



Artificial Intelligence Integration in Competency-Based Teaching: Prospects and Challenges

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Abstract

The rapid development of artificial intelligence technologies has brought significant changes to various fields, particularly education. These technologies have contributed to the emergence of more interactive, flexible, and adaptive teaching methods that respond to learners' individual differences and educational needs. In this context, competency-based teaching has become an important educational approach that seeks to enable learners to mobilize their knowledge, skills, and attitudes in order to address complex academic and real-life situations, rather than merely memorizing and reproducing information. Based on the convergence between the potential of artificial intelligence and the objectives of competency-based teaching, this study examines how artificial intelligence applications can be employed in designing educational activities, personalizing learning pathways, providing immediate feedback, and developing assessment methods based on learners' actual performance and achievement. It also discusses the impact of artificial intelligence on the educational process and its role in enhancing teachers' digital competence. In addition, the study addresses several challenges, including inadequate digital infrastructure, insufficient teacher training, algorithmic bias, data privacy concerns, and the limitations of artificial intelligence systems in processing certain linguistic and contextual features of the Arabic language. The study adopts a descriptive-analytical approach to present the main concepts and analyze the opportunities and challenges associated with the topic. It concludes that the effective integration of artificial intelligence into competency-based teaching requires pedagogically informed use, continuous teacher training, and clear ethical and institutional frameworks that ensure the improvement of learning quality without diminishing the teacher's role or the learner's autonomy.

Keywords: Artificial Intelligence; Competency-Based Teaching; Educational Process; Digital Competence; Teachers; Arabic Language.

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Introduction

The world has witnessed rapid advancements in artificial intelligence (AI) technologies in recent decades, to the point where its applications are now present in various scientific, economic, and social fields. The education sector has been among the most affected by these transformations, given the potential AI offers for analyzing learner data, personalizing educational content, designing activities, providing feedback, and developing assessment methods. Thus, the use of technology in education is no longer limited to digitizing content or using electronic media, but has become linked to building smart learning environments capable of interacting with the learner and responding to their level and needs.

This transformation comes at a time when educational systems are undergoing continuous review of their curricula and teaching methods, shifting from education based on the transmission and rote learning of knowledge to education that focuses on the learner's ability to apply acquired knowledge, skills, and attitudes to address different situations. One of the most prominent approaches that embodies this trend is competency-based teaching, which places the learner at the center of the educational process

and focuses on performance, achievement, and problem-solving, rather than solely on the quantity of memorized information.

The competency-based approach is based on the fundamental idea that possessing knowledge does not achieve educational goals unless learners are able to apply it in new and complex situations. Therefore, teaching according to this approach requires diversifying activities, considering individual differences, linking learning to practice, adopting continuous assessment, and providing feedback that helps learners identify their mistakes and improve their performance. Artificial intelligence applications can contribute to achieving these requirements by producing graded activities, adapting content to each learner's level, analyzing performance, and suggesting individualized learning paths.

Artificial intelligence also provides teachers with tools to help them prepare lessons and tests, develop educational content, monitor learners' progress, and identify their strengths and weaknesses. Smart learning systems, virtual assistants, and generative AI applications can support self-directed and collaborative learning and provide learners with multiple opportunities for practice, simulation, and problem-solving. However, these tools do not represent a complete replacement for the teacher; rather, they should be viewed as auxiliary tools that enhance the teacher's role in guidance, planning, assessment, and educational decision-making. Despite the potential that artificial intelligence (AI) offers for competency-based teaching, its application raises a number of educational, technical, and ethical challenges. The most prominent of these challenges include weak digital infrastructure, unequal access to technology, inadequate teacher training, the potential for inaccurate or biased information, and issues of data protection, intellectual property, and over-reliance on automated tools. AI applications also face particular difficulties when dealing with the Arabic language due to its diverse morphological and syntactic structures, the absence of diacritics in most texts, the multiplicity of dialects, and semantic and contextual ambiguity.

Therefore, this study focuses on the following question: How can AI be effectively employed in competency-based teaching, and what are the most prominent prospects and challenges associated with this application? This central question leads to a number of sub-questions, including: What is the nature of the relationship between AI and competency-based teaching? What opportunities do its applications offer for improving learning and assessment? What digital competencies do teachers need in the age of AI? And what difficulties might limit the effectiveness of these applications, especially when used in teaching Arabic? To address this topic, the study adopts a descriptive-analytical approach, describing the concepts and phenomena related to artificial intelligence and competency-based teaching, and analyzing the prospects and challenges posed by its application in the educational field. The study is organized into sections covering the nature of artificial intelligence, the relationship between artificial intelligence and human intelligence, the challenges of processing Arabic language, the concept of competency-based teaching, the impact of artificial intelligence on the educational process, and the digital competence that teachers need in the age of artificial intelligence.

Objectives:

- To clarify the relationship between artificial intelligence and competency-based teaching.
- To review the opportunities that artificial intelligence offers in this context.
- To discuss the challenges and difficulties that teachers and educational institutions may face.
- To offer some recommendations for the effective application of artificial intelligence in competency-based teaching.

Article Outline:

- 1- The Nature of Artificial Intelligence.
- 2- Artificial Intelligence and Human Intelligence.
- 3- Challenges of Artificial Intelligence in Dealing with the Arabic Language.

4- The Nature of Competency-Based Teaching.

5- Artificial Intelligence and its Impact on the Educational Process.

6- The Digital Competency of Teachers in the Age of Artificial Intelligence.

1- The Nature of Artificial Intelligence: Shortly after the invention of the computer, it became clear that it could perform operations beyond mathematical calculations, and that the speed of its operations could be utilized in many non-purely mathematical tasks. It was discovered that it could make decisions, recognize patterns, and even recognize images.

New fields emerged under the umbrella of artificial intelligence, the most important of which was "Natural Language Processing." This field has developed to encompass many aspects of natural language processing, including writing, spelling correction, morphology, syntax, semantics, translation, and even rhetoric and poetry.

The field of shape, image, and pattern recognition has entered into numerous applications, such as site recognition, military applications, mineral exploration, ocean navigation, spacecraft, and more. Other aspects of artificial intelligence include expert systems used in patient care, troubleshooting, automated control, and other areas. Handwriting recognition is just one such application.

Artificial intelligence is a term used to describe the capabilities exhibited by machines and software that mimic human cognitive abilities, such as learning, reasoning, and reacting to situations not explicitly programmed into the machine. It is also the name of an academic field concerned with how to create computers and software capable of intelligent behavior.

Professor Al-Azhar Al-Zanad addressed artificial intelligence in his book "Cognitive Linguistic Theories," stating that it is "the science that seeks to enable machines to perform tasks that humans do." By empowering it with intelligent mental skills that possess the capabilities of the human mind, the goal of artificial intelligence is to create intelligent machines that can act intelligently, that is, interact with their environment, gather information from it, and react in light of situational requirements, ensuring that the reaction is appropriate, suitable, and effective.

The term "artificial intelligence" was coined by the American computer scientist John McCarthy (1927-2011) in 1956. That same year, a scientific conference was held at Dartmouth College in the United States to discuss ongoing research into the possibility of designing an intelligent machine capable of imitating and simulating human actions. At this conference, generous funding campaigns were announced to achieve an invention resembling the human mind, enabling machines to operate independently without human intervention.

The development of programming languages and computer science has spurred the advancement of artificial intelligence (AI) to such an extent that it has become a science in its own right, integrating many other disciplines such as programming, logic, mathematics, and even psychology and philosophy. AI technology has made significant leaps forward, with "deep learning" being its most prominent manifestation. This technology relies on developing artificial neural networks that mimic the workings of the human brain, meaning they are capable of experimenting, learning, and self-improving without human intervention.

Artificial intelligence is the study of intelligent behavior (in humans, animals, and machines) and represents an attempt to find ways to instill such behavior in artificial machines.

Furthermore, artificial intelligence is one of the most challenging and controversial subjects for all of humanity. The difficulty of this subject may not be immediately apparent, but it becomes much clearer later on. Research in artificial intelligence is sometimes compared to deep space exploration in terms of its level of difficulty, but a crucial fact emerges: research in this field is far more challenging than space exploration. In space exploration, we at least have a grasp of the main technical problems, but unfortunately, in artificial intelligence, the situation is different. On the other hand, this difficulty is

compensated for by the benefits achieved, both practically and intellectually. On the practical side, artificial intelligence has already established itself as a scientific field.

The computer has become the cornerstone of this modern applied linguistics branch connected to artificial intelligence, given that the latter focuses on deeper and more comprehensive knowledge bases than databases.

The Arabic language has greatly benefited from it in developing linguistic applications that have achieved a qualitative leap. This explains why there is no solution to the language problem without resorting to the methods of this intelligence and knowledge engineering, in pursuit of its universality and unity. Artificial intelligence research has concluded that the basic function of the human mind that distinguishes it from the rest of creation is its ability to produce and use symbolic systems, foremost among them the linguistic symbolic system used in: communication, representing information, and storing and transmitting knowledge. Computer programs are based on this.

