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Exploring Studies on the Use of Artificial Intelligence in Education: A Meta-Synthesis Study

Yapay Zekanın Eğitimde Kullanımına İlişkin Çalışmaların İncelenmesi: Bir Meta Sentez Çalışması

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Abstract: This meta-synthesis study systematically examines recent research on the use of artificial intelligence (AI) in education, a field that has rapidly expanded in recent years. The primary aim is to evaluate the effects of AI, explore stakeholders' perceptions and acceptance levels, and assess future trends. Master's and doctoral theses published between 2018 and 2023 were identified through the Higher Education Council National Thesis Center (YÖKTEZ) and ProQuest databases. Following PRISMA guidelines, inclusion and exclusion criteria were applied, allowing only English or Turkish full-text theses or dissertations that used qualitative or mixed methods at the K-12 or higher education levels. Studies employing quantitative methods, focusing on non-educational domains, or lacking full-text access were excluded. Ultimately, 27 studies were selected. These were analyzed using the meta-synthesis process described by Polat and Ay (2016), and thematic findings were synthesized. Results indicate that AI enhances academic achievement, personalizes learning, and enriches instructional practices. Teachers and students generally express positive attitudes toward AI, though concerns remain about data privacy, security, and ethical issues. The findings also highlight challenges, such as insufficient technological infrastructure, limited institutional support, and the need for substantial budgets. The study concludes that strategic national policies are essential for effectively transitioning to AI-supported educational systems.

Keywords: Artificial intelligence in education, educational technology in AI, AI-based educational tools.

Öz: Bu meta-sentez çalışması, son yıllarda hızla genişleyen bir alan olan eğitimde yapay zekâ (YZ) kullanımına ilişkin güncel araştırmaları sistematik biçimde incelemektedir. Çalışmanın temel amacı, YZ destekli uygulamaların etkilerini değerlendirmek, paydaşların algı ve kabul düzeylerini ortaya koymak ve geleceğe yönelik eğilimleri incelemektir. 2018–2023 yılları arasında yayımlanan yüksek lisans ve doktora tezleri, Yükseköğretim Kurulu Ulusal Tez Merkezi (YÖKTEZ) ve ProQuest veri tabanları aracılığıyla belirlenmiştir. PRISMA kılavuzları doğrultusunda dâhil etme ve hariç tutma ölçütleri uygulanmış; yalnızca İngilizce veya Türkçe, tam metin erişimi bulunan, K-12 ya da yükseköğretim düzeyinde yürütülmüş nitel veya karma yöntem tezleri analize alınmıştır. Nicel yöntem kullanan, eğitim dışı alanlara odaklanan veya tam metin erişimi olmayan çalışmalar kapsam dışı bırakılmıştır. Sonuçta 27 tez seçilmiş ve Polat ve Ay'ın (2016) tanımladığı meta-sentez süreci doğrultusunda tematik olarak incelenmiştir. Bulgular, YZ'nin akademik başarıya katkı sağladığını, öğrenme süreçlerini kişiselleştirdiğini ve öğretim yöntemlerini zenginleştirdiğini göstermektedir. Öğretmenler ve öğrenciler YZ'ye genel olarak olumlu yaklaşmakta; ancak veri gizliliği, güvenlik ve etik konularında kaygılar da taşımaktadır. Ayrıca teknolojik altyapı yetersizlikleri, sınırlı kurumsal destek ve yüksek bütçe gereklilikleri önemli engeller olarak belirlenmiştir. Çalışma, YZ destekli eğitim sistemlerine geçişte ulusal düzeyde stratejik politikaların geliştirilmesi gerektiği sonucuna ulaşmıştır.

Anahtar Kelimeler: Eğitimde yapay zekâ, yapay zekâda eğitim teknolojisi, yapay zekâ tabanlı eğitim araçları

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Introduction

Artificial intelligence, which is developed by imitating human intelligence, is the modeling of human learning by machines (Almasri, 2024; Coşkun & Gülleroğlu, 2021). Rapid developments in AI are becoming increasingly widespread in various areas of the education process. Personalizing teaching and learning environments further increases the interest in AI. AI applications allow students to learn at their own level, speed, and style (İşler & Kılıç, 2021; Shete et al., 2024). Countries such as China and America, which have achieved substantial success in AI, have transformed their education systems toward using and developing AI systems (Knox, 2020). Additionally, when AI studies in the field of education are examined, one can come across not only information-based applications such as personalized education systems, intelligent agents, chatbots, evaluation systems, and article analysis systems but also different applications in different areas of education such as course programs, exam management, language translations, and cyber security (Arslan, 2020). Educational administrators gain efficiency by using artificial intelligence (AI) systems in management tasks such as student application and registration, budgeting, class assignments, and purchasing activities (İşler & Kılıç, 2021).

Artificial intelligence has come to the forefront as a technology that has led to radical changes in education. Although these developments are intended to simplify processes, they raise some concerns. Data security, the risk of increasing inequalities, and the fear that the role of teachers will diminish are among the main criticisms of using AI in education (Bai et al., 2023; Felix, 2020; Shete et al., 2024). In integrating AI into the education system, it is important to carefully evaluate its ethical and social impacts (Ferhataj et al., 2025). Although the volume of academic research in AI has steadily increased, studies focusing on its educational applications remain relatively limited (Arik & Seferoglu, 2022; Tlili et al., 2025).

The primary rationale for conducting this study, which concentrates on perceptions of and approaches to using AI in education, stems from the accelerated advancement of AI technologies. Recent review studies discuss the impact of AI usage in education (e.g., Batista et al., 2024; Bond et al., 2024; Bozkurt et al., 2021; Martin et al., 2024; Zawacki-Richter et al., 2019). However, more research might still be needed to

comprehensively understand the social, individual, ethical, and educational implications. This research investigates the factors that shape positive and negative perceptions of AI. The study aims to critically analyze the integration of AI in diverse educational contexts and establish a foundational framework for its future applications. It aims to contribute to the broader literature on AI by facilitating informed decision-making through a nuanced understanding of its potential benefits and risks.

Literature Review

People have been curious about building machines that can think and act intelligently throughout history. Various efforts were devoted to making this idea a reality. For example, in 1950, Alan Turing, an important figure in the AI field, developed a Turing machine intelligence test, questioning the thinkability of machines. In 1950, the concept of AI was first articulated at a conference held at Dartmouth College (Nabiyev & Erümit, 2022). Following 1960, as technological progress accelerated, AI research expanded beyond simple thinking machines to develop more sophisticated algorithms and systems to imitate human intelligence. The world witnessed the emergence of diverse artificial intelligence (AI) technologies, including artificial neural networks, intelligent agents, natural language processing, expert systems, and robotics (Kayabaş, 2010). Key developments in AI include IBM's chess-playing computer defeating a chess champion in 1997, the rise of virtual assistants like Siri, Google Assistant, and Cortana between 2011 and 2014, AlphaGo's victory in the game of Go in 2016, and the establishment of ethical AI guidelines in the EU in 2018 (Ghimire & Edwards, 2024; Nabiyev & Erümit, 2022).

The current review study was initiated in 2023, and during the preparation of the current study, the literature has shown limited use of AI in education, particularly with the assistance of ChatGPT. The release of transformative language models, such as GPT-3 in 2020 and ChatGPT in 2022, led to a significant turning point in the field. This rapid advancement in large language models (LLMs), a subset of AI, has enhanced the ability to process and generate human-like text. Generative AI is a broader term used for AI capable of creating text, visuals, sound, and other elements using just a few prompts (Ghimire & Edwards, 2024; Nabiyev & Erümit, 2022).

Nabiyev (2021) defined AI as the ability of a computer or a computer-controlled machine to perform tasks that require high-level cognitive processes, i.e., the ability of machines to imitate human skills. The primary AI techniques include expert systems, fuzzy logic, genetic algorithms, artificial neural networks, intelligent agents, decision trees, and Bayesian networks (Akdeniz & Özdinç, 2021). However, no consensus exists on which techniques fit best for learning theories (Fahimirad & Kotamjani, 2018).

Education is an evolving process that is influenced by societal needs and technology. It started with books and progressed through radio, television, computers, and the internet, enabling access to diverse resources anytime and anywhere (Korucu & Biçer, 2022). The recent integration of AI further signifies a transformative phase in education (Dağ, 2022). According to Nabiyev and Erümit (2022), AI is employed in education for automatic achievement assessment, prior knowledge reinforcement, instructor-student evaluation, virtual classroom assistants, and personalized learning.

