

## Beyond the Hype: A Scoping Review of Artificial Intelligence Integration in Learning

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The present study aims to systematically and comprehensively examine recent research on the use of artificial intelligence in the field of education. The primary objective of this study is to identify the main thematic focuses of artificial intelligence research in education, to determine the advantages and limitations reported in the literature, and to evaluate current trends from a holistic perspective. To this end, a search was conducted in the Web of Science database to identify studies including "Artificial Intelligence" as a primary keyword, along with either "Educational Technology" or "Instructional Technology" among the associated keywords. This search yielded 432 studies published between 2021 and 2025. The selection of studies was guided by the PRISMA (2009) flow diagram, and 44 articles that met the predefined inclusion criteria were included in the review. The research was conducted within the framework of a Scoping Review, following the stages proposed by Arksey and O'Malley (2005). The selected studies were analysed in terms of publication year, research methods, sample groups, artificial intelligence tools used, and research purposes. The findings indicate that research on artificial intelligence in education predominantly focuses on themes such as student achievement, attitudes, perceptions, adoption, and language learning. The results of the study are presented in tables and figures, thus providing an overview of current trends and highlighting research gaps to guide future studies and educational practice.

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## Introduction

The field of artificial intelligence (AI) can be defined as a broad technological domain comprising algorithms and systems that seek to emulate human problem-solving, reasoning and adaptability processes, as well as learning from environmental data and performing various tasks based on this learning. In the extant literature, AI is predominantly defined as 'systems that can reason, make decisions, and mimic various aspects of human intelligence based on specific rules, data structures, and environmental information' (Gayed, 2025). The rapid

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advancements witnessed in subfields such as machine learning and deep learning have contributed to the evolution of AI, transforming it from a mere technology that processes data into a sophisticated system capable of continuous learning, identifying patterns, and generating more productive outcomes (Ratten and Jones, 2023). This evolution carries significant implications, particularly in the field of education, offering the potential to transform the quality of teaching processes, students' learning experiences, and educators' instructional designs (Shin et al., 2024).

The significance of artificial intelligence in education is attributable to its capacity to render learning processes more flexible and adaptable. AI-based systems have been shown to facilitate personalised learning experiences by offering functions such as delivering content according to students' individual characteristics and learning speeds, monitoring their development in real time, and identifying learning difficulties at an earlier stage (Della Ventura, 2018). Gayed's study demonstrates that educators find AI tools to be especially beneficial in terms of analysing student performance in detail, identifying learning gaps, and generating more targeted feedback according to students' needs. Such capabilities enable the educational process to be monitored more systematically and decisions to be based on more reliable data, thereby positively contributing to the quality of teaching practices (Sánchez-Vera, 2024).

The rapid proliferation of artificial intelligence tools necessitates a reassessment of instructional design in higher education. While these tools offer a wide range of opportunities, from creating course materials to supporting students, they require careful evaluation in terms of accuracy, reliability, and ethical use (Ratten and Jones, 2023). While educators find the possibilities offered by artificial intelligence useful, they particularly emphasise the importance of preserving students' critical thinking, academic integrity, and independent learning skills (González-Rico & Sintes, 2024). The application of AI in education exhibits a high degree of diversity, offering a range of functions that can be tailored to meet diverse teaching requirements. An exemplar of such an application is intelligent teaching systems, which are designed to create personalised learning experiences that are tailored to the characteristics of individual students. These systems analyse students' learning speeds, needs, and performance data to deliver content that is appropriate to their level, thereby contributing to a more effective and sustainable learning process (Xia et al., 2024). Another practice that is becoming increasingly common in higher education institutions is the use of chatbots that are tailored to specific disciplines or course content. These tools facilitate the provision of instantaneous feedback to students during exam preparation or subject revision, thereby supporting them in developing greater autonomy in their learning processes. These systems are regarded as instruments that augment autonomous learning, as they empower students to oversee their own learning processes with greater efficacy (Sánchez-Vera, 2024).

Artificial intelligence tools, which students frequently utilise in their academic writing, problem-solving, and content development processes, offer significant contributions in terms of increasing productivity and managing the learning process more effectively (Arslan, 2020). These tools facilitate students in accessing information with greater alacrity, planning complex academic tasks, and conducting their work in a more systematic manner, thereby adding flexibility to the learning process. The findings of Cortez and colleagues reveal that students use AI-based applications efficiently for both acquiring knowledge and structuring academic tasks.

From the perspective of educators, the implementation of artificial intelligence has the potential to offer significant advantages, particularly in student-centred and interactive teaching methods such as project-based learning (PBL) (Çam et al., 2021). The potential of artificial intelligence to deliver personalised guidance, provide instantaneous feedback, and utilise learning analytics to demonstrate students' progress are significant factors that contribute to the enhancement of teaching quality (Tamer & Övgün, 2020). Research by Ruiz Viruel et al. demonstrates that AI-supported PBL applications have a significant positive impact on student motivation and academic achievement. Furthermore, the integration of artificial intelligence within educational institutions has been identified as a pivotal factor in enhancing teaching methodologies and facilitating the effective functioning of these institutions (Chen et al., 2020). A review of the extant literature indicates that the automation of administrative tasks, including document organisation, examination assessment and student tracking, has the potential to reduce the workload of teachers and institutions (Shin et al., 2024).

Despite the proliferation of research on the subject of artificial intelligence in education, extant studies remain fragmented and often focus on specific tools, contexts, or outcomes, thus impeding the acquisition of a comprehensive understanding of the field. In this respect, there is a clear need for a systematic and holistic mapping of current research trends, applications, and research gaps. The present study addresses this need by providing a structured synthesis of recent literature through a scoping review approach. In contrast to earlier reviews, which have tended to concentrate on specific aspects of artificial intelligence in education, this study provides a comprehensive analysis by integrating multiple dimensions, including research methods, sample characteristics, AI tools, and research purposes. From a theoretical perspective, the study makes a significant contribution to the existing literature by developing a broad conceptual framework that categorises and systematises existing research, thereby facilitating a clearer understanding of how artificial intelligence is positioned within educational contexts. Furthermore, it identifies critical research gaps and areas that have been underexplored, thus offering a roadmap for future studies and supporting the development of more theory-driven and pedagogically grounded research in the field.

1. The objective of this research is to examine studies on the use of Artificial Intelligence (AI) in education in the Web of Science database. The research questions identified within the scope of the study are as follows:
2. The objective of this study is to ascertain the distribution of the examined studies according to their publication years, and to what extent this distribution reflects the historical development of the literature.
3. The present study seeks to ascertain the prevalence of preferred research designs (quantitative, qualitative, mixed) and methodological approaches in the studies examined.
4. The diversity of data collection tools (surveys, interviews, log analysis, etc.) used to evaluate artificial intelligence applications in education is a subject that merits further investigation.
5. The present study seeks to ascertain the demographic and educational level-based distribution of the sample groups focused on in the relevant studies.
6. Which types of artificial intelligence tools (generative AI, intelligent teaching systems, adaptive platforms) are directly employed, or whose impact is measured, in the studies examined?

7. The following investigation seeks to ascertain the thematic categories under which the primary implementation objectives of the studies under discussion are grouped, and the contributions they aim to make to the field of education literature.

## **Method**

### ***Research Design***

The present study examined works on the use of Artificial Intelligence (AI) in Education in the Web of Science database. The present examination was conducted using the Scope-Defined Scanning Study method. The approach adopted to ensure the appropriate use of this defined method was carried out in accordance with the stages outlined by Arksey and O'Malley (2005). The following stages are delineated herewith: (1) The initial step in this process is the formulation of the research questions, (2) The identification of relevant studies is the second step in the process, (3) The third point to consider is the selection of studies, (4) The following section will present a graphical representation of the data, (5) The subsequent step in the process is the evaluation, summarisation and reporting of results. The study proceeded through the following sequence of steps.

### ***Selection of Relevant Studies***

A search was conducted in the Web of Science database to identify studies on the use of Artificial Intelligence (AI) in education. The search strategy was designed to identify studies in which the term "Artificial Intelligence" was used as a primary keyword, along with either "Educational Technology" or "Instructional Technology" among the associated keywords. The objective of this study was to examine research on the utilisation of artificial intelligence in educational settings based on these specified criteria. Subsequent to the identification of studies that met these keyword conditions, exclusion and inclusion criteria were established in order to determine the articles to be included in the study. The development of these criteria was informed by a thorough examination of representative studies retrieved through this search strategy. The exclusion and inclusion criteria are presented in Table 1. The most recent five-year period (2021–2025) was selected in order to capture the current use of Artificial Intelligence (AI) in the field of education. In accordance with these criteria, the final search process was conducted in the Web of Science database.

**Table 1. Inclusion and exclusion criteria**

| Criterion        | Coverage                                                                                                                                                                                                | Exclusion                                                                                                                                                                                             |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Time             | The last 5 years (2021–2025)                                                                                                                                                                            | These are timeless works.                                                                                                                                                                             |
| Literature Focus | Activities related to artificial intelligence in education and the outcomes thereof (e.g., academic achievement, impact, scientific process skills, attitudes, perceptions, productivity, usage of AI). | Artificial intelligence studies conducted outside the field of education (e.g., in engineering, healthcare, banking, finance, and other non-educational domains) and studies conducted prior to 2021. |

|         |                                                                                                                                                                     |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example | This study will analyse students' intentions to use conversational artificial intelligence (CAI) as an educational tool, and their actual academic usage scenarios. |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### Work Selection

A search was conducted in the Web of Science database using the specified search terms "Artificial Intelligence, Educational Technology, Instructional Technology," which resulted in 432 articles. The articles were subjected to a review process, which was based on exclusion and inclusion criteria. These criteria were applied following an examination of the titles and abstracts. The PRISMA (2009) model was utilised in the process of article selection. The article selection process is illustrated in Figure 1.