Artificial intelligence (AI) encompasses a broad spectrum of computer science, extending into philosophical and psychological issues. Over the past thirty years, the definitions and boundaries of AI have constantly shifted. Leading computer programmers have adopted some of its techniques without realizing it, while others use it to enhance their offerings. It could be argued that every computer program contains elements of AI if it performs meaningful tasks. However, AI specifically refers to applications that clearly mimic intelligent behavior.

2. Artificial Intelligence and Human Intelligence:

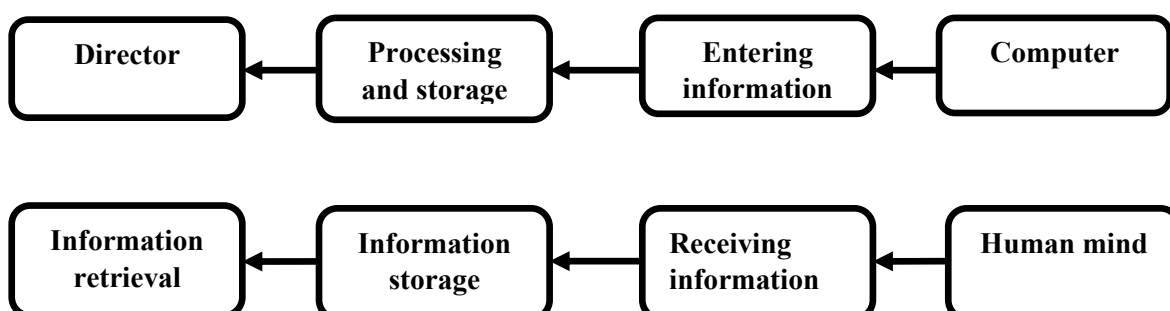
Currently, seminars are being held and publications and research are being produced on the field of linguistics and computers, particularly concerning the Arabic language. These studies focus on processing Arabic linguistic phenomena using computational methods, with the aim of storing linguistic rules and data in computers. This processing also seeks to enable computers to possess systematic performance capabilities comparable to those of humans.

The difference between artificial intelligence and human intelligence is evident in:

- The ability to create a model: Humans are capable of inventing and creating this model, while a computer model is a representation of a model previously created in the human mind.
- The types of inferences that can be drawn from a model differ. Humans are capable of using various mental processes, such as innovation, invention, and different types of inference, while computer processes are limited to specific inferences, according to established rules programmed into the software itself.
- Artificial intelligence focuses on studying the representation of models in computer memory and methods of searching and inference, such as logic, comparison, and induction.

We can draw a diagram illustrating the relationship between the stages of computer development (the electronic brain) and the stages of human brain development in information processing:

Figure No. (1): It illustrates the relationship between the stages of computer development (electronic brain) and the stages of human brain development in information processing.



Thus, the computer has made many things easier for the human mind in matters related to the study of the linguistic branching of topics, and the connection between these two parties has deepened until "language has become subject to automated processing through mathematical, logical and statistical analysis, and the computer has prepared for its encounter with language with super speed, huge memory, small size, artificial intelligence methods, and sophisticated programming languages".

3- Problems of Artificial Intelligence in Dealing with the Arabic Language:

Processing the Arabic language faces varying challenges. The challenge is less in the phonetic aspect due to the clarity of the phonetic information, but it increases in the morphological, then lexical, then syntactic and semantic aspects:

- Semantic Ambiguity:

The main obstacle we encounter is semantic ambiguity, whether at the structural or syntactic level. This ambiguity hinders achieving high accuracy in processing Arabic texts. For example, the word "al-waldan" (the dual) is confused with the word "walad" (the plural). The former is in the nominative case with an alif and in the accusative case with a ya, while the latter remains unchanged in nominative, accusative, and genitive cases. The computer cannot differentiate between "al-waldan" and "al-wildan." Furthermore, the computer confuses "fatair" (the plural of "fatira") with "fatair" (the singular of "ta'ir"), which has the letter fa' attached, as mentioned previously.

We must acknowledge that research in semantic processing still requires significant and costly efforts, which the private sector cannot bear. Therefore, a large-scale project involving leading researchers is necessary to develop the techniques we have achieved and avoid the errors inherent in these techniques.

- The Structure of Arabic Sentences.

The structure of Arabic sentences requires a complex process of understanding and identifying the features of vocabulary that suit the grammatical function. Furthermore, Arabic sentences are subject to syntactic irregularities such as deletion, addition, fronting, and postponement. This presents a significant challenge for artificial intelligence.

- Dialectal Diversity:

The diversity of Arabic dialects challenges speech recognition technologies, especially regarding the substitution of letters like "seen" for "thaa," "jeem" for "qaaf," "ghain" for "qaaf," or "dhaa" for "daad." This is in addition to variations in stress, intonation, and speech delivery. This dialectal diversity is not found in other languages to such a degree.

4- The Nature of Competency-Based Teaching:

The goal of teaching today has become to give meaning to learning. The learner must understand life in all its aspects, especially the obstacles that human society faces today. Definitions of teaching in this regard have varied and differed, but most agree that teaching is a structured, interactive process between the teacher and the learner, aimed at helping the learner develop their abilities and potential, thus facilitating adaptation to their surrounding environment.

Competency-based teaching is a prominent model that serves our teaching needs. So, what is meant by competency-based teaching? To answer this question, we were able to obtain several definitions, including:

Competency-based teaching aims to enable the learner to construct their own learning path through interaction within the educational setting, including the teacher, peers, knowledge content, resources, and other elements. It is built upon active learning that relies heavily on problem-solving and problem-solving. Competency-based teaching is defined as: "A cognitive, skill-based, or motor activity practiced in meaningful and problem-solving situations, employing a comprehensive set of abilities. It expresses observable and measurable behavior that emerges after evaluation."

From this definition, we can identify three key points of competency-based teaching:

- Competency-based teaching aims to prepare the individual to adapt to their lived reality.
- Knowledge is a tool that helps the individual overcome the situations they encounter.
- The goal of teaching is not knowledge itself, but rather how to acquire and organize it effectively.

5- Artificial Intelligence and its Impact on the Educational Process:

Artificial intelligence (AI) represents a revolution in teaching and learning methods. It can personalize content, assessments, and teaching approaches, thereby enhancing the student learning experience and boosting academic outcomes. Despite challenges related to privacy, cost, and bias, the benefits of AI in education outweigh these obstacles. Its adoption contributes to fundamental changes in the design and delivery of education. AI strategies are a crucial step in improving the learning experience, enabling educational institutions to leverage them to provide personalized and effective education, while focusing on addressing challenges to ensure maximum benefit from this technology. AI plays a pivotal role in reshaping and improving the educational process by developing innovative teaching methods, such as personalizing educational content, analyzing student data to identify their needs, and providing immediate feedback. It also simplifies administrative tasks for teachers, leading to improved learning outcomes and increased student engagement. Furthermore, it can enhance interaction and motivation through the use of virtual assistants and provide immediate responses to student inquiries. Advanced data analytics also enables the development of more integrated and personalized curricula, allowing students to progress according to their varying abilities and levels.

6- Digital Competence of Teachers in the Age of Artificial Intelligence:

Developing digital competencies for teachers in the field of artificial intelligence is a crucial step in supporting their ability to integrate this technology into education and professional development. International organizations' efforts should not be limited to issuing theoretical frameworks but must be accompanied by training and remedial programs to enhance teachers' technical skills. This will enable them to interact effectively with smart tools and applications, utilize machine learning systems, and engage with educational robots and other smart learning platforms. The absence of these skills will render the frameworks mere theoretical concepts, inapplicable to any practical application.

Furthermore, teachers should possess the ability to analyze and interpret data, allowing them to understand student performance, identify their needs and future aspirations using specialized AI tools. Digital competency for teachers also includes the ability to interact effectively with students and the educational community by using AI technologies to deliver personalized learning experiences, provide immediate and motivating feedback, and support student progress with meticulous and ongoing monitoring.

Moreover, teachers must possess critical thinking skills and the ability to objectively evaluate AI applications in education. This will enable them to analyze its benefits and challenges and ensure that ethical, security, and privacy considerations are taken into account when using AI. Thus, digital competence for teachers under artificial intelligence can be achieved when they are able to understand the relevant technology, analyze educational data, and provide a personalized and effective learning experience, with constructive interaction with students and the educational community, as well as having the ability to systematically evaluate various applications of artificial intelligence in education.

Conclusion:

After reviewing this presentation on the use of artificial intelligence in competency-based teaching, we can affirm that this technology represents a tremendous opportunity to advance the educational process. It enables personalized learning, provides immediate feedback, and enhances critical thinking and interactive skills. However, the successful integration of AI into education requires a delicate balance between leveraging its potential and preserving the teacher's role as a cornerstone of the educational process.

Despite the technical, pedagogical, and ethical challenges facing this transformation, the solution lies in developing well-considered strategies that rely on providing a digital infrastructure, ongoing teacher training, and policies that protect data privacy and ensure the ethical use of these technologies.

In conclusion, AI remains a supportive tool, not a replacement for the teacher, and its success in competency-based teaching depends on the awareness and engagement of educational stakeholders. Therefore, I urge everyone—researchers, teachers, and policymakers—to consider how to effectively and responsibly utilize this technology to achieve higher quality and more innovative education.

Footnotes:

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