According to Fahimirad and Kotamjani (2018), AI can transform education differently. It makes grading automatic, saving time for teachers. AI tutors can assist students with essential topics. It can provide feedback on the progress of students. AI can substitute some teaching tasks, but will likely shift teachers to facilitators. In a judgment-free environment, AI fosters trial-and-error learning (Fahimirad & Kotamjani, 2018). Learning analytics employs AI to examine massive amounts of data to recognize patterns and anticipate outcomes. Chatbots and virtual assistants enhance the interaction between students and educational technologies, leading to more interactive experiences (Ouyang & Jiao, 2021). Some other usage areas of AI in education include content and curriculum development, virtual realities for immersive education, and learning experiences with gamification (Chen et al., 2020).

Despite its advantages, there are also concerns regarding the use of AI in education. For example, researchers have reported that the teaching profession could be threatened, probably due to changes in the role of teachers. Data confidentiality cannot be ensured, and moral sensitivity cannot be maintained (Bai et al., 2023; Osetskyi et al., 2020; Shete et al., 2024). According to Osetskyi et al. (2020), AI implementation might pose some challenges. These involve difficulty assessing student creativity, ensuring classroom management, and providing motivational and emotional support. Concerns are also associated with the dehumanization of education and changes in teacher-student dynamics. Technical issues, such as crashes and viruses, also pose risks to student data privacy.

Recent systematic reviews, meta-syntheses, and meta-analyses of AI integration in education offer critical insights into its current applications, which enhance our understanding of AI's effectiveness and challenges in educational settings. For example, Batista et al. (2024) systematically reviewed 37 studies on using generative artificial intelligence (GAI) in higher education. They discovered that GAI offered assistance to students, increased teaching effectiveness, and simplified research tasks. The study revealed that effort, performance expectancy, and social influence are important factors contributing to GAI attitude. Concerns regarding evaluation methodologies, organizational policies, and integrity threats were also noted (Batista et al., 2024). Fu et al. (2024) synthesized findings from 126 systematic reviews on educational AI and identified three key impact areas: student learning (affect, 21st-century skills, cognition, personalized learning, and assessment), teaching (evolving instructor roles, curriculum design, and teacher development), and educational administration. Similarly, Bond et al. (2024) conducted a meta-review of research on using AI in higher education by examining 66 review studies. Using a well-known classification adopted by the literature, the findings indicated that studies focused on the general application of AI; some specifically addressed its use in adaptive systems, personalization, profiling, and predictive analytics. The advantages of AI in this context include facilitating personalized learning, enhancing student outcomes, reducing administrative workload for managers and teachers, and supporting educators' professional development. However, the study also identified several disadvantages, such as ethical concerns, challenges in curriculum adaptability, inadequate infrastructure, and a lack of technical skills. Dönmez (2024) conducted a bibliometric study on AI-driven educational tools for feedback, highlighting their role in enhancing learning outcomes. The research explored key themes, including AI technology, applications such as automated writing

assessment and learning analytics, and the link between AI and instructional design. It also addressed ethical and societal concerns surrounding AI in education. Türkmen (2025) reviewed 35 studies on explainable artificial intelligence (XAI), which enhances the transparency of AI models and helps users understand how outputs are generated. Using the PICOS (Population, Intervention, Comparison, Outcome, Study Design) framework, the review found that increased transparency increases user adoption, motivation, and trust.

Problem Statement and Research Questions

The emergence of COVID-19 prompted significant changes and transformations in education. The following figure (Figure 1) was obtained when the keywords "AI in education" were explored in Google Trends between 2019 and 2025. As shown in Figure 1, AI's popularity in education increased with time. However, the main increase has occurred due to the introduction of ChatGPT in November 2022. Nevertheless, the number of academic studies in education is still not as expected (Arık & Seferoğlu, 2022; Tlili et al., 2025).

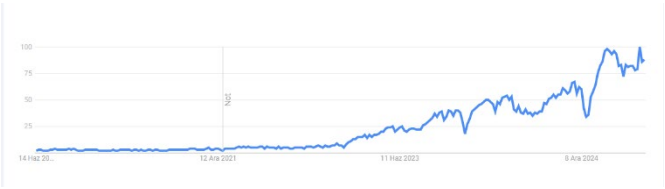

Figure 1. Google trends analysis

The application of AI in education has many benefits, but there are also drawbacks. Using well-planned strategies to implement the AI transformation process will reduce the likelihood of potential problems. This study analyzes master's theses and doctoral dissertations concerning the use of artificial intelligence (AI) in education. The study aims to offer a comparative overview of existing knowledge, identify gaps in the literature, and guide future research. In this way, it is expected to provide in-depth insights into the impact of AI, its application areas, examples, and future directions in education. This meta-synthesis study has the potential to deepen and broaden our understanding of the field by combining previous research. Meta-synthesis studies examine the qualitative research results in a field to develop new conclusions (Polat & Ay, 2016). This study synthesizes diverse findings from different studies to identify themes and trends and present new perspectives. The following research questions were posed based on the study's aim:

1. What are the general characteristics (e.g., publication year, degree level, language, and country of institution) of the studies on the use of AI in education?
2. What methodological features are employed in the selected studies (i.e., research designs and data collection instruments)
3. How are studies distributed across different research areas or educational domains?
4. What recommendations do the reviewed studies propose based on their findings?

Method

This study used meta-synthesis to review existing studies on AI in education. This approach was used to understand the current state of AI in education and identify potential future research directions. Meta-analysis studies integrate the results of qualitative or mixed methods. It intends to produce knowledge and gain deeper insights (Karakose et al., 2024). Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) was employed for data collection (Moher et al., 2010; Page et al., 2021). In the current study, data extraction began in August 2023. Research exploring the use of AI in education was prompted by the introduction of ChatGPT in November 2022. Owing to the limited number of articles published during that period, the study focused specifically on master's theses and doctoral dissertations as its sample. Furthermore, such studies provided more detailed insights than typical articles.

After determining the topic, the following keywords were identified: 'artificial intelligence,' 'artificial intelligence in education,' 'artificial intelligence and education,' and 'education and AI'. First, a literature review was initiated to select studies for meta-synthesis. During the review, the keywords were entered into the Turkish Council of Higher Education Thesis Center (YÖKTEZ) for Turkish sources and the ProQuest databases for English sources. A total of 298 Turkish and 609 English sources were reviewed. Studies lacking full texts were excluded. The inclusion and exclusion criteria were determined, and studies to be meta-synthesized were selected based on these criteria. The following inclusion criteria have been established:

- Only master's theses and doctoral dissertations written in English or Turkish should be considered.
- The full texts of the studies should be available.
- Studies employing qualitative and mixed research methods are considered.
- Studies based on K12 and higher education are selected.

The following exclusion criteria were determined:

- Studies with inaccessible full-text
- Studies that did not employ qualitative research
- Studies on AI, but unrelated to education
- Studies outside the scope of K-12 and higher education levels

Following the database screening process, studies for which full texts were inaccessible were excluded, resulting in 847 studies. Initially, titles were screened, followed by abstracts for further exclusion. After a detailed examination based on the inclusion and exclusion criteria, 27 studies (17 master's theses and 10 doctoral dissertations) were included. The PRISMA procedure adopted in the current study is illustrated in Figure 2:

The coding list of the studies included in this meta-synthesis study is provided in Appendix I. Note that the code MT indicates the master's thesis, and the code DD refers to the doctoral dissertation. Appendix II also provides the PRISMA checklist offered by Page et al. (2021).

Data Analysis

Researchers can use different methods in the field of meta-synthesis research. A review of the existing literature shows that the approach, selection process, and evaluation of included studies vary, as do the types of findings, numbers, and synthesis process (Güneş & Erdem, 2022). In this study, data analysis was conducted using the thematic synthesis method.

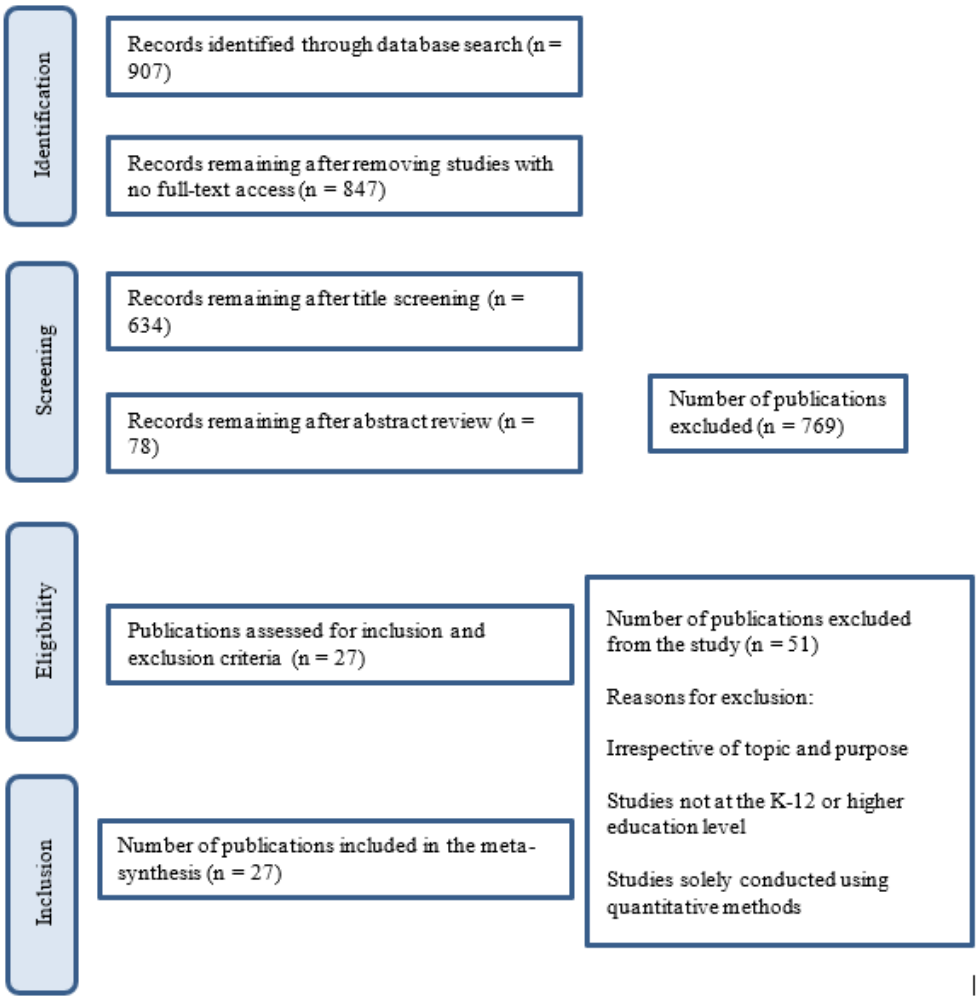

Figure 2. Procedure for the PRISMA

The steps of the meta-synthesis process prepared by Polat and Ay (2016) were followed to ensure validity and reliability. (1) The research started by identifying the main topic and related questions. Keywords were determined for the literature review after deciding on the topic. (2) A literature review was conducted using carefully selected keywords. (3) Sources were initially screened by their titles, followed by abstracts, and potentially relevant studies were recorded for further detailed analysis. (4) Studies were selected using inclusion and exclusion criteria and PRISMA guidelines. Studies that did not meet these criteria were excluded. The remaining studies were recorded. Studies were carefully monitored based on their alignment with the research questions, methodologies, publication dates, and predefined inclusion and exclusion criteria. (5) All studies were continuously read with an iterative process following the selection of 27 studies for meta-synthesis. Each selected study was examined in depth to identify commonalities and differences, leading to the development of overarching themes and sub-themes. (6) The findings were synthesized, highlighting similarities and distinctions across studies, and presented using tables or graphs, according to research questions that focused on different characteristics. (7) Finally, the entire process and the results were reported (Polat & Ay, 2016).

A thematic synthesis was employed as the preferred approach to analyze the data because it allows researchers to systematically combine and interpret results from multiple qualitative studies. Similar to thematic analysis, thematic synthesis uses techniques commonly used in thematic analysis of qualitative research but modifies them for systematic reviews. This method maintains a connection to the original studies while facilitating the development of new interpretations and explanations (Thomas & Harden, 2008).

The thematic coding process was conducted in three stages, as described by Thomas and Harden (2008). First, the results from the selected studies were analyzed using an inductive (data-driven) coding method, whereby codes, themes, and sub-themes emerged from the findings rather than being constructed from a predefined theoretical framework. Codes were created based on the findings' similarities and differences. Second, similar codes related to findings from different studies were grouped and organized into tables to reveal key descriptive themes and sub-themes related to the research questions.

More complex analytical themes were developed from the descriptive ones, allowing for deeper interpretations and explanations beyond the original studies (Güneş & Erdem, 2022). Research questions guided the identification of themes and subthemes. The MS Office Excel software was used for categorization and tabulation. The codes and themes were reviewed at intervals of at least two weeks to ensure continuity and consistency. Two field experts were consulted to ensure the reliability of the study, and their opinions were used to determine themes and sub-themes. The required arrangements were made in accordance with the expert opinions and feedback. Conflicts were resolved based on the discussion until a consensus was reached. Each step in the study was explained in detail to increase transparency.

Findings

Findings Associated with Study Characteristics

This section presents the characteristics of the studies, such as publication year, publication type, and publication language. A total of 27 studies, including 17 master's and 10 doctoral theses, were included in this meta-synthesis study. Table 1 shows the distribution of the included studies according to publication year and publication type.

Table 1 shows that the number of theses and dissertations seems to increase with the emergence of the pandemic and digital transformation. However, the real increase may be attributed to the introduction of ChatGPT in 2022. Although the starting date was set as 2018, no studies meeting the inclusion criteria were found for that year upon examination.

Of the 17 master's theses included in the meta-synthesis study, six were published in Turkish and 11 in English. Three of the 10 doctoral dissertations were prepared in Turkish and seven in English (Figure 3).

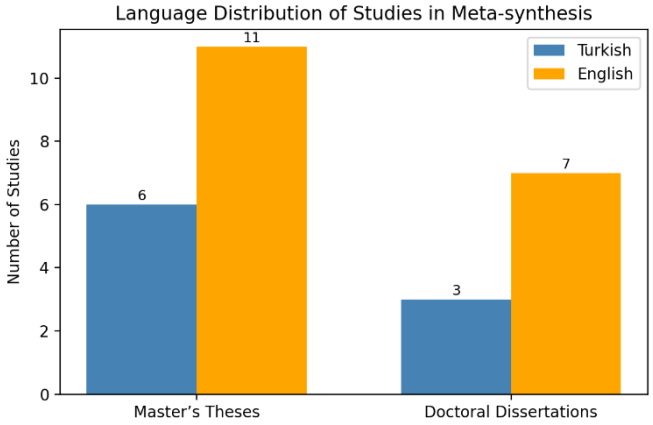

Figure 3. Language distribution of the studies

Table 2 lists the countries where the studies originated. The table included each study's country of origin based on the location, study codes, and frequency of its degree-granting institution.

As can be seen from the table, most studies are conducted in Turkey and the United States of America. The analysis also shows contributions from countries such as the UAE, Egypt, Portugal, and Canada. The observed distribution suggests a geographically widespread academic interest in applying AI within education.

Findings Associated with the Methodological Patterns

When the distribution of the studies included in the meta-synthesis according to research methods was explored, 11 studies used mixed methods, nine used qualitative research, five employed case studies, and two did not disclose their methods. It should be noted that studies referring to similar methods using similar terms were merged into one category to ensure precision.

First, the data collection methods and tools of the studies were examined (Table 2).

Meta-synthesis studies include both qualitative and mixed-methods research. Consequently, the quantitative data collection instruments used in the reviewed studies were also incorporated into Table 2. Results indicated that the interview was the most common technique in qualitative studies, while the semi-structured interview was the most preferred tool. In the next step, studies were explored based on the teaching level.

Results revealed that most studies on AI were conducted at the higher education level. Two studies concentrated on primary schools, eight on secondary schools, and six on high schools. One study focused on the associate degree level, and seven worked with graduate students. Considering educators in terms of the study group, eight studies worked with K12 teachers, whereas six studies worked with high school instructors.

Findings Associated with The Distribution of Studies by Research Area

The next step shows the study findings according to the research area (Table 4).