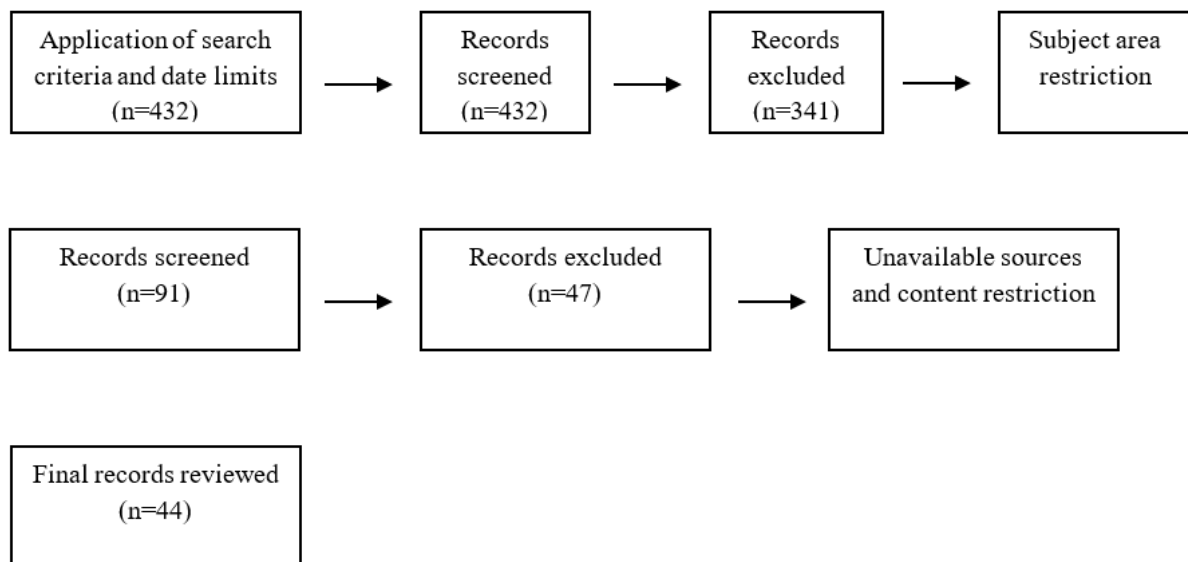


Figure 1: PRISMA flow diagram

A search was conducted in the Web of Science database using the specified search terms "Artificial Intelligence, Educational Technology, Instructional Technology," which resulted in 432 articles. Of the 432 articles obtained in the initial phase, 341 were excluded. The articles that were excluded from the review were not considered on the basis that they were not relevant to the field of education (for example, engineering, health, software, etc.). Following a thorough review of the remaining 91 articles, 47 were excluded from further consideration. In this section, the rationale for excluding the articles is elucidated. The exclusionary decision was made on the basis that the articles in question were inaccessible and their content did not meet the desired criteria.

Table 2. Findings of the article studies examined

|             | 1                                                                    | 2                                                                                              | 3                                                                                                                                                             | 4                                                                                             | 5                                                                                                                       | 6                                                                                                             | 7                                                                                                                         |
|-------------|----------------------------------------------------------------------|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| Author      | Fachrurrozie vd.                                                     | Gayed, JM.                                                                                     | Alves-Noreña vd.                                                                                                                                              | Marengo vd.                                                                                   | Viruel vd.                                                                                                              | Du vd.                                                                                                        | Liu vd.                                                                                                                   |
| Year        | 2025                                                                 | 2025                                                                                           | 2025                                                                                                                                                          | 2025                                                                                          | 2025                                                                                                                    | 2025                                                                                                          | 2025                                                                                                                      |
| Method      | Quantitative                                                         | Mixed Method                                                                                   | Mixed Method                                                                                                                                                  | Quantitative                                                                                  | Quantitative                                                                                                            | Quantitative                                                                                                  | Quantitative                                                                                                              |
| Pattern     | Relational Screening                                                 | Relational Screening                                                                           | Experimental Study                                                                                                                                            | Scale Development                                                                             | Relational Screening                                                                                                    | Relational Screening                                                                                          | Relational Screening                                                                                                      |
| Sample      | Teacher and Faculty Member                                           | Teacher (Elementary School, High School, etc.)                                                 | University Students                                                                                                                                           | University Students                                                                           | Teacher (Elementary School, High School, and Faculty Member)                                                            | University Students                                                                                           | University Students                                                                                                       |
| Sample size | 230                                                                  | 132                                                                                            | Ø                                                                                                                                                             | 664                                                                                           | 300                                                                                                                     | 111                                                                                                           | 1.167                                                                                                                     |
| AI          | ChatGPT Canva                                                        | AI                                                                                             | ChatBot                                                                                                                                                       | AI                                                                                            | AI                                                                                                                      | AI (Speech Applications)                                                                                      | AI (English Learning Applications)                                                                                        |
| Objective   | Examination of factors affecting the use of artificial intelligence. | An examination of instructors' attitudes toward artificial intelligence in terms of variables. | Development of an artificial intelligence-supported software for analyzing the emotional state of university students and early detection of risky behaviors. | Development of the Generative Artificial Intelligence Attitude Scale for university students. | Examining the perceptions of elementary and high school teachers and faculty members regarding artificial intelligence. | An investigation into university students' perceptions of AI-supported second language speaking applications. | An examination of the adoption of artificial intelligence-supported English learning applications by university students. |
|             | 8                                                                    | 9                                                                                              | 10                                                                                                                                                            | 11                                                                                            | 12                                                                                                                      | 13                                                                                                            | 14                                                                                                                        |
| Author      | Engeness, I. ve Gamlem, SM.                                          | Ortega-Rodríguez, P.J. ve Pericacho-Gómez, FJ.                                                 | Sánchez-Vera, F.                                                                                                                                              | Huang vd.                                                                                     | Zhang vd.                                                                                                               | Kayaalp vd.                                                                                                   | Hao vd.                                                                                                                   |
| Year        | 2025                                                                 | 2025                                                                                           | 2025                                                                                                                                                          | 2024                                                                                          | 2024                                                                                                                    | 2025                                                                                                          | 2025                                                                                                                      |
| Method      | Theoretical Approach                                                 | Quantitative                                                                                   | Mixed Method                                                                                                                                                  | Quantitative                                                                                  | Literature Review                                                                                                       | Mixed Method                                                                                                  | Quantitative                                                                                                              |
| Pattern     | Conceptual Research Design                                           | Relational Screening                                                                           | Relational Screening                                                                                                                                          | Experimental Study (Semi-grouped)                                                             | Scoping Review                                                                                                          | Relational Screening                                                                                          | Relational Screening                                                                                                      |
| Sample      | Student                                                              | University Students                                                                            | University Students                                                                                                                                           | Student (grades 4-10)                                                                         | Literature (Studies on students with disabilities)                                                                      | University Students                                                                                           | University Students                                                                                                       |
| Sample size | Ø                                                                    | 152                                                                                            | 42                                                                                                                                                            | 134.425                                                                                       | 29                                                                                                                      | 20                                                                                                            | 483                                                                                                                       |
| AI          | AI Essay Assessment Technology (EAT)                                 | ChatGPT                                                                                        | ChatBot                                                                                                                                                       | Utah Compose                                                                                  | AI-Based Robot, Computer Systems, Virtual Reality Systems                                                               | ChatGPT Pixton (Web 2.0 Tool)                                                                                 | ChatGPT                                                                                                                   |
| Objective   | Designing an AI-powered feedback                                     | An examination of university students' perceptions of                                          | Examining the impact of topic-specific chatbots on                                                                                                            | An investigation of the effect of the Utah Compose                                            | Examining the effects of artificial intelligence-                                                                       | The examination of the impact of tools such as ChatGPT                                                        | The examination of the impact of artificial intelligence usage on                                                         |

|             |                                                                                                                     |                                                                                                                                                                                |                                                                                     |                                                                                         |                                                                                                        |                                                                                                           |                                                                                                                                                                 |
|-------------|---------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
|             | application and examining its impact.                                                                               | ChatGPT in terms of variables.                                                                                                                                                 | students' academic achievement and perceptions.                                     | application on students' writing skill performance in exams.                            | supported educational technologies for students with disabilities.                                     | and Pixton on university students' academic performance.                                                  | university students' critical thinking.                                                                                                                         |
|             | 15                                                                                                                  | 16                                                                                                                                                                             | 17                                                                                  | 18                                                                                      | 19                                                                                                     | 20                                                                                                        | 21                                                                                                                                                              |
| Author      | Liu, HG. ve Fan, JQ.                                                                                                | Huang, M.                                                                                                                                                                      | Zhao vd.                                                                            | Samala vd.                                                                              | Zhao, Y.                                                                                               | Chen, K.                                                                                                  | Sun, GH.                                                                                                                                                        |
| Year        | 2025                                                                                                                | 2025                                                                                                                                                                           | 2024                                                                                | 2025                                                                                    | 2025                                                                                                   | 2025                                                                                                      | 2024                                                                                                                                                            |
| Method      | Quantitative                                                                                                        | Mixed Method                                                                                                                                                                   | Mixed Method                                                                        | Literature Review                                                                       | Literature Review                                                                                      | Quantitative                                                                                              | Literature Review                                                                                                                                               |
| Pattern     | Relational Screening                                                                                                | Relational Screening                                                                                                                                                           | Relational Screening                                                                | Scoping Review                                                                          | Scoping Review                                                                                         | Relational Screening                                                                                      | Scoping Review                                                                                                                                                  |
| Sample      | University Students                                                                                                 | Middle School Students                                                                                                                                                         | University Students                                                                 | Literature (GenAI)                                                                      | Artificial Intelligence in Education                                                                   | University Students                                                                                       | Literature (GenAI)                                                                                                                                              |
| Sample size | 637                                                                                                                 | 616                                                                                                                                                                            | 298                                                                                 | 453                                                                                     | 79                                                                                                     | 218                                                                                                       | Ø                                                                                                                                                               |
| AI          | AI                                                                                                                  | AI (Language Learning Platforms)                                                                                                                                               | ChatGPT                                                                             | GenAI                                                                                   | AI                                                                                                     | AI                                                                                                        | GenAI                                                                                                                                                           |
| Objective   | The examination of the effect of AI-supported language learning on university students' willingness to communicate. | The examination of the effect of artificial intelligence-supported language learning platforms on middle school students' language learning and participation levels in class. | An examination of university students' acceptance of ChatGPT in terms of variables. | Examination of Generative Artificial Intelligence (GenAI) studies under various themes. | The examination of the impact of artificial intelligence on personalized and problem-focused learning. | An examination of university students' generative artificial intelligence literacy in terms of variables. | Evaluation of the principles and applications of “prompt engineering” for the effective use of Generative Artificial Intelligence (GenAI) in nursing education. |
|             | 22                                                                                                                  | 23                                                                                                                                                                             | 24                                                                                  | 25                                                                                      | 26                                                                                                     | 27                                                                                                        | 28                                                                                                                                                              |
| Author      | González-Rico, P. ve Sintes, ML.                                                                                    | Xia vd.                                                                                                                                                                        | Sáez-Velasco vd.                                                                    | Acosta-Enriquez vd.                                                                     | Yu vd.                                                                                                 | Karataş vd..                                                                                              | Swist vd.                                                                                                                                                       |
| Year        | 2024                                                                                                                | 2024                                                                                                                                                                           | 2024                                                                                | 2024                                                                                    | 2024                                                                                                   | 2024                                                                                                      | 2024                                                                                                                                                            |
| Method      | Mixed Method                                                                                                        | Quantitative                                                                                                                                                                   | Mixed Method                                                                        | Quantitative                                                                            | Quantitative                                                                                           | Qualitative                                                                                               | Qualitative                                                                                                                                                     |
| Pattern     | Relational Screening                                                                                                | Relational Screening                                                                                                                                                           | Relational Screening                                                                | Relational Screening                                                                    | Relational Screening                                                                                   | Descriptive and Discovery-Focused Design                                                                  | Relational Screening                                                                                                                                            |
| Sample      | University Students                                                                                                 | University Students                                                                                                                                                            | University Students, Faculty Members                                                | University Students                                                                     | University Students                                                                                    | University Students                                                                                       | University Students, Faculty Members, Administrators                                                                                                            |
| Sample size | 182                                                                                                                 | 600                                                                                                                                                                            | 10                                                                                  | 499                                                                                     | 328                                                                                                    | 13                                                                                                        | Ø                                                                                                                                                               |
| AI          | ChatGPT                                                                                                             | GenAI                                                                                                                                                                          | GenAI                                                                               | ChatGPT                                                                                 | ChatGPT                                                                                                | ChatGPT                                                                                                   | AAI-EdTech                                                                                                                                                      |



