quality of education is the sum of tools, means, methods and procedures that contribute to raising the level of education and moving it to the best levels.

Development of Life Skills:

Life skills encompass various abilities that help individuals manage their lives, interact with others, and effectively address different challenges and problems. These skills are crucial for avoiding potential risks and achieving balance in personal and social aspects of life.

Individuals generally acquire various life skills through interactions and experiences, which contribute to their success in navigating life. The development of these skills is influenced by social and human aspects and varies depending on an individual's life journey.

Imbalances in personality traits or characteristics can hinder enjoyment and success in life. This imbalance may arise from difficulties in interactions with others, leading to challenges in personal development.

The Role of Artificial Intelligence:

Smart applications powered by artificial intelligence can aid individuals in acquiring and enhancing life skills. These applications can help overcome barriers and support personal development. Therefore, it is essential to promote the culture of using and integrating AI in daily life, along with educating people about technological tools and resources available in various aspects of life.

Development of achievement knowledge acquisition: By statistically processing learners' results and analyzing the data, educators can assess changes in cognitive achievement and motivation to learn. This involves comparing and discussing the outcomes and interpreting the findings, which ultimately contributes to enhancing the learner's cognitive performance.

Based on this foundation, artificial intelligence applications designed to improve the educational process at the university level include the following:

Educational software systems with AI components: These systems monitor and guide students' progress while collecting information about each student's performance.

Computer-based educational systems with independent databases: These systems consist of knowledge bases that cover educational content and teaching strategies.

Intelligent learning systems: These systems connect behavioral and cognitive approaches to learning. They emerge from artificial intelligence research and include models related to the subject matter being taught, as well as information about students and teachers. Educators recognize that the effectiveness of these systems should be evaluated based on the knowledge acquired by students rather than what has been taught.

Intelligent learning systems utilizing artificial intelligence technology in universities consist of:

Models of Intelligent Learning Systems:

A. The Domain Model:

This model is characterized by:

- **Content Generation:** It creates learning materials, explanations, and examples related to the topic or curriculum being taught by the intelligent educational system.

- **Problem Generation:** It generates problems and questions for the student to solve, serving as exercises or tests to reinforce learning.
- **Solution Generation:** It provides model solutions and answers to the questions and problems associated with the learning topic. This includes identifying and illustrating the correct procedures, steps, and various approaches that can be applied to arrive at those solutions.
- **Evaluation and Feedback:** The model evaluates and corrects the student's answers and performance, assessing not just the final outcome but also each step taken towards reaching the solution. This is done by comparing the student's response with the accurate answers generated by the intelligent education system.
- **Explanatory Generation:** It generates necessary explanations and justifications for answering two crucial learning questions: Why? and How? This includes clarifying the particular method or strategy used to solve a problem and explaining the process followed to reach that solution.

B. The Teaching Model

This model is characterized by the following features:

- **Control of System Components:** It manages other components of the intelligent education system to ensure cohesive functioning.
- **Personalized Teaching Decisions:** It makes informed teaching decisions tailored to each student, including determining the most suitable teaching style and strategy for their learning needs.
- **Knowledge Bridging:** It aims to reduce the gap between the expert knowledge contained in the domain model and the knowledge possessed by the student, facilitating a more effective learning experience.

C. The Student Model

This model is characterized by the following features:

- **Assessment of Knowledge State:** It establishes the student's current level of knowledge and progress in learning a subject.
- **Progress Tracking:** It records the student's educational progress within the system, including the nature of errors made during the learning process.
- **Behavioral Metrics:** It provides continuous measures and indicators of the student's learning behavior.
- **Misconception Identification:** It identifies and distinguishes between misconceptions and gaps in the student's understanding of concepts.
- **Performance Evaluation:** It assesses the student's performance in answering questions posed by the system, considering both the accuracy of responses and the time taken to provide them.

D. The Interface Model

This model is characterized by the following features:

- **Connection Facilitation:** It serves as a link between the student and the intelligent education system, as well as among the various components of the program itself.
- **Interactive Dialogue:** It enables a two-way interactive dialogue between the smart education system and the student, fostering engaging communication.
- **Personalized Presentation:** It incorporates the student into the learning process through appealing presentation methods and a flexible, diverse approach to delivering educational content. This is tailored to suit the individual needs and preferences of each student, using natural language they can easily understand.
- **Variety in Questioning:** It offers various methods and formats for presenting questions and problems, as well as different ways for students to respond, ensuring alignment with real-world scientific contexts.

Difficulties in Implementing Artificial Intelligence Applications in Higher Education

A. Educational and Instructional Challenges

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One of the most prominent difficulties facing artificial intelligence in this domain includes:

- **Lack of Infrastructure:** Insufficient wireless communication, computer hardware, and software hinder the digital world's requirements. Many students lack access to classrooms equipped with computers connected to high-speed internet, and this is often true for their homes as well.
- **Shortage of Specialists:** There is a lack of qualified trainers and professors who can keep pace with the evolving technologies and effectively use computers in education.
- **Eye Fatigue:** Prolonged reading of lengthy text passages on small screens can cause eye strain and fatigue.
- **Training Requirements:** Professors, students, and administrators must receive training to use these devices proficiently and effectively.
- **Curriculum Development:** There is a shortage of trained personnel to design and prepare curricula that integrate these systems.

B. Social Challenges

Artificial intelligence faces several difficulties in the social realm, which can be summarized as follows:

- **Unclear Nature of AI Education:** The unclear nature of this type of education among community members has led to a degree of aversion towards it.
- **Small Display Sizes:** The limited screen size of mobile devices hinders the effective presentation of information.
- **Input Difficulties:** Entering information on mobile devices can be challenging, especially with small keyboard layouts.
- **Limited Storage Capacity:** Mobile phones often lack sufficient storage space to accommodate large amounts of information.
- **Operating System Variability:** Differences in operating systems across mobile devices can complicate the use of educational applications.

Conclusion

Based on the above discussion, it is clear that despite the significant advantages and importance of artificial intelligence (AI) applications in education, there are valid concerns regarding their negative uses. Communities that take pride in their cultural heritage and derive strength from their unique cultural identities must carefully consider how to implement AI. It is crucial to utilize artificial intelligence in tandem with human intelligence, ensuring that both individual and societal needs are met. This approach necessitates avoiding many of the potential negatives associated with AI.

Recommendations

To address these concerns and maximize the benefits of AI in education, the following recommendations are proposed:

- **Design Scientific AI-Based Software:** Develop educational software that is scientifically grounded in AI principles.
- **Integrate AI in Universities:** Employ AI applications in university institutions and utilize them widely in the educational process.
- **Create Supportive Learning Environments:** Provide educational environments that facilitate the integration of AI applications in social studies education.
- **Conduct Experimental Studies:** Carry out research to demonstrate the effectiveness of educational programs that incorporate AI.
- **Promote Technological Culture:** Foster awareness of technology in educational institutions and the community to highlight the positive impacts of AI.
- **Recognize the Importance of AI:** Acknowledge artificial intelligence as a key modern application that contributes to individual and community advancement.
- **Develop Language Learning Platforms:** Create AI-based platforms specifically for teaching languages, with a focus on Arabic.
- **Arabization of Technology:** Adapt technological systems and devices to make them more user-friendly for learners.

- **Produce Culturally Relevant AI Applications:** Develop applications powered by AI that reflect the country's culture, identity, and civilization.
- **Focus on AI in Education:** Integrate AI into educational practices and curricula.
- **Establish AI Specializations:** Open university programs focused on artificial intelligence.
- **Create AI Laboratories:** Set up laboratories dedicated to exploring AI applications and their implementation.
- **Design Custom Study Programs:** Develop tailored study programs that leverage AI technologies.
- **Prepare Educators and Administrators:** Train professors, trainers, and administrators to effectively employ AI applications and keep pace with advancements in the field.
- **Provide Supportive Educational Environments:** Ensure that the educational environment is conducive to using AI technologies.

To effectively integrate AI into university education and meet future challenges, several fundamental actions are essential:

- **Conscious Import of AI Applications:** Ensure that AI applications are relevant and effective within local contexts and educational realities.
- **Effective Arabization:** Prioritize the proper adaptation of AI applications for usability.
- **Encourage Local Development:** Promote self-sufficiency in developing applications tailored to serve the public good, conducted by the local community in their own language. This is crucial because a people without their language lack identity; a people without identity lack roots, and a people without roots lack a guiding belief or culture.

Such efforts stem from a determined will to bridge the technological gap that external forces may attempt to create within society.

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