Table 1. Study distributions

	2018*	2019	2020	2021	2022	2023	Total
Master Thesis	0	MT9	MT13 MT14	MT12 MT16 MT17	MT1 MT2 MT3 MT4 MT5 MT10 MT15	MT6 MT7 MT8 MT11	17
Doctoral Dissertation	0			DD4 DD5	DD1 DD3 DD6 DD10	DD2 DD7 DD8 DD9	10
Total	0	1	2	5	11	8	27

Table 2. Countries where the studies originated

Country	Code Name	Frequency
Canada	MT16	1
Egypt	MT11, MT8	2
Portugal	DD10, MT12, and MT17	3
Turkey	MT3, DD2, MT7, DD1, MT2, MT6, MT5, MT4, and DD3	9
United Arab Emirates (UAE)	MT14, MT10, and MT15	3
United States of America	DD7, DD8, MT13, DD6, DD4, MT9, DD9, DD5, and MT1	9

Table 2. Methods and tools for data collection

Data collection techniques used	Data collection tools	Studies	F
Survey/scale	Perception survey	DD6	5
	Student opinion survey	MT2, MT9	
	Perception scale	MT17	2
	Attitude scale	MT9, DD6, MT12	
Content analysis	Document analysis	MT1, MT7, DD4, MT14, and MT16	6
	Case study analysis	DD8	
Interview	Semi-structured interview	DD1 MT1, MT3, MT4, MT5, DD3, MT6, MT8, DD5, MT10, DD8, MT13, DD9, and DD10	19
	Focus group interview	MT3	
	Interview form (type not specified)	DD2	
	Structured interview	MT11, MT12, and MT15	
Diaries	Researcher diaries	MT1	1
Observation	Researcher observation	DD1, DD7	2
	Field observation	DD4, DD7, and MT14	3
Discussion	Group discussions	DD9, MT14	2

Table 3. Teaching level of the study

School level	Studies	Frequency
Primary school	DD4, MT14	2
Middle school	MT1, MT3, MT5, DD3, DD4, DD7, MT14, and MT15	8
High school	DD1, DD2, DD4, MT10, MT14, and MT15	6
Associate degree	MT9	1
Bachelor	MT2, MT7, MT9, DD5, MT12, MT16, DD10, MT17, MT9, and DD6	10
Postgraduate	MT9, DD6, MT12, MT16, DD10, MT17, and MT9	7
K12 teachers	MT3, MT4, DD3, MT6, MT10, MT13, DD9, and MT15	8
High school instructors	MT2, MT8, DD5, MT11, DD8, and DD6	6
	Total	48

Table 4. Distribution of studies according to research areas or educational domains

Themes	Sub Themes	Studies	Frequency	Total
Impact of AI on academic outcomes	Impact on academic achievement	MT1, MT2, MT4, MT5, DD1, DD3, DD5, DD10, and MT10	9	16
	Effects of intelligent tutoring systems	MT2, MT5, DD1, DD3, DD4, DD5, DD6, DD7, MT10, MT12, MT13, MT14, and MT15	13	
	Use of artificial intelligence in assessment and evaluation	MT2, MT4, DD5, and MT15	4	
AI in the future perspective	AI future	MT7, DD2, DD3, DD10, MT8, MT9, MT11, MT12, MT16, and MT16	9	14
	Future anxiety and occupational risk	MT3, MT6, MT9, MT2, MT7, DD10, and MT13	7	
	Effect of AI on the role of teaching	MT2, MT3, MT4, MT7, DD2, DD10, MT13, and MT6	8	
Stakeholders' attitudes toward and acceptance of AI in education	Attitudes of administrators toward and acceptance of AI	DD4, DD8, DD10, and DD2	4	17
	Attitudes of teachers toward and acceptance of AI	MT2, MT3, MT1, MT4, MT6, DD3, DD8, MT8, MT13, and DD2	10	
	Attitudes of students toward and acceptance of AI	MT2, MT5, DD3, DD5, MT9, MT10, and MT12	11	
Ai perception	Student perception	MT2, MT5, DD3, DD6, DD7, and MT17	6	16
	Teacher perception	MT2, MT4, DD2, DD6, DD8, DD7, DD9, MT8, MT12, MT13, MT14, MT15, and MT6	13	
AI in educational institutions	Impact of AI on education system management	MT4, MT7, DD2, DD4, DD5, DD7, DD8, MT15, and MT16	9	17
	Difficulty in integrating AI into the system	MT4, MT7, DD3, DD9, DD10, MT8, MT13, MT15, and MT11	9	
	AI readiness of institutions	DD4, MT11, MT4, MT7, DD10, MT8, MT9, MT13, MT14	9	
AI from an ethical perspective	Concern about the morality of AI	DD2, DD3, DD7, MT8, MT13, and DD10	6	7
	AI reliability	DD2, DD7, DD9, and MT13	4	
Number of themes (6)	Number of subthemes (17)	Frequency	162	97

The results indicated that studies have examined the role of AI in education from multiple perspectives. Table 4 shows the impact of AI on academic outcomes, AI in the future perspective, stakeholders' attitudes toward and acceptance of AI in education, AI perception, AI in educational institutions, and AI from an ethical perspective.

In the next step, the studies were evaluated to determine whether they affected the predetermined outcomes. The results are given in Table 5.

Table 5: Study distributions according to research areas and their effect on the outcome variables

Themes	Sub Themes	Effect? Yes	Effect? No	F	Total
Impact of AI on academic outcomes	Impact on academic achievement	MT1, MT2, MT4, MT5, DD1, DD3, DD5, DD10, and MT10		9	16
	Effects of using intelligent tutoring systems	MT2, MT5, DD1, DD3, DD4, DD5, DD6, DD7, MT10, MT12, MT13, MT14, and MT15		13	
	Use of artificial intelligence in assessment and evaluation	MT2, MT4, DD5, and MT15		4	
AI in the future perspective	AI future	MT7, DD2, DD3, DD10, MT8, MT9, MT11, MT12, and MT16		9	14
	Future anxiety and occupational risk	MT3, MT6, and MT9	MT2, MT7, DD10, and MT13	7	
	Effect of using AI on the teaching role	MT2, MT3, MT4, MT6, MT7, DD2, DD10, and MT13		8	
Stakeholders' attitudes toward and acceptance of AI in education	Attitudes of administrators toward and acceptance of AI	DD4, DD8, and DD10	DD2	4	21
	Attitudes of teachers toward and acceptance of AI	MT2, MT3, MT1, MT4, MT6, DD3, DD8, MT8, and MT13	DD2	10	
	Attitudes of students toward and acceptance of AI	MT2, MT5, DD3, DD5, MT9, MT10, and MT12		7	
AI Perception	Student perception	MT2, MT5, DD3, DD6, DD7, and MT17		6	16
	Teacher perception	MT2, MT4, MT6, DD6, DD8, DD7, DD9, MT8, MT12, MT13, MT14, and MT15	DD2	13	
AI in educational institutions	Impact of AI on education system management	MT4, MT7, DD2, DD4, DD5, DD7, DD8, MT15, and MT16		9	17
	Difficulty in integrating AI into the system	MT4, MT7, DD3, DD9, DD10, MT8, MT13, and MT15	MT11	9	
	AI readiness of institutions	DD4, MT11	MT4, MT7, DD10, MT8, MT9, MT13, and MT14	9	
AI from an ethical perspective	Concern about the morality of AI	DD2, DD3, DD7, MT8, and MT13	DD10	6	7
	AI reliability		DD2, DD7, DD9, and MT13	4	

First, studies were evaluated based on their findings on how AI affected academic outcomes. Nine studies (MT1, MT2, MT4, MT5, DD1, DD3, DD5, DD10, and MT10) addressed academic achievement, and 13 (MT2, MT5, DD1, DD3, DD4, DD5, DD6, DD7, MT10, MT12, MT13, MT14, and MT15) investigated AI-assisted or intelligent tutoring systems. The results show that AI significantly influences personalized learning, focusing on individualized, needs-based, customized programs. Positive results are consistently reported in the studies, with special attention paid to the usefulness of the prompt feedback these systems offer, which increases user engagement and effectiveness. Only four studies concentrated on AI-supported assessment and evaluation in education, all of which emphasized the benefits of AI in this field. They point out that AI-based solutions provide a more objective and consistent method for measurement and evaluation.

Considering the "AI in future perspective" category, concerns have been raised over the long-term effects of incorporating artificial intelligence (AI) into education. Fourteen studies have examined the possible future impacts of AI on education. Studies in the "AI future" subcategory focused on how AI will likely be used in education. All nine studies (MT7, DD2, DD3, DD10, MT8, MT9, MT11, MT12, and MT16) reported that AI would be beneficial, becoming a crucial component of the educational system and substantially contributing to its development. Although AI has many advantages, the study coding DD2 emphasizes that the usage of AI needs to be regulated within a concise and structured framework.

In the future anxiety-occupational risk subcategory, studies addressed that AI will inevitably impact teaching. Three studies (MT3, MT6, and MT9) that investigated this effect raised concerns about possible employment risk or the profession's loss. Nonetheless, four studies (MT2, MT7, DD10, and MT13) contended that teaching will continue to be crucial. AI was projected mainly to help with routine tasks such as tracking and reporting. AI cannot take the role of a teacher since youth still need supervision and emotional support, which AI cannot offer. According to the MT2 study, students desire both AI and teacher mentoring, highlighting the vital role that human teachers play in filling in emotional and communication gaps. Considering the effect of using AI on the teaching role, studies show that AI will change the education profession, especially the roles of educators. The coding of MT2, MT3, MT4, MT6, MT7, DD2, DD10, and MT13 indicates that teachers must adapt their practices to AI. The study on MT3 shows that the importance of the profession may decline, and teachers may face economic challenges. While many studies acknowledge a shift in teaching roles, they do not view AI as a replacement, but rather as a collaborative tool.

Next, stakeholders' attitudes and acceptance of AI in education were explored. The acceptance of AI is key to its effective use in education. This category evaluated research on the acceptance of or attitude of students, teachers, and administrators. Seven studies reported positive views on the acceptance of AI by students. These were coded as MT2, MT5, DD3, DD5, MT9, MT10, and MT12. No study demonstrated a negative attitude or a less favorable view of acceptance. Ten studies examined teacher attitudes and acceptance levels, and almost all declared positive attitudes and high acceptance (MT2, MT3, MT1, MT4, MT6, DD3, DD8, MT8, and MT13). In contrast, one study (DD2) showed negative attitudes and low acceptance. Considering administrators' attitudes, DD4, DD8, and DD10 exhibited positive attitudes and acceptance, whereas DD2 manifested negative attitudes and a low level of acceptance. While the expressions used in the studies for students showed a more open and clear level of acceptance for teachers and institutional administrators, this situation was expressed more conditionally or with some concerns and worries. This situation was elaborated in detail in the previous studies (MT4, MT6, and MT8). AI is instrumental in simplifying tasks and is highly beneficial for personal learning. However, caution and precautionary measures should be exercised given the potential risks and ethical considerations. Additionally, the study coded MT4 noted the emotional deficiency of AI in communication, yet it maintained a favorable perspective on its acceptance. The research-coded MT2 indicated a high student attitude and acceptance level, yet it stressed the importance of teacher guidance. In MT12, students familiar with AI demonstrated a high level of acceptance, whereas those unfamiliar with it did not express any negative opinions. The study suggested that acceptance levels would likely increase if AI usage were to become more routine. In DD2, negative views from teachers and institutional administrators were reflected, and it was noted that while teachers and administrators acknowledged the benefits of AI, they hesitated to implement it in practice. Some educators and administrators opposed this new approach and preferred traditional practices. They expressed concerns about AI, citing emotional barriers along with moral and security issues as reasons for their reluctance to embrace it fully. While they acknowledged that AI could benefit teachers and students, they emphasized the importance of limiting and regulating AI use within specific boundaries.

The next step focused on AI opinions. Six studies focused on student opinions (MT2, MT5, DD3, DD6, DD7, and MT17). Students find AI successful and adaptable within the education system. They reported satisfaction with AI-supported systems, particularly those that allow for personalized learning and progress at the student's own pace, according to their individual learning needs. Studies (DD3, DD6, and MT17) revealed that chatbots actively engaged students in the teaching process. They reported high levels of enjoyment and expressed a willingness to ask questions.

Studies coding as MT2, MT4, DD2, DD6, DD8, DD7, DD9, MT6, MT8, MT12, MT13, MT14, and MT15 focused on teacher opinions and highlighted the positive impact of integrating AI into education. AI contributes to achievement, management, and other areas. Teachers report that AI facilitates the preparation of diverse learning materials and identifies learning gaps, enhancing their opinions about AI. Concerns have also been raised regarding the evolution or potential obsolescence of the professional roles of teachers in the context of AI integration.

Studies have also highlighted the potential of AI to improve educational system management (MT4, MT7, DD2, DD4, DD4, DD5, DD7, DD8, MT15, DD16). System management can reduce excessive paperwork, ensuring unbiased and prompt access to student and instructor data. AI can track student performance, attendance, and absence, and enable practical collaboration among institutions, parents, and teachers. Institutions can support individualized learning by using an intelligent teaching system in cooperation with teachers and students. Studies have stressed that preparing for such breakthroughs plays a critical institutional role.

As addressed by nine studies, AI integration into institutions poses several challenges (MT4, MT7, DD3, DD9, DD10, DT8, MT11, MT13, and MT15). These include technical and financial barriers caused by inadequate infrastructure, excessive expenses, and a lack of personnel with specialized skills. Educational gaps

and resistance to shifting from traditional to AI-based approaches hinder its implementation. Furthermore, ethical concerns about data privacy, security, and a lack of trust in AI systems represent substantial barriers to their integration.

Studies coded MT11 and DD4 explored AI integration readiness and proposed that institutions are more prepared than indicated in other studies. This may be due to the pandemic's rapid digital transformation and the introduction of ChatGPT in 2022. Furthermore, in DD4, Egypt's Minister of Education addressed this transformation during a UNESCO meeting, stating, "In the last 10 days, we have made more progress in digital and distance learning than in the last 10 years." Although MT11 indicated that resistance from certain authorities remains challenging, 90% of faculty members in the public sector expressed readiness for this change.

From an ethical perspective, AI involves concerns about its morality and reliability. Despite the belief in AI's advantages, concerns regarding its moral and trust implications persist, and seven studies (DD2, DD3, DD7, DD9, MT8, MT13, and DD10) addressed this issue. Studies (DD2, DD3, DD7, MT8, and MT13) revealed concerns among educators, parents, and students. These concerns range from data protection to privacy violations and inappropriate use. The lack of expertise in dealing with these issues is also a concern, with the potential to impact individuals' futures. The study (DD10) suggested that higher education institutions should include an article on this topic in their strategic plan. They should also train all senior management, academic, and administrative staff to adapt and make it part of their culture.

Another concern about AI integration is reliability (DD2, DD7, DD9, MT13). The possibility of privacy and security violations in obtaining and storing student data is especially concerning. The risk of unauthorized access to student information and the possibility of cyberattacks are the most prominent security issues.

Findings Associated with the Recommendations Proposed by the Studies

The recommendations derived from the meta-synthesis of the studies were organized into four distinct categories based on their thematic similarities: recommendations for researchers, educators, educational institutions, and policymakers (Table 6).

As shown in Table 6, a considerable proportion of the suggestions were directed toward educational institutions. It is recommended that informative sessions be organized aimed at fostering positive perceptions among key stakeholders: teachers, who are the primary implementers of AI, and students and their parents, who represent the end users. Emphasis should be placed on the significance of in-service training to enhance the competencies of teachers and to provide them with ongoing support. Furthermore, curricular updates, including integrating AI-related content into existing subjects and introducing dedicated courses specifically focused on AI, are considered imperative.

The inclusion of AI in the education system should be realized through the efforts of teachers and students, as well as national policy and education system regulation. Five suggestions were made for policymakers. As stated in the studies coded MT7, DD1, DD3, MT11, and DD10, the most common suggestion for policymakers is that governments should be supported in providing the necessary infrastructure for institutions to reach a certain level. In addition, the infrastructure should be prepared, and the essential maintenance, control, and arrangements should be provided in the following processes. In the studies coded MT7, DD3, and MT15, attention was drawn to establishing the necessary consultancy system for institutions to improve themselves. Similarly, it was stated that for countries to reach a certain level, they should not only use technology but also produce it, and educational institutions should be established to serve in this field.

Despite the recent rapid advancements in AI in education, the field remains under-researched. At this point, suggestions regarding the gaps in the literature are very valuable. The level of studies conducted in this field is insufficient, and more research should be done. It has been suggested in the studies coded MT1, MT4, DD1, DD3, MT9, MT11, MT12, MT16, MT17, DD5, DD7, and DD8 that both experimental studies and different types of studies that express opinions should be conducted more frequently. It is important that AI, which is advancing at such a rapid pace and in diverse domains, be incorporated into the educational system in a well-planned manner, both for the development of countries and for achieving competitiveness with other countries, as well as for the development of societies.

Discussion

This meta-synthesis study aims to obtain a broader and deeper understanding of AI use in education. National and international master's theses and doctoral dissertations published between 2018 and 2023 were explored. The Turkish Council of Higher Education Thesis Center and ProQuest databases were searched with specified keywords to find relevant studies. The study included 10 PhD doctoral dissertations and 17 master's theses, all of which used qualitative or mixed design methodologies. Most studies were written in English.

The increasing number of theses and dissertations focusing on AI over time indicates a growing research interest in the field, particularly in response to global changes such as the coronavirus pandemic and the introduction of ChatGPT. During the COVID-19 pandemic, scholars predominantly explored AI to address health-related issues. This may have laid the foundation for a broader, post-pandemic research agenda focused on the impact of AI on societal transformation (Fu et al., 2024). Although Bond et al. (2024) reported a temporary decline in review studies on AI in education in 2020, this was followed by a substantial increase in subsequent years. These findings suggest that the rapid shift to distance education, the acceleration of digitalization, the heightened demand for personalized learning environments, and the introduction of ChatGPT, along with other AI tools, may have collectively provoked a change in AI-related research. Akdeniz and Özdinç (2021) further corroborate this trend.

This meta-synthesis study focused on qualitative and mixed-methods research. Considering the data collection techniques, studies primarily used structured and semi-structured interviews alongside diaries, observations, and discussions, consistent with techniques commonly used in qualitative and mixed research. Considering that AI is an emerging technology utilized in education, it is not surprising that studies mostly utilized such data collection techniques because researchers might have been interested in how students, teachers, managers, and policy makers experience, think about, and adopt AI in education. This finding aligns with other systematic reviews, which indicate that perceptual and attitudinal tools are often employed to reveal thoughts and experiences regarding AI usage in education (Martin et al., 2024; Tunç & Baş, 2024). Notably, some studies used quantitative data to inform qualitative analyses.

Most of the research was conducted at the higher education level rather than in K-12 settings, likely due to greater access to resources, skills, and research opportunities at this level. This finding is in good agreement with the results of some review studies (Akdeniz & Özdinç, 2021; Fu et al., 2024) and partially consistent with others. For example, Türkmen (2025) found that quantitative research mainly targeted higher education, while mixed-methods studies more frequently focused on K-12 education.

Table 6. Study distributions based on the proposed suggestions

Categories	Recommendations of the Studies Reviewed	Studies	F
Suggestions for researchers	The number of experimental studies should be increased.	MT1, MT4, DD1, DD3, MT9, MT11, MT12, MT16, MT17, DD5, DD7, and DD8	12
	Use varied methods for different lessons and outcomes.	MT3, MT4, MT5, DD1, DD2, MT10, MT12, and MT16	8
	Examining distinct AI systems individually.	MT8, DD8, and DD10	3
	Re-implementation according to different education levels and student profiles	MT8, MT17, DD4, DD8, and DD9	5
	Include more studies that include varied teacher opinions to evaluate ITS	MT5, DD2, DD3, MT13, and MT16	5
Recommendations for educators	Expanding the coverage of AI teaching topics	MT1, MT5, and MT7	3
	Engage more in in-service training.	MT3, MT4, MT6, DD2, DD3, and MT15	6
	Increase the use of AI-supported teaching methods.	MT7, DD9	2
Recommendations for educational institutions	In-service training should be organized to increase AI awareness and usability.	MT3, MT4, MT6, DD2, DD3, and MT15	6
	Collaborate with AI companies for self-improvement.	MT3, DD1, MT11, MT15, DD7, and DD10	6
	Establish elective courses in this field and enhance incentives for enrollment.	MT6	1
	Update course curricula as needed.	MT6, MT7, DD2, DD3, MT11, and DD9	6
	Create a certification system for AI elective courses.	MT6	1
	Organize informative sessions for teachers, students, and parents to foster positive perceptions of AI.	MT3, DD2	2
	Investigate different types of institutions, both public and private.	MT9	1
	Explore the usability of AI systems for administrative management.	MT8	1
Recommendations for policymakers	Implement ethical and legal regulations.	DD2, MT12	2
	AI-related articles should be included in national development plans.	MT4, DD10	2
	To support infrastructure development in institutions to enhance global competitiveness.	MT7, DD1, DD3, MT11, and DD10	5
	Development of consultancy systems for institutions to improve	MT7, DD3, and MT15	3
	Shift from consuming to producing	MT7, DD3	2

The next step involved examining how AI was addressed according to research areas. Studies have reported the beneficial and positive effects of AI on academic outcomes. In this theme, some studies focused on the impact of AI on academic achievement, while others focused on the effects of Intelligent tutoring systems (ITSs) and the use of AI in assessment and evaluation.

ITSs are associated with artificial intelligence (AI) in education because they help create personalized learning. This means that instruction is adjusted to fit every student's needs, learning style, and speed by identifying students' weaknesses and adapting the lessons, making these smart teaching systems more effective. As revealed in the current study, personalized and adaptive learning has emerged as a key concept in review studies on AI (Bond et al., 2024; Bozkurt et al., 2021; Zawacki-Richter et al., 2019). Research corroborated that AI-driven personalization enhances achievement (Popenici & Kerr, 2017; Shete et al., 2024). Studies also support this trend, indicating the transformative role of AI in personalized learning (Adiguzel et al., 2023; Karakose & Tülübaş, 2023). Nonetheless, investigations into the role of AI in delivering personalized feedback and assessment remain an area that warrants further exploration (Dönmez, 2024).

The rapid growth of AI and its impact on professions were discussed under "AI in future perspective." This category showed various opinions. There was a consensus that AI would undoubtedly impact education in the future. The use of AI in education can offer significant advantages. It plays a vital role in improving the learning process and aids in the progress of educational development. This was also corroborated by the research envisioning the potential of AI. AI can substantially enhance educational systems, with the affordances of personalization, learning styles, adaptive learning, intelligent tutoring, and expert systems. However, its deployment necessitates careful regulation and a critical stance to mitigate concerns related to inaccurate data dissemination, bias, and ethical usage (Bond et al., 2024; Wang et al., 2024). Another subtheme addressed professional anxiety and the job-related risks faced by teachers, reflecting the concerns shared by various stakeholders about the effect of AI (Bai et al., 2023; Çetin & Aktaş, 2021). Teachers fear that AI might replace them in the future, but studies have not found significant proof to confirm this possibility (Batista et al., 2024). In the current study, it was found that although some believe that AI will replace teachers, it is argued that human teachers will always be needed because of their humanity, capacity to provide emotional support, and to encourage reflective thought and social skills, and this is consistent with review studies indicating AI would be a tool of enhancement rather than replacement (Charow et al., 2021). Rather than replacing education, AI should be viewed as a tool to improve it. In the future, instructors and AI will work together, with educators continuing to play crucial roles (Felix, 2020). In conclusion, it is undeniable that AI will impact most jobs, including education; however, teachers will continue to play a crucial role (Charow et al., 2021).

Next, we discussed the theme of the acceptance of AI in education by stakeholders. In the current study, studies on stakeholder attitudes toward AI implementation showed that most have positive perceptions and are open to future adoption. However, some researchers indicate that a minority are hesitant to embrace this technology. The literature on AI reveals similar trends, indicating the potential acceptance of AI tools by stakeholders across various domains. However, the significance of AI literacy has been identified as a crucial factor in AI adoption, as highlighted in other systematic review studies (Batista et al., 2024; Bond et al., 2024; Türkmen, 2025). The studies reviewed in this research demonstrated that students viewed AI-supported systems as gamified experiences. They believed that personalized learning approaches and instant feedback enhance motivation (Bond et al., 2024). Teachers believed that AI helps them choose and use educational resources more efficiently while automating routine tasks such as attendance tracking and grading (Adiguzel et al., 2023). These features may create positive perceptions among educators. However, the effectiveness of integrating AI into education depends on its acceptance and adoption by teachers and students, as well as the expectations set by institutions, the education system, and even governmental bodies.

AI represents a significant advancement in technology. Within the framework of the technology acceptance model (TAM), perceived usefulness, ease of use, and users' attitudes are critical factors that influence the future acceptance and adoption of a system (Davis et al., 1989). Positive perceptions and beliefs about the usefulness and usability of the system may encourage stakeholders to adopt it in the future. In conclusion, various stakeholders have shown a willingness to embrace AI; however, studies indicate that the adoption of AI could increase if a well-defined policy framework is implemented and ethical considerations are addressed. Furthermore, efforts to enhance AI literacy should be prioritized. Policy frameworks are crucial for widespread adoption of artificial intelligence and for stimulating increased funding (Baker et al., 2019). From an institutional perspective, budgetary allocations are essential. Studies showed higher education institutions are more willing to accept and use AI tools. However, they also require significant support, including financial resources, consultancy services, and long-term maintenance assistance.

In summary, while various parties are open to integrating AI, studies, as mentioned above, show that the adoption of AI could increase significantly if a clear policy framework is established, ethical issues are addressed, inequalities are removed, and AI literacy is promoted (Bond et al., 2024; Bozkurt et al., 2021; Charow et al., 2021). At this stage, governments should be encouraged to collaborate with the private sector and other global institutions to fund AI-related projects. The policy document "Artificial Intelligence in Education 2023" also refers to this circumstance. Following the agreement, AI training should be updated as needed, and more staff should be hired in this area by establishing AI faculties at the higher education level (Doug, 2019). When integrating AI systems into educational institutions, sufficient funds should be available for the necessary infrastructure, system installation, and maintenance (Sayari, 2025; Sharma, 2025).

Considering the institutional impact of artificial intelligence (AI), studies have addressed the impact of AI on education system management, the difficulty of AI integration into the system, and the readiness of institutions for AI. Many studies have indicated that AI has a positive effect on managerial facilitation. Institutions can automate routine tasks, such as managing student participation, recording grades, and handling excessive paperwork, with the help of AI. This finding is consistent with the results of similar review studies (Bond et al., 2024; Türkmen, 2025; Zawacki-Richter et al., 2019). Barriers still exist, including inadequate infrastructure,

high costs, a lack of skilled personnel, and resistance to change (Rong et al., 2023). The most significant sub-theme in the research was the ethical, legal, and societal impact of AI use. This issue stands out as a key determinant shaping stakeholders' AI adoption intention and their overall stance toward AI and has been addressed in many reviews on AI utilization (Martin et al., 2024; Türkmen, 2025; Wang et al., 2024).

Implications For Practice

This meta-analysis makes the following recommendations to increase the impact of AI in education, which are as follows. The current study highlights the importance of incorporating AI topics into educational curricula, as AI literacy is an essential skill for the future. Given the current understanding within the education community, comprehensive training programs should be organized for teachers to use AI more effectively, and professional guidance should be provided to ensure continuity (Batista et al., 2024; Sheikh et al., 2023). It is essential that a national-level strategy is framed to ensure the integration of AI into the education system. This strategy can provide a comprehensive education system roadmap at all levels. Providing the necessary technological infrastructure for schools to effectively use AI technologies is needed, as is the ongoing provision of technical support. Furthermore, universities, research centers, and technology companies should develop innovative solutions for integrating AI in education. Establishing robust data protection and privacy policies is necessary to ensure the security of student data. The establishment of faculties specializing in AI within high schools and higher education institutions is also recommended, along with the training of qualified personnel to provide technical support and technology in this field. Programs that raise awareness of the ethical use of AI must be planned for educators, parents, and students at all levels. Furthermore, to enable the full-scale integration of AI into the educational system, it is necessary to closely monitor global developments in this field to facilitate the integration of AI into the education system on a comprehensive scale. Participating in global education and technology networks, which enable the sharing of best practices and expertise among educators worldwide, can help achieve this goal.

Implications For Research

Some recommendations are proposed to suggest future research agendas for AI integration in educational settings. First, studies evaluating the long-term academic and social impacts of AI applications are essential because they can reveal both the sustainable benefits and potential risks of AI use. Such investigations contribute to a more comprehensive understanding of the educational role of AI. Second, comparative research should be conducted on the effects of AI-supported learning models across different student groups. Third, exploring how teachers adopt AI technologies and identifying the instructional stages at which these tools are used can offer insights into teacher training and curriculum design optimization. Finally, analyzing national and international policies and strategies regarding AI in education can serve as a foundation for evidence-based policymaking. This provides critical guidance for decision-makers in shaping future educational landscapes.

Conclusion

According to the study's findings, AI in education is increasingly favored by students and is widely accepted by educators and institutions, except for a few concerns and worries. Studies have concluded that difficulties exist in integrating AI into education, yet some expectations are held to overcome these difficulties. The most challenging part of this research is that although the number of studies in the field of AI has increased, it is not yet at a sufficient level, particularly during the data extraction period when this study was initiated. Other limitations are as follows: The research focuses on theses written in full text in Turkish and English, published between 2018 and 2023. Access to the studies is restricted to the National Thesis Center and ProQuest databases. While selecting master's and doctoral theses has provided valuable insights, it is important to note that these studies are generally not peer-reviewed as rigorously as journal articles.

As this study is a meta-synthesis, quantitative studies were not included; only qualitative and mixed-method studies were considered. Since the scope of AI studies is very broad, only studies conducted in K12 and higher education were included. However, one important limitation of this study is that it did not adequately address variations across international educational systems. Although we tried to include diverse contexts in our study, differences in school stages, curricular structures, and the absence of standardized frameworks may limit the generalizability of the findings. Future research should address this limitation by using international classification systems (e.g., UNESCO's ISCED) or performing subgroup analyses by region. Finally, although this meta-synthesis followed the PRISMA guidelines for thematic synthesis, several checklist items were not fully addressed due to the nature of qualitative evidence synthesis. Therefore, the results should be interpreted with caution.

The current study indicated high expectations, especially from policymakers, regarding infrastructure, funding, consultancy services, control, and security issues required for integrating AI in institutions. At this point, it is concluded that more research should be conducted and that this research should serve as a guide for policymakers.

Finally, in this study, the environmental impact of AI and its ethical and social dimensions were not specifically addressed. A new AI model development has various important environmental effects. For example, the development and testing of AI are energy-intensive. Mining rare metals for artificial intelligence hardware causes ecological damage. Data centers require significant amounts of energy and water. AI hardware quickly becomes outdated and is discarded in an unsafe manner (Niet et al., 2024). A Green AI approach has been proposed to alleviate the adverse environmental effects of AI by creating sustainable tools in their development and training phases to save energy and decrease the carbon footprint (Verdecchia et al., 2023).

Author Contributions

This paper was produced from the first author's master thesis under the supervision of the second author.

Ethical Declaration

The authors declare that the study was not subject to ethics committee approval and that the rules set by the Committee on

Publication Ethics (COPE) were followed throughout the study.

Conflict of Interest

The authors declare that there is no conflict of interest with any institution or person within the scope of the study

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Appendix I (Studies Used in Meta Synthesis)

Adams-Grigorieff, J. (2023). Grounded critical digital literacies: Youth countering algorithmic and platform power in school and everyday life [Doctoral dissertation, University of California, Berkeley], Code name: **[DD7]**.

Ahmed, F. M. (2020). The adoption of artificial intelligence in UAE education sector [master's thesis, The British University in Dubai], Code name: **[MT14].**

Ali, A. (2023). Assessing artificial intelligence readiness of faculty in higher education: Comparative case study of Egypt [Master's thesis, American University in Cairo], Code name: [**MT11**].

Alnusairat, R. H. (2022). The impact of using self-learning platforms on students' performance and motivating them to learn mathematics in Cycle/3 schools in the Emirate of Abu Dhabi [Master's thesis, The British University in Dubai (BUiD)], Code name: **[MT10].**

Ayed, I. A. H. (2022). Oman higher education institutions dealing with artificial intelligence [Doctoral dissertation, Universidade do Minho (Portugal)], Code name: [**DD10**].

Bağır, M. (2022). Fen bilimleri öğretmenlerinin eğitimde yapay zekâ kullanımı ile ilgili görüşleri [Master's thesis, Fırat Üniversitesi], Code name: **[MT3].**

Batuca, D. M. R. (2021). Looking to the future: AI in education [master's thesis, Institude of Lisbon], Code name: [**MT12**].

Charles, B. (2023). Leader learners' perceptions of artificial intelligence applications [Doctoral dissertation, Concordia University Chicago], Code name: [**DD8**].

Chong, J. V. (2020). Perspectives on artificial intelligence in education: A study of public elementary school teachers [master's thesis, Biola University], Code name: [**MT13**].

Çolak, A. F. (2022). Okullarda yapay zekâ öğretimi için geliştirilen kurs planı ve içeriklerin öğrencilerin üst bilişsel davranışlarına etkisi [Master's thesis, North Carolina State University], Code name: [**MT1**].

Davis, G. M. (2022). Human-like conversational artificial intelligence agents for foreign or second language learning: User perceptions, expectations, and interactions with agents [Doctoral dissertation, Stanford University], Code name: [**DD6**].

Demir Dülger, E. (2023). Lise müdürleri ve öğretmenlerinin eğitimde yapay zekâ kullanılmasına ilişkin görüşleri [Doctoral dissertation, İstanbul Okan Üniversitesi], Code name: [**DD2**].

Dengiz, Y. (2023). Yapay zekânın öğretmen eğitimi üzerindeki yenilikçi etkileri [Master's thesis, Muğla Sıtkı Koçman Üniversitesi], Code name: [**MT7**].

El Asmar, W. (2022). The effectiveness of AI-powered digital educational platforms: Students' attainment and teachers' teaching strategies in a private high school in Dubai [Master's thesis, British University in Dubai (BUiD)], Code name: [**MT15**].

Erümit, A. K. (2014). Polya'nın problem çözme adımlarına göre hazırlanmış yapay zekâ tabanlı öğretim ortamının öğrencilerin problem çözme süreçlerine etkisi [Doctoral dissertation, Karadeniz Teknik Üniversitesi], Code name: [**DD1**].

Gücük, G. (2022). İngilizce öğrenenlerin ve öğretmenlerin dil sınıflarında yapay zekâ kullanımına yönelik algısı [Master's thesis, İstanbul Aydın Üniversitesi], Code name: [**MT2**].

Karahan, O. (2023). Meslek lisesi bilişim teknolojileri öğretmenlerinin yapay zekâ ve makine öğrenmesi dersine yönelik eğilimlerinin belirlenmesi [Master's thesis, Gazi Üniversitesi], Code name: [**MT6**].

Kesler, S. (2022). Işığın madde ile etkileşimi ünitesinde yapay zekâ sisteminin öğrencilerin akademik başarısına etkisi [Master's thesis, Erzincan Binali Yıldırım Üniversitesi], Code name: [**MT5**].

Kornyo, E. A. (2021). Exploring the use of artificial intelligent systems in STEM classroom [Doctoral dissertation, Columbia University], Code name: [**DD4**].

Ma, Y. (2019). The impact of artificial intelligence on higher education [master's thesis, Missouri University of Science and Technology], Code name: [**MT9**].

Moraes, C. L. (2021). Chatbot as a learning assistant: Factors influencing adoption and recommendation [master's thesis, Universidade Nova de Lisboa], Code name: [**MT17**].

Sanca, M. (2022). Fen öğretiminde yapay zekâ destekli teknolojilerin kullanımına ilişkin fen bilimleri öğretmenlerinin görüşlerinin incelenmesi [Master's thesis, Van Yüzüncü Yıl Üniversitesi], Code name: [**MT4**].

Sharawy, F. S. (2023). The use of artificial intelligence in higher education: A study on faculty perspectives in universities in Egypt [Master's thesis, the American University in Cairo], Code name: [**MT8**].

Tatar, C. (2023). Rethinking English language arts classrooms with artificial intelligence education: Teachers' confidence and views [Doctoral dissertation, North Carolina State University], Code name: [**DD9**].

Thakore, A. (2021). AI solution with interactive communication: AI-enhanced chat for big data in education [Doctoral dissertation, Aspen University], Code name: [**DD5**].

Wang, H. (2021). A philosophical inquiry into the educational impacts of technology on student agency [master's thesis, McGill University], Code name: [**MT16**].

Yetişensoy, O. (2022). Sosyal bilgiler öğretiminde yapay zekâ uygulaması örneği olarak chatbotların kullanımı [Doctoral dissertation, Anadolu Üniversitesi], Code name: [**DD3**].

Appendix II PRISMA checklist

Section and Topic	Item #	Item definition	Reported	Notes
TITLE				
Title	1	Identify the report as a systematic review.	Yes	This study identifies the work as a "meta-synthesis study", a type of systematic review for qualitative studies.
ABSTRACT				
Abstract	2	See the PRISMA 2020 Abstracts checklist.	Yes	The abstract includes a structured summary of the objectives, methods, results, and conclusions.
INTRODUCTION				
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Yes	The primary rationale for conducting this study is presented at the end of the Introduction section.
Objectives	4	Provide an explicit statement of the review's objective(s) or question(s).	Yes	The aim and research questions of the study are presented just before the Methods section.
METHODS				
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Yes	The eligibility criteria are presented in the Methods section.
Information sources	6	Specify all databases, registers, websites, organizations, reference lists, and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Partially	Databases (Turkish Council of Higher Education Thesis Center, ProQuest) are used, but the exact list of searches consulted or searched are not listed specifically for each type of source.
Search strategy	7	The full search strategies for all databases, registers, and websites, including any filters and limits used, are presented.	Partially	Only keywords are used, but no whole search strings/filters are used.
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and, if applicable, details of automation tools used in the process.	Yes	Reported in the Data Analysis section. The PRISMA flow diagram is provided. Two field experts were consulted to ensure the study's reliability. They worked independently, and their opinions were used to determine themes and sub-themes. The required arrangements are made in accordance with the expert opinions and feedback. Conflicts were resolved based on the discussion until a consensus was reached.
Data collection	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and, if applicable, details of automation tools used in the process.	Yes	This was reported in the data analysis section. Following the selection of 27 studies for meta-synthesis, all studies were continuously read using an iterative process by the researchers (primarily by the first researcher). Findings were listed and coded using Microsoft Office Excel. The studies were grouped by their characteristics.
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g., for all measures, time points, and analyses), and if not, the methods used to collect the results.	Yes	Thematic coding is used and guided by the research questions. The variables are formed according to the research questions.
	10b	List and define all other variables for which data were sought (e.g., participant and intervention characteristics and funding sources). Describe any assumptions made regarding any missing or unclear information.	No	The study did not report any assumptions/simplifications regarding missing data.
Assessment of risk of bias	11	Specify the methods used to assess the risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study, and whether they worked independently, and if applicable, details of automation tools used in the process.	No	No assessment of study bias was performed.
Effect measures	12	Specify the effect measure(s) (e.g., risk ratio, mean difference) used in the synthesis or presentation of results for each outcome.	No	Not applicable (qualitative synthesis).
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g., tabulating the study intervention characteristics and comparing them with the planned groups for each synthesis)	Yes	The inclusion/exclusion criteria are stated in the Methods section.
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics or data conversions.	Yes	Iterative reading and Excel coding (data analysis)
	13c	Describe any methods used to tabulate or visually display the results of individual studies and syntheses.	Yes	Tables and figures are provided in the Results section. Refer to Tables 1–6 and Figures 2–3.

Section and Topic	Item #	Item definition	Reported	Notes
	13d	Describe any methods used to synthesize the results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) used to identify the presence and extent of statistical heterogeneity, and software package(s) used.	Yes	Thematic synthesis based on Polat and Ay (2016). The process is detailed in the Results section.
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g., subgroup analysis, meta-regression).	No	As this study employed a qualitative meta-synthesis approach, statistical methods, such as subgroup analysis or meta-regression, are not applicable. However, heterogeneity is addressed through thematic diversity.
	13f	Describe any sensitivity analyses conducted to assess the robustness of the synthesized results.	Partially	The sensitivity robustness is assessed through qualitative methods. These included repeated data readings, iterative coding, and field experts' theme review. Expert feedback is used to revise and refine the theme structures.
Reporting bias assessment	14	Describe any methods used to assess the risk of bias due to missing results in a synthesis (arising from reporting biases).	No	Not discussed.
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) for an outcome in the body of evidence.	Partially	A formal framework, such as CERQual, is not used, but multiple researchers reviewed and discussed interpretations to ensure certainty.
RESULTS				
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Yes	The PRISMA flow diagram was provided.
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Partially	Reasons for exclusion were stated generally (lack of access, method, or relevance), but individual studies were not listed.
Study characteristics	17	Cite each included study and present its characteristics.	Yes	See Appendix
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	No	Not assessed
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g., confidence/credible interval), ideally using structured tables or plots.	Yes	Tables 1–5 present the thematic results, with each theme supported by corresponding study codes.
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Partially	The results section covers each research question with synthesized findings. However, the risk of bias was not formally assessed.
	20b	Present the results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g., confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	No	This is not applicable because the meta-synthesis covers qualitative studies.
	20c	Present the results of all investigations of possible causes of heterogeneity among study results.	Partially	The qualitative heterogeneity was ensured through thematic variation.
	20d	The results of all sensitivity analyses conducted to assess the robustness of the synthesized results are presented.	Partially	The sensitivity robustness was assessed through qualitative methods. These included repeated data readings, iterative coding, and field experts' theme review. Expert feedback was used to revise and refine the theme structures.
Reporting biases	21	Present assessments of the risk of bias due to missing results (arising from reporting biases) for each assessed synthesis.	No	The risk of reporting bias was not formally assessed.
Certainty of the evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	No	Not assessed because the findings are based on thematic synthesis
DISCUSSION				
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Yes	The results were interpreted in the context of existing literature in the Discussion and Conclusion sections.
	23b	Discuss any limitations of the evidence included in the review.	Yes	In the Conclusion section,
	23c	Discuss any limitations of the review processes used.	Yes	In the Conclusion section,
	23d	Discuss implications of the results for practice, policy, and future research.	Yes	In the Conclusion section,
OTHER INFORMATION				

Section and Topic	Item #	Item definition	Reported	Notes
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	No	Not used.
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	No	Not used.
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	No	Not used.
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	No	No funders
Competing interests	26	Declare any competing interests of review authors.	No	No competing interests
Availability of data, code, and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	No	The documents can be made available upon reasonable request.

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. Doi: 10.1136/bmj.n71.