|             |                                                                          |                                                                                                                            |                                                                                                                                                                        |                                                                                        |                                                                                                                                                   |                                                                                                                                         |                                                                                         |
|-------------|--------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| Objective   | The examination of ChatGPT's impact on university students' soft skills. | The examination of the impact of GenAI-supported language learning applications on university students' language learning. | An examination of university students' and faculty members' perceptions of GenAI in terms of variables.                                                                | An examination of university students' attitudes toward ChatGPT in terms of variables. | An examination of the factors influencing university students' use of ChatGPT.                                                                    | The examination of ChatGPT's impact on language learning among university students.                                                     | Examining how artificial intelligence technologies can be designed during the pandemic. |
|             | 29                                                                       | 30                                                                                                                         | 31                                                                                                                                                                     | 32                                                                                     | 33                                                                                                                                                | 34                                                                                                                                      | 35                                                                                      |
| Author      | Cortez vd.                                                               | Figueroa vd.                                                                                                               | Shin vd.                                                                                                                                                               | Yi vd.                                                                                 | Wei vd.                                                                                                                                           | Zhang vd.                                                                                                                               | Ratten, V. ve Jones, P.                                                                 |
| Year        | 2024                                                                     | 2024                                                                                                                       | 2024                                                                                                                                                                   | 2024                                                                                   | 2023                                                                                                                                              | 2023                                                                                                                                    | 2023                                                                                    |
| Method      | Quantitative                                                             | Literature Review                                                                                                          | Literature Review                                                                                                                                                      | Literature Review                                                                      | Mixed Method                                                                                                                                      | Quantitative                                                                                                                            | Literature Review                                                                       |
| Pattern     | Relational Screening                                                     | Scoping Review                                                                                                             | Scoping Review                                                                                                                                                         | Scoping Review                                                                         | Relational Screening                                                                                                                              | Relational Screening                                                                                                                    | Scoping Review                                                                          |
| Sample      | University Students                                                      | Literature (Smart Classrooms)                                                                                              | Literature (AI EdTech)                                                                                                                                                 | Literature (Early Childhood Education (ECE) AI)                                        | University Students                                                                                                                               | University Students                                                                                                                     | Literature (AI EdTech)                                                                  |
| Sample size | 533                                                                      | Ø                                                                                                                          | Ø                                                                                                                                                                      | Ø                                                                                      | 60                                                                                                                                                | 452                                                                                                                                     | Ø                                                                                       |
| AI          | CAI (Communicative Artificial Intelligence)                              | AI                                                                                                                         | ChatGPT vb.                                                                                                                                                            | AI                                                                                     | AI (Language Learning Platforms)                                                                                                                  | AI                                                                                                                                      | AI                                                                                      |
| Objective   | An examination of the factors affecting university students' use of CAI. | Examining the ways artificial intelligence is used in smart classrooms and presenting an example application.              | The transformation of professors' roles in the adoption of AI EdTech in higher education and the integration of artificial intelligence into educational environments. | Examining the use and role of artificial intelligence in early childhood.              | The examination of the impact of artificial intelligence-supported language learning platforms on university students' language learning success. | An examination of university students' acceptance levels of artificial intelligence and their attitudes toward artificial intelligence. | The integration and use of artificial intelligence in educational technologies.         |
|             | 36                                                                       | 37                                                                                                                         | 38                                                                                                                                                                     | 39                                                                                     | 40                                                                                                                                                | 41                                                                                                                                      | 42                                                                                      |
| Author      | Hockly, N.                                                               | Stamenkovic vd.                                                                                                            | Mageira vd.                                                                                                                                                            | Kim, NJ. ve Kim, MK                                                                    | Koc-Januchta vd.                                                                                                                                  | Tyson, MM. ve Sauers, NJ                                                                                                                | Chen vd.                                                                                |
| Year        | 2023                                                                     | 2023                                                                                                                       | 2022                                                                                                                                                                   | 2022                                                                                   | 2022                                                                                                                                              | 2021                                                                                                                                    | 2021                                                                                    |
| Method      | Literature Review                                                        | Literature Review                                                                                                          | Quantitative                                                                                                                                                           | Qualitative                                                                            | Quantitative                                                                                                                                      | Qualitative                                                                                                                             | Literature Review                                                                       |
| Pattern     | Scoping Review                                                           | Scoping Review                                                                                                             | Experimental (without a control group)                                                                                                                                 | Relational Screening                                                                   | Experimental (Semi-grouped)                                                                                                                       | Relational Screening                                                                                                                    | Scoping Review                                                                          |
| Sample      | Literature (AI)                                                          | Literature (GenAI)                                                                                                         | High School Students                                                                                                                                                   | K-12 Teacher                                                                           | University Students                                                                                                                               | School Administrators                                                                                                                   | Literature (Personalized AI Language Learning)                                          |
| Sample size | Ø                                                                        | Ø                                                                                                                          | Ø                                                                                                                                                                      | 9                                                                                      | 42                                                                                                                                                | 7                                                                                                                                       | 108                                                                                     |



| AI          | AI                                                                                                                                                                             | GenAI                                                                                                                         | AsasaraBot<br>(Developed)                                                                                                 | AI                                                                                                                                           | AI (Biology Book)                                                                                               | AI (ALEKS)                                                                                                         | AI                                                                                                                                                       |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Objective   | Discussing the advantages and risks of artificial intelligence after the pandemic and possible transformation scenarios for the future “strong artificial intelligence” phase. | Examination of simulation and visualization-based educational technologies developed for artificial intelligence training.    | Examining the impact of the developed artificial intelligence tool (AsasaraBot) on high school students' language skills. | The acceptance of AI-powered writing applications by teachers, the advantages they offer, and an examination of their role in the classroom. | The examination of the impact of an AI-supported biology textbook on university students' academic performance. | An examination of school administrators' experiences in adopting and implementing artificial intelligence systems. | An examination of publication trends, prominent themes, and developmental dynamics in the field of personalized language learning between 2000 and 2019. |
|             | 43                                                                                                                                                                             | 44                                                                                                                            |                                                                                                                           |                                                                                                                                              |                                                                                                                 |                                                                                                                    |                                                                                                                                                          |
| Author      | Lee, HS. ve Lee, J                                                                                                                                                             | Davies vd.                                                                                                                    |                                                                                                                           |                                                                                                                                              |                                                                                                                 |                                                                                                                    |                                                                                                                                                          |
| Year        | 2021                                                                                                                                                                           | 2021                                                                                                                          |                                                                                                                           |                                                                                                                                              |                                                                                                                 |                                                                                                                    |                                                                                                                                                          |
| Method      | Literature Review                                                                                                                                                              | Literature Review                                                                                                             |                                                                                                                           |                                                                                                                                              |                                                                                                                 |                                                                                                                    |                                                                                                                                                          |
| Pattern     | Scoping Review                                                                                                                                                                 | Scoping Review                                                                                                                |                                                                                                                           |                                                                                                                                              |                                                                                                                 |                                                                                                                    |                                                                                                                                                          |
| Sample      | Literature (Artificial Intelligence, Machine Learning, Deep Learning, Education, PE)                                                                                           | Literature (Educational Technology)                                                                                           |                                                                                                                           |                                                                                                                                              |                                                                                                                 |                                                                                                                    |                                                                                                                                                          |
| Sample size | Ø                                                                                                                                                                              | Ø                                                                                                                             |                                                                                                                           |                                                                                                                                              |                                                                                                                 |                                                                                                                    |                                                                                                                                                          |
| AI          | AI                                                                                                                                                                             | AI                                                                                                                            |                                                                                                                           |                                                                                                                                              |                                                                                                                 |                                                                                                                    |                                                                                                                                                          |
| Objective   | Presenting a framework for potential applications in physical education by outlining the fundamental concepts and principles of artificial intelligence.                       | An examination of how and why different stakeholders in the field of educational technology evaluate artificial intelligence. |                                                                                                                           |                                                                                                                                              |                                                                                                                 |                                                                                                                    |                                                                                                                                                          |

The second table presents the review criteria on the horizontal axis and the findings for each study on the vertical axis. The review criteria are enumerated as follows: The following elements must be included in the study: “Author”, “Year”, “Method”, “Design”, “Sample”, “Sample Size”, “AI”, and “Purpose”. The relevant studies were analysed in the context of these headings, and the data obtained were transferred to the vertical columns. The data for each study was assigned a number and included in the table. In the "Author" column, the names of authors were listed in APA 7 format for studies with multiple authors; publication dates were indicated in the "Year" column.

The following section provides a systematic presentation of the methods and models employed in the relevant studies, arranged under the headings of Method and Design. In the Method section, the "Literature Review" method is defined and explained within an academic framework. Literature review is defined as the process of data collection through meticulous examination of extant sources and documentation. This methodological approach facilitates the elucidation of the research problem and the presentation of the historical context of the study (Karasar, 1994, p. 183).

Information regarding the sampling used in each study is presented under the heading "Sample." In the designated "Sample Size" column, studies that lack data on sample size are indicated by the 'Ø' symbol, signifying that this information is unavailable. Information pertaining to the artificial intelligence system utilised in the study can be found in the section entitled "AI". Research pertaining to artificial intelligence in general is categorised under the designation "AI". In certain studies, tools that are specifically selected or highlight particular functions of artificial intelligence (e.g., Utah Compose) are mentioned separately. Literature pertaining to the utilisation of artificial intelligence in the domain of chatbot applications is commonly referred to by the colloquial term "chatbot, chatbot, chat robot." In this study, the term "chatbot" has been employed. Furthermore, this section provides a synopsis of additional tools employed in conjunction with artificial intelligence. Finally, the main objective of each study has been conveyed briefly and concisely under the heading "Purpose".

## Findings

### *Publication years of the studies reviewed*

The studies examined demonstrate that the years of publication for studies on artificial intelligence in education are between 2021 and 2025. A review of publication dates indicates a surge in studies on artificial intelligence in education since 2024.

Table 3. Publication years

| Years of Publication | Studies                                                    |
|----------------------|------------------------------------------------------------|
| 2021                 | 41, 42, 43, 44                                             |
| 2022                 | 38, 39, 40                                                 |
| 2023                 | 33, 34, 35, 36, 37                                         |
| 2024                 | 11, 12, 17, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32 |
| 2025                 | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 13, 14, 15, 16, 18, 19, 20  |

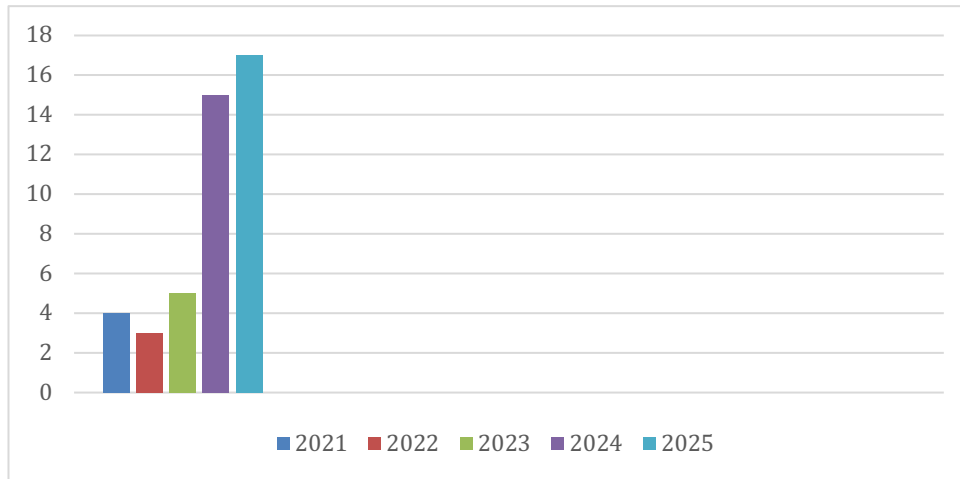


Figure 2. Number of articles by year

### *Research designs used in the studies reviewed*

Quantitative methods were selected in 17 (38.6%) of the listed studies. In 13 (29.5%) of them, a literature review was selected. In 9 (20.5%) of them, a mixed method combining both quantitative and qualitative methods was selected. In 4 (9.1%) of them, a qualitative method was selected, and in the remaining 1 (2.3%) study, a theoretical approach was used.

Table 4. Research designs

| Research Designs     | Studies                                                      |
|----------------------|--------------------------------------------------------------|
| Quantitative         | 1, 4, 5, 6, 7, 9, 11, 14, 15, 20, 23, 25, 26, 29, 34, 38, 40 |
| Scoping Review       | 12, 18, 19, 21, 30, 31, 32, 35, 36, 37, 42, 43, 44           |
| Mixed Method         | 2, 3, 10, 13, 16, 17, 22, 24, 33                             |
| Qualitative          | 27, 28, 39, 41                                               |
| Theoretical Approach | 8                                                            |

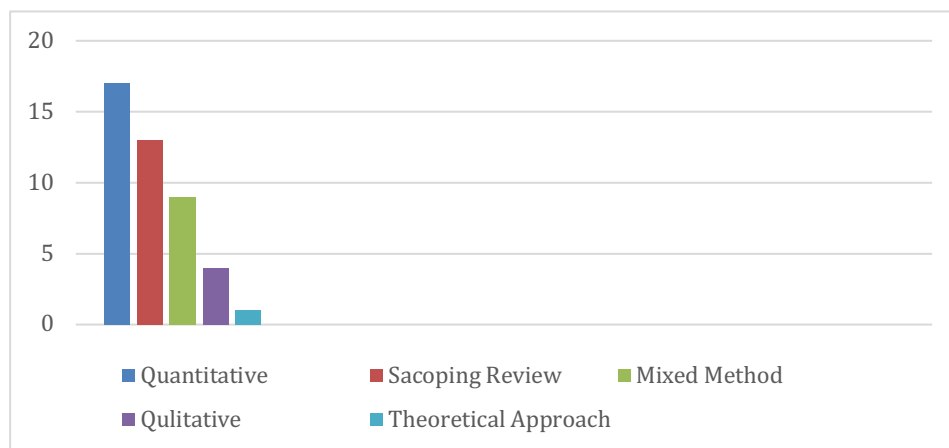


Figure 3. Number of articles by year

### *Data collection tools used in the studies reviewed*

The data collection tools employed in the reviewed studies were categorised into scales and open-ended question headings, with the objective of ascertaining the impact of artificial

intelligence utilisation on various variables, including attitude, acceptance, and academic achievement.

**Table 5. Data collection tools**

| Data Collection Tools | Studies                                                      |
|-----------------------|--------------------------------------------------------------|
| Scale, Survey         | 1, 4, 5, 6, 7, 9, 11, 14, 15, 20, 23, 25, 26, 29, 34, 38, 40 |
| Literature            | 12, 18, 19, 21, 30, 31, 32, 35, 36, 37, 42, 43, 44           |
| Scale, Interview Form | 2, 3, 10, 13, 16, 17, 22, 24, 33                             |
| Interview Form        | 27, 28, 39, 41                                               |

### ***Sample groups used in the studies examined***

The sample types utilised in the studies that examined artificial intelligence in education were selected from students, teachers, administrators, and literature studies related to the subjects addressed in the studies. A number of studies have examined more than one group as their sample.

**Table 6. Sample groups**

| Sample Groups                                              | Studies                                                                                          |
|------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| Student (elementary school, high school, university, etc.) | 3, 4, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 20, 22, 23, 24, 25, 26, 27, 28, 29, 33, 34, 38, 40 |
| Teacher (elementary school, high school, university, etc.) | 1, 2, 5, 24, 28, 39                                                                              |
| Administrator (School, etc.)                               | 28, 41                                                                                           |
| Literature                                                 | 12, 18, 21, 30, 31, 32, 35, 36, 37, 42, 43, 44                                                   |

### ***Artificial intelligence tools preferred in the studies examined***

The analysis revealed a preference for multiple artificial intelligence tools across the examined studies. In general, the heading "AI" was selected for studies that addressed artificial intelligence. In the course of the studies, the artificial intelligence tools that were most frequently preferred were 'ChatBot' and "ChatGPT". The artificial intelligence tools most frequently employed in studies concerning language learning or speaking skills were designated "Language Learning AI." In some of the studies, artificial intelligence tools specific to that study were developed or used, and these tools were termed "Study-Specific AI." A number of the studies examined defined the artificial intelligence tool they used as "Generative Artificial Intelligence" or "GenAI," and these studies were grouped under this heading. Finally, one study utilised an artificial intelligence tool designed for the enhancement of communication skills, categorised as "Communication-Purpose AI."

**Table 7. Preferred artificial intelligence tools**

| AI Tools                      | Studies                                                         |
|-------------------------------|-----------------------------------------------------------------|
| AI                            | 2, 4, 5, 12, 15, 19, 20, 30, 32, 34, 35, 36, 39, 41, 42, 43, 44 |
| ChatBot                       | 3, 10                                                           |
| ChatGPT                       | 1, 9, 13, 14, 17, 22, 25, 26, 27, 31                            |
| Language Learning AI          | 6, 7, 16, 33                                                    |
| AI for Work                   | 8, 11, 28, 38, 40                                               |
| GenAI                         | 18, 21, 23, 24, 37                                              |
| AI for Communication Purposes | 29                                                              |

### ***The objectives of the studies analysed***

Upon analysis, it was determined that the studies had multiple objectives. The purposes of the studies examined were grouped under six headings, and two of these headings were found to be particularly salient. A general tendency has been observed in studies falling under the rubric of "Impact on Success" to examine the effects of artificial intelligence tools on students' academic or various skills. A series of studies, collectively termed "Framework Presentation", were conducted to examine AI-related studies and to make a contribution to the extant literature. It should be noted that some studies were grouped under more than one heading. In this particular context, Table 8 illustrates the headings according to which the studies were grouped.

**Table 8. Objectives of the studies**

| Purpose of the Studies  | Studies                                            |
|-------------------------|----------------------------------------------------|
| AI Adoption             | 7, 17, 34, 39, 41                                  |
| AI Usage                | 1, 20, 26, 28, 29, 30, 32, 35                      |
| Perception / Attitude   | 2, 5, 6, 9, 10, 24, 25, 34                         |
| Impact on Success       | 10, 11, 13, 14, 15, 16, 22, 23, 27, 33, 38, 40,    |
| Frame Presentation      | 12, 18, 19, 21, 30, 31, 32, 35, 36, 37, 42, 43, 44 |
| Scale Development       | 4                                                  |
| Application Development | 3, 8, 38                                           |

### **Discussion and Suggestions**

In the presented scoping review, studies published over the last five years (2021-2025) on the use of artificial intelligence in education were systematically examined, and the current state of the field was presented from a holistic perspective. A comprehensive analysis of 44 studies identified in the Web of Science database has revealed a substantial surge in AI research in education, particularly in recent years, with this increase gaining significant momentum by 2024. This phenomenon is closely related to the increased visibility of generative AI tools (especially ChatGPT and GenAI-based systems) in educational environments.

When the methodological distribution of the studies examined is evaluated, quantitative research designs clearly stand out. The preponderance of studies employing quantitative or mixed methods underscores the prevailing focus in research on artificial intelligence on measurable variables such as perceptions, attitudes, adoption, and academic achievement. Conversely, the relative paucity of qualitative research and studies addressing in-depth classroom applications suggests that the pedagogical transformation of artificial intelligence in educational processes has not yet been examined in sufficient detail. This situation demonstrates that research in this field tends to concentrate on 'measuring impact', but offers limited answers to the questions of 'how' and 'why'.

The findings from the research demonstrate that, although the field of artificial intelligence was initially conceptualised within a general theoretical framework, there has been a recent shift towards the practical benefits provided by ChatGPT and similar dialogue-based generative artificial intelligence tools. This functional use, particularly observed in the fields of foreign language acquisition, academic writing skills, and individualised learning support processes, represents a new paradigm in the pedagogical integration of educational technologies. The findings of experimental research on language learning, consistent with current study data, confirm that AI-supported applications not only optimise students' cognitive competencies such as writing, speaking, vocabulary and grammar, but also significantly increase motivation and

self-efficacy perception regarding the learning process. This situation demonstrates that artificial intelligence should be evaluated not only through concrete cognitive outputs such as academic achievement, but also through affective dimensions such as reducing learning anxiety and building a participatory learning ecosystem. This thus demonstrates that technology interacts directly with learning psychology (Huang, 2025; Liu and Fan, 2025; Mageira et al., 2022; Xia et al., 2024; Wei, 2023). However, the fact that the majority of the studies under review were conducted with university students indicates a clear sample bias in the extant literature. The paucity of studies conducted at the primary and secondary levels of education suggests that the pedagogical effects of artificial intelligence on younger age groups are not yet fully understood. Furthermore, the relative paucity of studies focusing on teacher training, teachers' in-class decision-making processes, and school administrators' experiences with artificial intelligence applications can be considered a significant research gap in the field.

Upon scrutiny of the objectives of the aforementioned studies, it is observed that a significant proportion of them focus on the impact of artificial intelligence on student achievement, perceptions and attitudes towards artificial intelligence, and the processes of usage and adoption. Moreover, it has been determined that compilation studies, which aim to provide a conceptual framework by comprehensively addressing the existing literature, also occupy an important place. The proliferation of review studies signifies that the field of artificial intelligence research in education has attained a degree of maturity and saturation. Nevertheless, this situation also indicates that new studies should focus on more original applications, long-term effects, and interdisciplinary approaches. Conversely, an evaluation of studies examining the effects of AI-supported teaching applications on student achievement reveals a contribution to the development of higher-order cognitive skills such as academic achievement, critical thinking, and problem solving. However, it should be noted that the efficacy of these positive results is largely based on short-term applications and self-report measurement tools. The dearth of studies examining long-term effects, supported by experimental and quasi-experimental designs, limits the generalizability of the findings (González-Rico and Sintés, 2024; Hao, et al., 2025; Kayaalp, et al., 2025; Koc-Januchta, et al., 2022; Sánchez-Vera, 2025).

In view of the findings, the following recommendations can be made for future research. Firstly, it is recommended that qualitative and mixed-method studies be increased in order to more thoroughly reveal the pedagogical effects of artificial intelligence in education. It is hypothesised that research focusing on classroom applications, teacher-student interactions, and how learning processes are transformed will make significant contributions to the field. Moreover, an increase in the number of studies conducted with elementary and secondary school students will facilitate a more precise evaluation of the effects of artificial intelligence on diverse age groups. Finally, it is imperative to address issues such as the ethical dimension, academic integrity, data privacy, and artificial intelligence literacy in a more systematic manner to ensure the sustainable and responsible advancement of artificial intelligence use in education. However, it should be noted that the study is not without its limitations. Despite its status as the most significant reference instrument within academic circles, the utilisation of the Web of Science database as the exclusive data source may have resulted in the exclusion of pertinent studies from other databases from the review. Moreover, an exclusive focus on studies published within the last five years has resulted in the exclusion of earlier applications of artificial intelligence in education. Furthermore, the predominance of quantitative methodologies and the utilisation of self-reporting instruments in the majority of the studies

examined can be identified as a secondary factor contributing to the restriction of the findings' depth. In conclusion, the scoped review presented here comprehensively addresses current research in the field of artificial intelligence in education, revealing trends, areas of focus, and research gaps in the literature. The findings indicate that AI-based applications have the potential to make significant contributions to educational processes; however, further examination is necessary to fully understand these contributions. In this respect, the study aims to provide a guiding framework for both researchers and practitioners.

Notwithstanding the contributions of the present study, it is imperative to acknowledge its limitations. Firstly, the study is limited to articles indexed in the Web of Science database, which may have resulted in the exclusion of relevant studies from other databases. Secondly, the analysis was restricted to publications from the last five years (2021–2025), potentially overlooking earlier foundational research in the field. Thirdly, it is important to note that only studies published in accessible formats and meeting specific inclusion criteria were considered in this analysis. This may have introduced selection bias. Furthermore, the restriction of the inclusion of studies to those published in English may have resulted in an underrepresentation of non-English language studies. Finally, the predominance of quantitative and self-report-based studies in the reviewed literature may have influenced the depth and diversity of the findings.

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