

Article

Capacity Building for Student Teachers in Learning, Teaching Artificial Intelligence for Quality of Education

Zehra Altınay ^{1,*}, Fahriye Altınay ², Ramesh Chander Sharma ³, Gokmen Dagli ⁴, Rustam Shadiev ⁵,
Betül Yikici ⁴ and Mehmet Altınay ⁴

¹ Societal Research and Development Center, Faculty of Education, Near East University, Mersin 99138, Turkey

² Societal Research and Development Center, Institute of Graduate Studies Faculty of Education, Near East University, Mersin 99138, Turkey; fahriye.altinay@neu.edu.tr

³ Department of Computer Science and Engineering, Graphic Era Hill University, Dehradun 248002, India; rcsharma@gehu.ac.in

⁴ Faculty of Education, University of Kyrenia, Mersin 99138, Turkey; gokmen.dagli@kyrenia.edu.tr (G.D.); betul.yikici@kyrenia.edu.tr (B.Y.); mehmet.altinay@kyrenia.edu.tr (M.A.)

⁵ College of Education, Zhejiang University, Hangzhou 310027, China; rustamsh@gmail.com

* Correspondence: zehra.altinaygazi@neu.edu.tr

Abstract: The future of education relies on the integration of information technologies, emphasizing the importance of equity and inclusiveness for quality education. Teacher education programs are essential for fostering qualified educators for the future. Integrating AI in education is crucial to ensure inclusivity and comprehensive services for all. This study aims to evaluate student teachers' perceptions of using AI in learning and teaching, and to provide suggestions for enhancing sustainable education through information technologies. A qualitative research design was adopted to gather perceptions and experiences from 240 student teachers who participated in a seminar on AI usage and completed self-reflection tasks. These student teachers, enrolled in various teaching methods and principal courses, contributed to the thematic analysis. The study reveals that AI should be carefully planned and incorporated into lesson plans to enhance personalized learning. Student teachers reported that AI supports and motivates the learning process, effectively transforming students' needs and learning experiences. However, they also noted potential drawbacks, such as AI imposing restrictions on the teaching profession, replacing teachers, and producing biased results. The study suggests that capacity-building strategies for student teachers should be enriched across different courses to raise awareness about AI's applications.

Keywords: artificial intelligence in education; student teachers; sustainable education; teacher education programs; quality of education



Citation: Altınay, Z.; Altınay, F.; Sharma, R.C.; Dagli, G.; Shadiev, R.; Yikici, B.; Altınay, M. Capacity Building for Student Teachers in Learning, Teaching Artificial Intelligence for Quality of Education. *Societies* **2024**, *14*, 148. <https://doi.org/10.3390/soc14080148>

Academic Editor: Ben Kisby

Received: 11 June 2024

Revised: 4 August 2024

Accepted: 8 August 2024

Published: 10 August 2024



Copyright: © 2024 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

The foundations of future education lie in shaping societies with technology integration within the scope of sustainable development goals [1]. The 17 Sustainable Development Goals aim to ensure a sustainable, peaceful, prosperous, and equitable life for all, now and in the future. These goals serve as a framework for community development in various areas, including education, health, social protection, job opportunities, climate change, and environmental protection [2].

To achieve digital education as a national and international policy agenda, efforts should focus on enhancing digital skills and competencies. This includes developing basic digital skills from an early age, fostering digital literacy to tackle disinformation, and providing education in computing. Moreover, there is a need for a strong understanding of data-intensive technologies such as artificial intelligence (AI) and advanced digital skills to produce more digital specialists. It is also crucial to ensure that girls and young women are equally represented in digital studies and careers [3,4]. This highlights the role of AI

in education and its impact on the future transformation of societies. The primary aim is to ensure inclusive and equitable quality education and to promote lifelong learning opportunities for all [5].

UNESCO, in a report on AI, covers aspects such as perception, learning, decision-making, problem solving, language interaction, and creativity. These aspects motivate educators and scientists to consider AI for overcoming educational difficulties and achieving Sustainable Development Goal 4 through innovation. This goal reinforces changes in the roles of teachers as they transfer knowledge to the next generations. Since Sustainable Development Goal 4 relies on justice and inclusive learning and teaching, AI technologies become essential facilitators [6].

Higher education institutions play a significant role in driving digital transformation to foster research, societal responsibility, learning, and teaching for the future of education and societies. A value-driven approach through solidarity and sustainability is essential [7]. As higher education institutions act as bridges for societal changes, universal collaborations for collective responsibility are crucial [8]. Additionally, these institutions need to focus on teaching and developing creative and critical learners through problem solving for lifelong learning [9].

Recent studies have emphasized the importance of AI in education. On the strength side, AI offers personalized learning experiences by identifying students' strengths and weaknesses, tailoring instruction to individual needs. It provides immediate and personalized feedback, supporting continuous learning and development, and helps in rapid data analysis, easing the teacher's workload and accelerating accessibility in education. AI creates interactive and engaging learning environments, increasing student engagement and motivation, and facilitates collaborative and social learning, enhancing student interaction and cooperation. The weaknesses of AI include ethical concerns related to data privacy and the potential for biased results. AI also lacks emotional understanding and cannot provide the same emotional support as human teachers. Dependency on AI can lead to reduced development of students' soft skills and critical thinking. Furthermore, AI may decrease face-to-face interactions, fail to provide adequate teacher-student interaction, and hinder students' creativity and self-confidence by limiting independent thinking and empathy. Guilherme [10] provides insights into the significance of AI for student and teacher relationships. Darvishi et al. [11] noted that students tend to rely on AI assistance rather than learning actively. Conversely, Ogata et al. [12] highlight the role of AI in personalized learning. Flores-Vicar and Garcia-Pemalvo [13] discuss the ethics, potential, and challenges of artificial intelligence in quality education. Their study summarized perspectives from teaching, research, students, and institutions, and offered suggestions for future applications and pedagogy.

From a teaching perspective, there is a need for an AI literacy plan to train teachers in technical skills and ethical-philosophical debates. AI can support teaching in various ways, such as through open educational resources, content recommendation, student emotion detection, intelligent tutoring systems, AI-driven teaching assistants, automatic grading of exams, and automatic monitoring of forums.

From a research perspective, it is essential to deepen research in AI and education by developing AI systems that assist teachers and improve teaching with responsible, ethical, and equitable AI. From a student perspective, project-based learning, flexible learning, collaborative learning, and self-regulated learning can improve overall educational quality. Students will need to develop new digital competencies, including information processing, computational thinking, and digital learning.

From an institutional perspective, it is important to develop consensual public policy frameworks to regulate and raise awareness of the ethical use of AI in education; improve the governance, accessibility, and reliability of AI; and support the professional development of teachers.

AI tools can reduce students' capacity, so supporting them by making them active participants in their learning processes and taking more responsibility for their learning is

essential. AI regulations and ethics must be implemented without compromising human values, undermining diversity, or creating new inequalities. Therefore, focusing on capacity building in AI for student teachers within learning and teaching is essential. The next generation will be integrated with technology, making it crucial to analyze student teachers' perceptions of the future of education. This research study aims to evaluate the use of AI in learning and teaching by examining its strengths and weaknesses.

The research questions are as follows:

- How can AI be used in learning and teaching based on the perceptions of student teachers?
- What are the strengths of using AI in learning and teaching based on the perceptions of student teachers?
- What are the weaknesses of using AI in learning and teaching based on the perceptions of student teachers?

2. Literature Review

The advent of neural networks, cloud computing, machine learning, and big data has empowered engineers to develop mechanisms capable of simulating human intelligence [14]. Current advancements in AI have created extraordinary prospects for the future impact of AI in education (AIED). AI in education (AIED) improves learning by giving personalized and adaptive instruction to each student. It provides real-time feedback and data insights to help continuous learning. Nevertheless, AIED faces challenges like data privacy concerns and the need for emotional and social support from human teachers. These prospects are often based on misconceptions of current technical capabilities, a need for more information about advanced AI in education, and limited perceptions of the roles of education in society [15]. Expanding on these developments, Zhai et al. [14] refer to machines that can see, perceive, learn, respond, and solve problems as AI. Palmer [16] described AI as the 'new oil', while Tahiru [17] noted the rapid advancement and widespread application of AI, which has become integral to all human endeavors and has impacted how people learn.

The potential of AIED, focusing on the use of AI in education, and the significant role of education in creating AI literacy are becoming critical topics in policy discussions [15]. However, AI's acceptance in educational settings has been hindered by challenges and ethical concerns [17]. By 2021, over 30 countries had successfully implemented national AI policies, detailing plans and prospects for AI's influence on various sectors, including education, and regularly examining the ethical and social implications of AI [18]. In the US, the AI policy agenda is currently being developed, marked by substantial economic transformations and concerns about ethical and social uncertainties [19]. Schiff's [18] findings indicate that AIED is largely absent from policy discussions. Instead, the focus is predominantly on the value of education in supporting an AI-prepared workforce and developing more AI specialists. Despite the prominence of ethical discussions about AI in policy documents, the ethical implications of AIED receive limited attention.

As a result of the development of machine learning and AI procedures, attitudes towards these two domains have started to become prominent in various fields. One of the most impacted careers is teaching [20], as AI has essential implications for both teaching and learning [21]. In fact, AI-supported teaching is expected to transform the teaching and learning process [22]. Consequently, significant resources have been committed to integrating AI into education [23].

3. Materials and Methods

Theoretical Framework

The study employs a qualitative research design to gather and analyze the perceptions and experiences of student teachers regarding the use of AI in education. Specifically, it is designed as a descriptive case study. The study is methodologically grounded in a qualitative, descriptive research design, using thematic analysis to explore and understand student teachers' perceptions of AI in education. Data were gathered through self-reflection

tasks completed by 240 student teachers from various educational departments who participated in a seminar on the use of AI in education. The self-reflection tasks included three questions to evaluate the perceptions of using AI in learning and teaching, the strengths of using AI, and the weaknesses of using AI. This approach effectively provides in-depth insights into the strengths and challenges of integrating AI into educational practices and informs future teacher education programs and educational policies.

The theoretical framework of this study focuses on integrating artificial intelligence (AI) in education to enhance the quality and inclusivity of teaching and learning processes. This framework is built upon several key theoretical components:

- *Sustainable Development Goals (SDGs)*: The framework aligns with the 17 SDGs, particularly Goal 4, which focuses on ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all. This theoretical foundation justifies the integration of AI in education to achieve sustainable, equitable, and high-quality education.
- *Digital Transformation in Education*: The framework emphasizes the necessity of digital skills and competencies in transforming education. It highlights the importance for teachers and students to develop digital literacy, which includes understanding and effectively utilizing AI technologies. This theoretical stance is supported by the literature on digital education and the integration of advanced digital tools in educational practices.
- *Personalized and Collaborative Learning through AI*: The framework posits that AI can significantly enhance personalized learning by tailoring educational experiences to individual student needs. AI's ability to provide real-time feedback, data-driven insights, and adaptive learning environments is seen as transformative for modern education.
- *Ethical and Emotional Considerations in AI Integration*: The study recognizes the ethical challenges and emotional implications of using AI in education. It incorporates theoretical perspectives on the ethical use of AI, data privacy, and the potential for AI to perpetuate biases. It also considers the emotional aspects of learning, emphasizing that while AI can augment educational practices, it cannot replace human teachers' empathetic and emotional support.
- *Capacity Building for Future Teachers*: The framework focuses on building the capacity of student teachers to integrate AI into their teaching practices. It suggests that teacher education programs should include training on AI technologies, ethical considerations, and developing AI-supported lesson plans. This aligns with theories on teacher professional development and the need for continuous learning and adaptation to new technologies.

Two hundred forty student teachers' perceptions of AI in instruction were gathered from those enrolled in the Teaching Methods and Principles course. In this course, student teachers learned how to teach in their fields. AI-supported instruction was part of the course, and they participated in a seminar on how to use AI in the learning and teaching process. A qualitative research design was employed, specifically a case study approach, involving student teachers from various departments such as geography, social sciences, preschool education, classroom teaching, Turkish teaching, math education, sports education, and special education, who completed self-reflection tasks.

An AI facilitator supported the fourteen-week Teaching Methods and Principles course. As future educators, technology-supported instruction is vital for their professional development. These student teachers, as candidates for the future of education, attended seminars to learn about AI and its applications. As part of the Teaching Methods and Principles course, they learned teaching principles and methods, particularly how to use AI in their learning and teaching. The course instructor first delivered a seminar on using technology in teaching, followed by the AI facilitator introducing AI to the student teachers. The student teachers then engaged with the AI facilitators' learning management platform to enhance their personalized learning through course content.

To examine the perceptions of student teachers about AI-facilitated learning and teaching experiences, a self-reflection task was prepared, and three experts reviewed the task questions. The self-reflection task included three questions to evaluate the perceptions of using AI in learning and teaching, the strengths of using AI, and the weaknesses of using AI.

The self-reflection task was administered at the end of the semester to those who completed the Teaching Methods and Principles course. Two hundred forty student teachers voluntarily responded to the questions.

A. Data Collection and Analysis

Three self-reflection task questions were created to answer the research questions in the study. The students studying at the university were chosen as the target audience. At the beginning of the form, it was stated that the answers would be kept confidential for reliability reasons. No discrimination was made based on gender or age. A content analysis technique was used to analyze the research data, aiming to explain the data obtained from the research with various concepts [24]. Content analysis data triangulation was conducted [25] using the Code-Category-Theme method. The research data were collected in the fall semester of 2023. Research permissions were obtained from the relevant institutions, and the necessary Ethics Committee permission was secured to collect data.

The research data were summarized and evaluated by establishing a logical context within the themes created according to the subject and purpose of the research. Efforts were made to collect data related to each theme for analysis, thereby focusing more effectively on the relevant themes. In the findings and comments, direct quotations were provided under the categories determined by these themes. According to Patton [26], direct quotations are the primary source of data, as they reveal people's experiences and thoughts about their world through in-depth analysis. In this study, the quotations are presented without any changes.

In the first stage of content analysis, after transcribing the interviews and assigning a number to each participant, the data obtained were examined within the framework of the research and divided into meaningful sections, and the conceptual meaning was named and coded. The reliability formula suggested by Miles and Huberman [27] was used for the reliability calculation of the study, and the average reliability was calculated at 92%.

4. Results

The research findings were analyzed to answer each research question, and the results of this analysis are given below, respectively.

4.1. Use of AI in Learning and Teaching Based on Perceptions of Students and Teachers

Based on student teachers' perceptions, the findings regarding the use of artificial intelligence in learning and teaching were examined as the first dimension. The aim is to improve the quality of education through artificial intelligence by developing the capacity of student teachers in next-generation education. In this context, 240 student teachers were asked, "How is the use of artificial intelligence in learning and teaching based on the perceptions of student teachers?" The answers to this question were coded, and themes were extracted. The distributions of these themes are given in Table 1.

Based on Table 1, the analysis of student teachers' perceptions regarding the use of artificial intelligence (AI) in learning and teaching reveals several key insights:

The most significant finding is that 24% of student teachers believe feedback should be given to students using online assessments and evaluations, highlighting the importance of continuous and immediate feedback in the learning process. Additionally, 20% emphasized the need for personalized learning to identify and address students' strengths and weaknesses, showing a strong preference for individualized instruction.

Furthermore, 19% of student teachers noted the importance of summarizing and providing for different learning styles, and an equal percentage stressed the value of

preparing visual and creative presentations with AI. This reflects the recognition of diverse learning needs and the potential of AI to cater to them effectively.

Table 1. Findings regarding the perceptions and thoughts of student teachers regarding the use of artificial intelligence in learning and teaching, based on their perceptions.

Category	Code	Frequency (n)	Percentage (%)
How to use artificial intelligence in learning and teaching based on the perceptions of student teachers	Making education more individual, interactive, and accessible	32	13%
	Summarizing and providing students with different learning styles	46	19%
	Promotes collaborative-based learning	22	9%
	Artificial intelligence increases interaction with students	26	11%
	Artificial intelligence provides students with a personalized experience	22	9%
	Supporting and motivating students' learning process	36	15%
	Transforming students' needs and learning processes in a more effective way	37	15%
	Providing personalized learning, interactive and participatory learning, real-time feedback, data collection and analysis, and collaborative and social learning with artificial intelligence.	29	12%
	The use of artificial intelligence should be planned; a lesson plan should be prepared	39	16%
	Artificial intelligence should be designed to highlight students' strengths and strengthen their weaknesses	34	14%
	Artificial intelligence is included in classical learning environments to additionally guide the teacher in consolidating and understanding what the student has learned	28	11%
	Personalized learning should be developed by using artificial intelligence to determine the subjects in which students are either good or bad	49	20%
	Training should be carried out by preparing visual and creative presentations with artificial intelligence	46	19%
	Feedback should be given to students using online assessments and evaluations	57	24%
	Increasing problem solving skills, analysis abilities, and using artificial intelligence as an incentive to increase creativity	44	18%

Other notable insights include the importance of planning the use of AI and preparing lesson plans (16%), supporting and motivating students' learning processes (15%), and transforming students' needs and learning processes more effectively (15%). These findings indicate a comprehensive approach to integrating AI in education, where planning, motivation, and effective transformation are considered crucial.

Additionally, 14% of student teachers believe AI should be designed to highlight students' strengths and strengthen their weaknesses, emphasizing a balanced and supportive approach to student development. Collaborative-based learning and increased interaction with students were also noted by 9% and 11% of candidates, respectively, showing the potential of AI to enhance engagement and teamwork.

Based on student teachers' perceptions and thoughts about using artificial intelligence in learning and teaching, the findings highlight several key points. According to the student teachers, education should be more individual, interactive, and accessible. Teachers should also focus on providing students with different learning styles and encouraging collaborative-based learning.

Teachers reported that AI increased student interaction, provided personalized experiences, supported the learning process, and motivated students. They noted that AI effectively transforms students' needs and learning processes, offering personalized, interactive, and participatory learning. AI also provides convenience to teachers in areas such as real-time feedback, data collection and analysis, and collaborative and social learning.

Teachers emphasized the importance of planning the use of AI, preparing lesson plans, and designing AI to highlight students' strengths and address their weaknesses. Including AI in traditional learning environments helps teachers consolidate and understand what students have learned. AI can identify students' strengths and weaknesses more efficiently, aiding in the development of personalized learning.

Additionally, teachers suggested that feedback should be given to students using online assessments and evaluations. They stressed the need to increase problem-solving skills and analysis abilities through AI, using it as an incentive to boost creativity.

In line with these thoughts, some participants' opinions are as follows:

"I can say that studies should be carried out to design artificial intelligence to emphasize students' strengths and strengthen their weaknesses" (Student teacher, 12).

"I think it is important to use artificial intelligence as an incentive to increase problem-solving skills, analysis skills and increase creativity" (Student teacher, 127).

"It is of great importance to include artificial intelligence in classical learning environments and plan it so that the teacher additionally guides the student in reinforcing and comprehending what he has learned." (Student teacher, 227).

These findings suggest that student teachers see significant potential in AI to provide personalized, interactive, and effective learning experiences, while also emphasizing the need for careful planning, diverse instructional strategies, and continuous feedback to maximize the benefits of AI in education.

4.2. Strengths of Using AI in Learning and Teaching Based on Perceptions of Student Teachers

The perceptions and thoughts of student teachers about the strengths of using artificial intelligence in learning and teaching were also examined. In this context, 240 participants were asked for their opinions. The answers to this question were coded, and themes were extracted. The distributions of these themes are given in Table 2.

An analysis of Table 2 for student teachers' perceptions regarding the strengths of using artificial intelligence (AI) in learning and teaching reveals several key insights:

The most notable strength identified by the student teachers is that AI offers a personalized learning experience for students, with 23% of responses highlighting this benefit. This indicates a strong recognition of AI's potential to tailor learning to individual student needs and preferences.

Additionally, 20% of the candidates noted that AI provides a wide range of educational materials, suggesting that AI can significantly enrich the resources available for teaching and learning. Sixteen percent of respondents noted that AI increases student interest by providing enriched content and interactive materials. This highlights AI's role in making learning more engaging and appealing.

AI's capability to measure students' actual performance was recognized by 15% of the participants, reflecting the importance of accurate and objective assessment tools in education. Similarly, 15% of candidates appreciated AI's ability to track students more easily, highlighting the efficiency AI brings to monitoring student progress.

Table 2. Findings regarding the perceptions and thoughts of student teachers regarding the strengths of using artificial intelligence in learning and teaching, based on their perceptions.

Category	Code	Frequency (n)	Percentage (%)
Strengths of using artificial intelligence in learning and teaching based on the perceptions of student teachers	Artificial intelligence provides fast data analysis	12	5%
	Providing continuous learning	18	8%
	Psychological counseling and guidance	24	10%
	Providing individualized learning	16	6%
	Providing personalized feedback	22	9%
	Easier tracking of students	36	15%
	Providing an interactive and engaging learning experience	7	2%
	Lightening the teacher's workload	29	12%
	Providing accessibility in education	8	3%
	Continuous learning and development	34	14%
	Contributing to teacher education	23	10%
	Providing students with a visually and auditorily rich presentation	19	8%
	Offering a personalized learning experience for students	56	23%
	Measuring students' actual performance	37	15%
	Increasing students' interest by providing enriched content and interactive materials	39	16%
	Promoting collaboration among students	12	5%
	Providing diversity in education	8	3%
	Providing instructional content for each student	28	12%
	Providing interesting and interactive learning environments	22	9%
	Having a wide range of educational materials	48	20%
	Offering a more customized learning experience according to students' learning styles and skills	53	%

Continuous learning and development facilitated by AI were mentioned by 14% of respondents, underscoring AI's role in fostering ongoing educational growth. Furthermore, 12% of student teachers noted that AI lightens the teacher's workload and provides instructional content for each student, indicating that AI can streamline teaching processes and reduce the burden on educators.

Psychological counseling and guidance provided by AI were acknowledged by 10% of the participants, suggesting that AI can play a supportive role in addressing students' emotional and mental health needs. Contributions to teacher education were also recognized by 10% of the respondents, reflecting AI's potential to enhance teacher training and professional development.

Other significant strengths include providing personalized feedback (9%), creating interesting and interactive learning environments (9%), and supporting individualized learning (6%). Additionally, AI was noted for its ability to facilitate fast data analysis (5%), promote collaboration among students (5%), and ensure accessibility in education (3%).

Based on student teachers' perceptions and thoughts about the strengths of using artificial intelligence in learning and teaching, the findings highlight several key points. According to the student teachers, artificial intelligence provides rapid data analysis, continuous learning, and psychological counselling and guidance. Additionally, AI in

education offers individualized learning, personalized feedback, easier student tracking, and an interactive and engaging learning experience.

Student teachers also stated that AI eases the teacher's workload, accelerates accessibility in education, and greatly benefits continuous learning and development. AI contributes to teacher education by providing students with a visually and auditorily rich presentation environment and a personalized learning experience. Furthermore, AI facilitates measuring students' actual performance, increases student interest through enriched content and interactive materials, encourages student cooperation, and introduces diversity in education.

Additionally, the use of AI in education offers teaching content tailored to each student, creates interesting and interactive learning environments, and provides a wide range of educational materials. It also offers a more customized learning experience based on students' learning styles and skills.

In alignment with these thoughts, here are some participant opinions:

"I can clearly say that using artificial intelligence in education is very useful in providing students with individualized learning" (Student teacher, 112).

"I think it is a very important benefit that artificial intelligence provides students with a more customized learning experience according to their learning styles and skills." (Student teacher, 136).

"It can easily provide interesting and interactive learning environments through artificial intelligence" (Student teacher, 189).

These findings indicate that student teachers perceive AI as a powerful tool that enhances personalization, engagement, and efficiency in education. AI's ability to provide a wide range of educational materials, enrich content, and support continuous learning and development is highly valued. However, the emphasis on personalized learning experiences and the ability to measure actual performance suggests that the integration of AI in education should focus on tailoring instruction to individual needs and providing accurate assessments to maximize its benefits.

4.3. Weaknesses of Using AI in Learning and Teaching Based on Perceptions of Students Teachers

The weaknesses of using artificial intelligence in learning and teaching, based on student teachers' perceptions, were also examined. In this context, 240 participants were asked for their opinions. The answers to this question were coded, and themes were extracted. The distributions of these themes are given in Table 3.

Table 3 presents the perceptions and thoughts of student teachers regarding the weaknesses of using artificial intelligence (AI) in learning and teaching, highlighting several critical concerns. Ethical and privacy issues are significant, with 15% of respondents believing that ethical problems may arise with AI, and 19% expressing concerns about data privacy issues. Additionally, 19% note that AI can sometimes give biased results, and 20% see AI as dangerous with regard to privacy and bias issues. There is also concern that AI could perpetuate discrimination among students, as noted by 5% of the respondents.

Emotional and social concerns are also prominent. Nine percent of respondents state that AI lacks emotional understanding, 7% point out a deficit in emotional learning with AI, and 20% highlight the lack of sufficient emotional and social development for students. The interaction and individualization aspects of AI are problematic, with 9% mentioning a lack of interaction between students and teachers, 9% indicating deficiencies in individualization, and 26% concerned about AI's inability to provide adequate teacher–student interaction.

The impact of AI on teaching and learning raises additional concerns. Twenty-nine percent fear that AI may impose restrictions on the teaching profession and replace teachers, 12% point out the inability of AI to manage classrooms effectively, and 20% feel that AI fails to provide adequate student motivation. Overdependence on AI is a concern for 25%, who believe it leads to a lack of soft skills, impaired critical thinking, and decreased

self-confidence. Furthermore, 14% note that AI negatively affects students' critical thinking skills, 19% believe it reduces creativity, 18% are concerned that AI encourages copying works, and 3% worry about the potential increase in unemployment due to AI.

Table 3. Findings regarding the perceptions and thoughts of student teachers regarding the weaknesses of using artificial intelligence in learning and teaching, based on their perceptions.

Category	Code	Frequency (n)	Percentage (%)
Weaknesses of using artificial intelligence in learning and teaching based on the perceptions of student teachers	Ethical problems may occur with artificial intelligence	35	15%
	There may be problems with data privacy issues	46	19%
	Provides a lack of emotional understanding	22	9%
	Can sometimes give biased results	46	19%
	Showing a lack of interaction	22	9%
	May show deficiencies in individualization	21	9%
	Showing emotional learning deficit	17	7%
	Teachers can impose restrictions on their profession and replace teachers	69	29%
	The teacher's inability to give the same love to the student	36	15%
	Inability to manage classroom	29	12%
	Failure to provide student motivation	47	20%
	Overdependence leads to a lack of soft skills, impaired critical thinking, and decreased self-confidence	61	25%
	Dangerous regarding privacy and bias issues	49	20%
	May prevent independent thinking and empathy for others	36	16%
	Negatively affects critical thinking skills	33	14%
	Copying works	42	18%
	It increases unemployment	7	3%
	Reduces creativity	45	19%
	Lack of sufficient emotional and social development for students	49	20%
	Potential to perpetuate discrimination among students	12	5%
	Inability to provide teacher–student interaction	63	26%

The findings regarding the weaknesses of using artificial intelligence in learning and teaching, based on the perceptions of student teachers, reveal several concerns. According to the student teachers, AI may present ethical problems, issues with data privacy, and a lack of emotional understanding. They noted that AI can sometimes produce biased educational results and reduce interaction between students and teachers.

Additionally, the participants expressed that AI may show deficiencies in individualization in education, emotional learning, and could potentially harm the teaching profession by limiting or replacing teachers. They highlighted that AI lacks the ability to provide the love, classroom management, and motivation that human teachers offer.

Student teachers also stated that AI can lead to overdependence in students, hinder the development of soft skills, harm critical thinking, and reduce students' self-confidence. They mentioned that AI could be dangerous in terms of privacy and bias and may prevent students from thinking independently and empathizing with others. Furthermore, AI was perceived to negatively impact students' critical thinking skills, reduce sensitiv-

ity to plagiarism, diminish creativity, and fail to support students' emotional and social development adequately.

The student teachers also indicated that AI has the potential to perpetuate discrimination among students and cannot provide adequate teacher–student interaction.

Reflecting these thoughts, here are some participant opinions:

“The possibility of ethical problems will increase by using artificial intelligence in education.” (Student teacher, 92).

“Excessive dependence on artificial intelligence, causing a lack of soft skills, damage to critical thinking, and decreased self-confidence are important drawbacks.” (Student teacher, 176).

“The ability of teachers to impose limitations on their profession and replace the teacher through artificial intelligence are important weaknesses.” (Student teacher, 78).

The findings from Table 3 indicate significant concerns among student teachers regarding the use of AI in education. Ethical and privacy issues, lack of emotional and social support, interaction deficiencies, and the potential negative impact on teaching and learning are prominent. The respondents emphasize the importance of addressing these weaknesses to ensure that AI integration in education is effective, ethical, and supportive of both students' and teachers' needs.

5. Discussion

The findings of this study highlight several critical insights into student teachers' perceptions regarding the use of artificial intelligence (AI) in learning and teaching. These insights offer a multifaceted view of both the potential benefits and challenges associated with integrating AI into educational environments. This discussion aims to synthesize these findings, link them to existing literature and theoretical frameworks, and provide a comprehensive analysis of their implications for future educational practices.

The highest scientific production on AI in higher education is seen in computer science and social sciences, with significant adoption also in medicine, psychology, and environmental sciences. This underscores the interdisciplinary nature and broad scope of AI research in higher education, highlighting its cross-disciplinary impact across various academic fields.

5.1. Enhancing Individualized and Interactive Learning

One of the most prominent themes identified in the study is the ability of AI to facilitate individualized and interactive learning experiences. The data suggest that AI can significantly enhance the personalization of education, allowing for tailored instructional approaches that cater to the unique needs and learning styles of each student. This finding is supported by the high frequency (20%) of student teachers recognizing the potential for AI to develop personalized learning by identifying students' strengths and weaknesses.

AI's ability to provide real-time feedback and facilitate data-driven decision making [28,29] is particularly noteworthy. Student teachers in the study reported that AI tools could offer immediate and personalized feedback, thereby supporting continuous learning and development. This capability is crucial for fostering a responsive and adaptive learning environment, which can enhance student engagement and motivation. The provision of rapid data analysis and personalized feedback also supports the development of self-regulated learning skills [30], as students can better understand their learning progress and areas for improvement.

The literature supports these findings, indicating that AI can enhance personalized learning by adapting content and feedback to individual student needs. For instance, ref. [31] identifies the potential of artificial intelligence to create personalized curricula, democratize education, and revolutionize teaching and learning methods. However, the authors caution that existing digital divides and social inequalities may exacerbate educational disparities. They further emphasize the need for inclusive and equitable AI-driven

education systems, leveraging open resources and human-centered design to ensure high-quality learning opportunities for all, regardless of socio-economic or geographical barriers. Ref. [32] reports that AI-powered learning platforms, such as the Korbit platform, significantly enhance learning outcomes compared to traditional MOOC platforms. Participants on the Korbit platform experienced higher course completion rates and learning gains 2 to 2.5 times greater than those using traditional methods or receiving no personalized feedback. The authors highlight the transformative potential of AI in providing personalized, active, and practical learning experiences, underscoring the importance of making such technology widely accessible to democratize education.

Ref. [33] highlights the effectiveness of AI-assisted tools, developed using machine learning models, in addressing learning challenges for students with neurodevelopmental disorders (NDDs). The authors present evidence that AI tools can enhance social interaction and supportive education for these students. Additionally, they offer recommendations for future AI tool development, emphasizing the need for personalized learning solutions for individuals with NDDs.

Ref. [34] found that combining adaptive and intelligent roles in pedagogical agents significantly enhances personalized adaptive learning systems (PALS). These agents effectively compensate for the lack of physical connection in online settings. The authors suggest that incorporating such agents in PALS leads to improved student performance, higher task completion rates, increased motivation, and greater engagement.

Ref. [35] revealed that implementing a functional chatbot on a higher education institution's web portal significantly enhances student interaction and support services by providing instant, personalized responses and reducing response times. This advancement streamlines communication, empowers students to efficiently find information, and fosters a positive learning environment, with ongoing enhancements expected to further improve its effectiveness.

5.2. Supporting Collaborative and Social Learning

The findings also highlight the potential of AI to promote collaborative and social learning. AI-driven platforms can facilitate group work and peer interactions [36,37], which are essential components of modern educational practices. The study participants noted that AI could support and motivate collaborative learning by providing tools that enable students to work together more effectively. This aspect was recognized by 9% of the participants, emphasizing the role of AI in enhancing collaborative-based learning.

Research supports these findings by demonstrating how AI can bolster collaborative learning environments. For example, ref. [38] discussed how modern higher education environments, transitioning from traditional to innovative learning spaces, present both benefits and challenges. Results indicate that traditional learning environments have limitations, necessitating inventive solutions to meet evolving educational demands. They also revealed diverse learning scenarios, including hybrid and remote setups, and the integration of online platforms and virtual tools. These new modalities introduce complexities such as reduced face-to-face interactions and an increased need for instructional and technological support. However, innovative learning spaces were found to enhance student engagement, collaboration, and creativity. They also highlighted technology's critical role in shaping learning environments and influencing pedagogical methodologies.

Ref. [39] reported that current aviation curricula focus more on foundational digital skills than on AI and machine learning competencies due to the newness and specialized nature of aviation AI and implementation challenges. Aviation curricula mainly teach basic digital skills needed in the aviation industry. They often miss out on AI and machine learning due to their complexity and recent development. To meet industry needs, new programs should include AI training and teamwork skills to prepare students for future aviation technology. This misalignment with industry goals highlights the need for dedicated AI programs. The authors offer a methodology and competency framework to help

educators bridge this gap, emphasizing the importance of AI literacy and collaboration skills for the future of aviation.

Ref. [40] noted that using machine learning algorithms to create heterogeneous groups based on student behavior and performance significantly improved collaborative learning outcomes compared to random group formation. This approach enhanced student performance and satisfaction, contributing to more effective group dynamics in online education.

Ref. [41] found that social media platforms, particularly Twitter, facilitated engagement and student-centered design of online courses in higher education before and during the pandemic. Despite complex issues and safety concerns leading to student hesitancy, social media remains integral. The emergence of generative AI tools presents new challenges and opportunities. The authors critically analyze social media and AI's intentional use, challenges, and implications, highlighting the importance of maintaining hope and employing strategic navigation in educational technology. Their findings reflect the experiences of faculty and students at a southwest border university.

5.3. Addressing the Ethical and Emotional Challenges

Despite the numerous advantages, the integration of AI in education also poses significant ethical and emotional challenges. The study participants expressed concerns about data privacy, ethical implications, and the potential for AI to produce biased results, with 19% of responses highlighting issues related to data privacy and bias. These concerns align with the broader discourse on AI ethics in education, emphasizing the need for robust regulatory frameworks and ethical guidelines to govern AI use.

Moreover, the study reveals apprehensions regarding the emotional aspects of learning. AI's lack of emotional understanding and inability to provide the same level of emotional support as human teachers were cited as major drawbacks, with 15% of participants noting this lack of emotional interaction. This finding underscores the importance of maintaining a balance between technological integration and human interaction in educational settings. While AI can augment certain aspects of teaching, it cannot fully replace the emotional and empathetic connection that human teachers provide [42].

Recent literature echoes these ethical and emotional concerns. Ref. [43] found that AI chatbots have the potential to revolutionize digital mental health but must address ethical and practical challenges. Results highlight the importance of integrating human–AI Interaction (HAI) principles, responsible regulation, and scoping reviews to maximize benefits and minimize risks. Collaborative approaches and modern educational solutions are crucial for mitigating biases and ensuring a more inclusive and effective digital mental health landscape.

Ref. [44] reported that incorporating issues of religion and religiosity in AI design and implementation can enhance societal acceptance of the technology. Understanding religiosity's impact on AI responses is crucial for developing ethically responsible AI solutions that respect diverse beliefs and value systems.

Ref. [45] indicated that consumers often display a neutral emotional tone when leaving one-star ratings, underscoring the need for better management of unfavorable reviews. It also found that user interaction with products and services significantly affects the likelihood of publishing reviews. The authors recommend acquiring tools and skills, especially in utilizing AI for sentiment analysis, to enhance management efficiency.

Ref. [46] revealed that, despite ethical concerns, human–robot relationships, particularly those involving intimate robots, have been relatively unproblematic, primarily due to the lack of need to consider the robot's emotions. However, advancements in AI and artificial emotions suggest that robots may develop the capability to love in the future, potentially complicating these interactions in unforeseen ways.

5.4. Implications for Teacher Education and Professional Development

The findings of this study have significant implications for teacher education and professional development programs. To harness the potential of AI in education effec-

tively, it is essential to equip future teachers with the necessary skills and knowledge to integrate AI tools into their teaching practices. This includes training on the ethical use of AI, addressing data privacy issues [47–49], and developing strategies for leveraging AI to enhance student learning outcomes [50,51]. Teacher education programs should also focus on enhancing teachers' abilities to create and implement AI-supported lesson plans [52,53] that emphasize personalized and interactive learning. As suggested by the study participants, AI should be designed to highlight students' strengths and address their weaknesses, thereby supporting a more holistic approach to education.

6. Conclusions

Results on using artificial intelligence in learning and teaching: The study examined student teachers' perceptions as the first dimension. In this context, 240 student teachers were asked about their views on using artificial intelligence in learning and teaching. The responses were coded, and themes were extracted. The results of these themes are presented below.

According to the student teachers' opinions, teachers should give more importance to their education to ensure that it is more individual, interactive, and accessible [4,25]. Additionally, teachers should be more careful about providing students with different learning styles and encouraging collaborative-based learning. Teachers reported that AI increased interaction with students, provided personalized experiences, supported the learning process, and motivated students. They noted that AI transforms students' needs and learning processes more effectively; offers personalized, interactive, and participatory learning; and provides convenience to teachers in areas such as real-time feedback, data collection and analysis, and collaborative and social learning [54].

In this context, teachers emphasized the importance of planning the use of AI, preparing lesson plans, and designing AI to highlight students' strengths and address their weaknesses. Including AI in classical learning environments helps teachers consolidate and understand what students have learned. AI can determine students' strengths and weaknesses more easily, aiding in the development of personalized learning. Teachers also suggested that feedback should be given to students using online measurement and evaluation and that AI should be used to enhance problem-solving skills, analysis abilities, and creativity [55].

Results regarding the strengths of using artificial intelligence in learning and teaching based on the perceptions of student teachers:

The second dimension of the research aimed to reveal the perceptions and thoughts of student teachers about the strengths of using artificial intelligence in learning and teaching. In this context, the opinions of student teachers highlighted several key strengths of AI.

Student teachers stated that AI provides the opportunity to perform rapid data analysis, supports continuous learning, and offers psychological counseling and guidance. Additionally, they noted that AI benefits education by providing individualized learning, personalized feedback, and easier student tracking, and creating interactive and engaging learning experiences [47,56].

The participating student teachers also mentioned that AI eases the teacher's workload, accelerates accessibility in education, and greatly benefits continuous learning and development. AI contributes to teacher education by offering students a visually and auditorily rich presentation environment and a personalized learning experience.

Furthermore, student teachers emphasized that AI makes it easier to measure students' actual performance, increases student interest through enriched content and interactive materials, encourages student cooperation, and introduces diversity in education. They also stated that AI provides teaching content tailored to each student, creates interesting and interactive learning environments, offers a wide range of educational materials, and provides a more personalized learning experience based on students' learning styles and skills [57].

The findings regarding the perceptions and thoughts about the weaknesses of using artificial intelligence in learning and teaching, based on the perceptions of student teachers, highlight several concerns. According to the student teachers, ethical problems may occur with artificial intelligence, there are issues with data privacy, and it provides a lack of emotional understanding [58]. They noted that AI can sometimes produce biased educational results and reduce interaction between students and teachers. Additionally, the participating student teachers expressed that AI may show deficiencies in individualization in education, lack emotional learning, and potentially harm the teaching profession by limiting or replacing teachers.

They pointed out that AI has weaknesses, such as not being able to provide the love and motivation that teachers give to students, nor manage the classroom effectively. This raises concerns about student motivation and the role of instructors in AI-facilitated instruction [59]. They also stated that AI fosters dependency in students, hinders the development of soft skills, harms students' critical thinking, and decreases students' self-confidence. Furthermore, they mentioned that AI can be dangerous in terms of privacy and bias, preventing students from thinking independently and empathizing with others.

Student teachers stated that AI negatively affects students' critical thinking skills, reduces sensitivity to plagiarism, diminishes creativity, and fails to support students' emotional and social development adequately. They also expressed that AI has the potential to maintain discrimination among students and cannot provide sufficient teacher–student interaction [59].

7. Future Directions

Future research should explore the long-term impacts of AI integration in education, particularly its effects on student learning outcomes, teacher–student relationships, and the overall educational experience. There is also a need to investigate the development of AI tools that can better address the emotional and social aspects of learning, ensuring that the use of AI in education does not compromise the human elements crucial for effective teaching and learning.

Student teachers should be educated using information technologies through innovative pedagogy, distinct from traditional methods. As the heart of future education, student teachers must enhance their capacity by leveraging technological advancements. AI presents an opportunity to explore and improve the potential of learning and teaching, contributing to more sustainable education. Future studies should investigate using AI applications and their outcomes to shape new pedagogical approaches and enrich learning and teaching environments.

Additionally, policymakers and educational leaders should consider the findings of this study when developing AI-related educational policies and frameworks. Ensuring that AI integration is guided by ethical principles and that teachers are adequately supported in their professional development will be key to realizing the full potential of AI in education.

Author Contributions: Conceptualization, B.Y.; methodology, Z.A.; investigation, F.A.; resources, R.S. and M.A.; data curation, R.C.S.; writing—original draft, G.D. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Ethical board of Near East University made decision for this study which is numbered as 1078 on 12 January 2024.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author.

Conflicts of Interest: The authors declare no conflicts of interest.

References

- Orishev, J.; Achilov, S. Digital technologies as an educational process in preparing future teachers for project activities. *Sci. Innov.* **2023**, *2*, 425–429. [\[CrossRef\]](#)
- Henderson, K.; Loreau, M. A model of Sustainable Development Goals: Challenges and opportunities in promoting human well-being and environmental sustainability. *Ecol. Model.* **2023**, *475*, 110164. [\[CrossRef\]](#)
- Chatterjee, R.; Bandyopadhyay, A.; Chakraborty, S.; Dutta, S. Digital Education: The Basics with Slant to Digital Pedagogy—An Overview. In *Digital Learning Based Education: Transcending Physical Barriers*; Springer: Singapore, 2023; pp. 63–80. [\[CrossRef\]](#)
- Hickmann, T.; Biermann, F.; Spinazzola, M.; Ballard, C.; Bogers, M.; Forestier, O.; Kalfagianni, A.; Kim, R.E.; Montesano, F.S.; Peek, T.; et al. Success factors of global goal-setting for sustainable development: Learning from the Millennium Development Goals. *Sustain. Dev.* **2023**, *31*, 1214–1225. [\[CrossRef\]](#)
- Coker, H.; Mercieca, D. Digital technology for inclusive education: Reflecting on the role of teachers. In *Inclusion, Equity, Diversity, and Social Justice in Education: A Critical Exploration of the Sustainable Development Goals*; Springer Nature: Singapore, 2023; pp. 233–243. [\[CrossRef\]](#)
- