



## Original Article (Mixed)

# Designing a model for using artificial intelligence in learning for elementary school students

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**Receive:**

15 June 2025

**Revise:**

30 July 2025

**Accept:**

29 August 2025

**Abstract**

The present study was conducted with the aim of designing a model for applying artificial intelligence in elementary school students' learning. This study was applicable in terms of its purpose, and mixed and exploratory in terms of the type of data; in such a way that the qualitative part was conducted using the paradigmatic grounded theory method and the quantitative part was conducted using a survey method. Participants in the qualitative part included academic experts and scholars from the Ministry of Education selected through conscious sampling and the snowball method; and in the quantitative part, 319 education managers and elementary school principals in Tehran were determined based on the Cochran formula. Data collection in both parts was conducted using the field method; semi-structured interviews were used in the qualitative part and a researcher-made questionnaire was used in the quantitative part. The validity and reliability of the instruments were confirmed in both parts. Qualitative data were analyzed by theoretical coding, and quantitative data by confirmatory factor analysis. The findings showed that the AI application model consists of 19 components and 106 indicators in the form of six dimensions of the paradigm model. In this model, the central phenomenon includes learning enrichment and learning individualization; causal factors include technical infrastructure, intelligent support, and technology growth in the family; contextual factors include learning management, learning content, and teacher capabilities; intervening factors include ethics, information security, and educational technology; strategies include personalization of education, feedback, intelligent evaluation, content quality, and learning assistant; and outcomes include deep learning, improving teacher efficiency, high-quality evaluation, and educational innovation. Finally, the obtained model was quantitatively evaluated with confirmatory factor analysis, and the fit indices showed that the model was confirmed.

**Keywords:**

AI,  
Learning and  
Education,  
Technical  
Infrastructure,  
Technology Growth,  
Elementary School  
Students

**Please cite this article as (APA):** Heidarian, A., Shafizadeh, H. and Shariatmadari, N. (2025). Designing a model for using artificial intelligence in learning for elementary school students. *Management and Educational Perspective*, 7(2), 443-467.



<https://doi.org/10.22034/jmep.2025.547563.1574>



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## Extended abstract

### Introduction

The rapid advancement of computing and information processing methods has accelerated the expansion of AI applications, with the aim of enabling computers to perform their tasks by simulating intelligent human behaviors such as inference, analysis, and decision-making (Duan, Edwards & Dwivedi et al., 2019).

AI in education has great potential to enhance learning, teaching, and assessment by suggesting or providing personalized or tailored learning to learners, developing teachers' understanding of the learning process, and providing anywhere-anytime search engines and immediate feedback (Xia et al., 2022). AI in learning helps learners actively construct their own knowledge by exploring and manipulating elements of the learning environment (Randhawa et al., 2020).

AI helps to increase the quality of education and not only assists in the learning process but also provides facilities such as tutoring, grading, lesson planning, and feedback to students (Mondal et al., 2019). Timms stated that collaborative robots are used in collaboration with teachers to teach everyday tasks such as spelling, pronunciation, and adjusting students' abilities (Timms et al., 2016). Artificial intelligence helps personalize content to meet the demand for education, so it plays a significant role in the organization of course materials (Mondal et al., 2019). Therefore, it can be said that it is one of the most important phenomena in education that will be used more in the future (Rezaei et al., 2024). According to the US Department of Education, it is estimated that artificial intelligence in education in this country will increase by 47.5% from 2017 to 2021, which is expected to see a significant growth in companies developing artificial intelligence in education (Liang et al., 2020). During the emergence of Corona, educational technologies, especially artificial intelligence, were used in many countries, but in Iran, very little of artificial intelligence has entered the field of education. Despite the fact that the use of modern educational and training equipment and technologies in line with the goals of education has been considered in the document on the fundamental transformation of education, artificial intelligence has been taken for granted; and only education and training, teachers, and students use virtual spaces as modern educational technologies; while artificial intelligence has spread around the world and provides significant help to teachers and students. Accordingly, the researcher in this study seeks to answer the question: What is the model for using artificial intelligence in learning for elementary school students in Tehran province?

### Theoretical foundations

#### Infrastructure and technological background

Educational developments based on artificial intelligence require appropriate technical infrastructure and access to modern technologies for families. Infrastructure includes servers and network storage, educational software and applications, appropriate bandwidth, multimedia tools, and information processing equipment that enable smart education and active student interaction (Li et al., 2020). In addition, parental mental preparedness, family economic and cultural status, and the use of artificial intelligence tools in daily life are effective contexts for the acceptance and use of smart systems (Chen et al., 2020).

Smart support enables access to content at any time and place, personalized services, and active student interaction with content, complementing the teacher's role in the education process, which is in line with the active learning theory (Rezavan et al., 2022).

#### Learning Management and Educational Content

Learning management involves identifying student needs, continuously monitoring the learning process, providing feedback and continuous evaluation; and improves the quality of



education (Tsai et al., 2019). Learning content should be in line with educational objectives, utilize interactive tools such as games and videos, and enhance students' academic achievement. Teachers' ability to use artificial intelligence for teaching and content production has a direct impact on the effectiveness of education (Zhu et al., 2020).

Content personalization strategies, providing immediate feedback, and intelligent assessment facilitate individual and active learning and take into account individual student differences (Popenici & Kerr, 2017).

### **Interveners and Ethics in Smart Education**

The use of smart technologies in education is associated with ethical and security considerations. Respecting privacy, trustworthiness in the use of content, and developing security infrastructures are critical components (Livingstone, 2012). Educational technology, including artificial intelligence tools, media, and virtual reality technology, acts as an intermediary between the student and the learning process and enables continuous and personalized learning through timely intervention and resource management.

### **Implications of Smart Learning**

The use of artificial intelligence leads to deep learning, improved teacher efficiency, accurate evaluation, and educational innovation. Deep learning is possible by strengthening cognitive skills, increasing the ability to analyze and solve problems, active student participation, and repeating material until complete learning. By continuously monitoring student progress and utilizing smart evaluation, teachers can provide timely corrections and feedback, and improve learning outcomes by combining face-to-face and virtual methods and producing multimedia content (Li et al., 2020).

Sun (2024) examined various uses of artificial intelligence in education in a study titled "Applications of Artificial Intelligence in Education." The research method of this study was a review and analysis. The results showed that AI can improve personalized learning, adaptive learning, virtual reality technology, and teaching assessment, and change the traditional learning system by providing new teaching methods and assessment systems.

Alam et al. (2024) analyzed the future role of AI in education in a study titled "Future Applications and Prospects of AI in Education". The research method of this study was analytical and descriptive. The results showed that AI, with active participation in data analysis, virtual classrooms, adaptive assessments, and personalized learning, can create more effective and efficient educational experiences and requires the participation of educators and legislators to fully realize this potential.

### **Research Methodology**

This research is applicable in terms of purpose, and mixed exploratory (qualitative and quantitative) in terms of data. The qualitative stage was conducted based on systematic data, and the statistical population included 19 academic experts, educational technology specialists, and education managers, of which 16 interviews were used as the basis for the analysis. The quantitative phase was conducted as a cross-sectional survey with a statistical population of 1880 school principals and educational districts in Tehran, and 319 people were selected by stratified random sampling. Qualitative data were collected through semi-structured interviews and library studies, and quantitative data were collected with a researcher-made questionnaire consisting of 19 components and 106 indicators. The validity and reliability of the tools were confirmed by test-retest methods, model reliability test, and inter-coder test, respectively, at 80–86%.

### **Research findings**

The research findings showed that the application of artificial intelligence in elementary school students' learning has several basic dimensions that interact with each other in a systematic way. On one hand, technical infrastructure and intelligent support enable active, personalized, and continuous learning, and on the other hand, teacher empowerment and content management ensure that the education process proceeds with quality and effectiveness. Ethical considerations and information security, along with educational technologies, as intervening factors, ensure the safe and sustainable use of systems. Content personalization strategies, feedback, smart assessment, and learning assistants enhance students' individual and collaborative learning, leading to outcomes such as deep learning, educational innovation, improved teacher effectiveness, and quality assessment.

### **Discussion and Conclusion**

The research findings show that implementing smart learning in Tehran elementary schools requires appropriate technical infrastructure and families' access to modern technologies. Servers, bandwidth, software, and multimedia tools enable smart learning and active student interaction with content (Chen et al., 2020; Rezavan et al., 2022). The readiness and support of teachers and families, especially a positive attitude towards educational technologies, play a key role in the success of smart learning (Valeri et al., 2024; Alam et al., 2024).

In learning and educational content management, identifying student needs, providing continuous feedback, and regular evaluation improve the quality of education (Tsai et al., 2019). The use of interactive tools and multimedia content enhances students' active participation and academic achievement (Zhu et al., 2020; Sun, 2024). Teachers' ability to utilize AI for teaching and content production also has a direct impact on learning effectiveness (Chen et al., 2022).

Ethical and security considerations, including protecting students' privacy and developing security infrastructure, are essential for the successful implementation of smart technologies (Wang et al., 2024; Omar et al., 2024). Educational technologies, through media, content production tools, and virtual reality, enable interactive and personalized learning and reduce teachers' workload (Sun, 2024).

The implications of using AI in learning include enrichment, individualization, and active learning. Providing diverse examples, simulating real-world situations, and purposeful exercises facilitates deep and active learning (Valeri et al., 2024; Sun, 2024). Content personalization strategies, immediate feedback, and intelligent assessment enable effective learning that is responsive to individual differences (Chen et al., 2022; Zhu et al., 2020).

Finally, AI can help improve the quality of learning, increase student engagement, improve teacher efficiency, and innovate in education (Alam et al., 2024; Wang et al., 2024). This technology enables a more effective, efficient, and personalized learning experience for students.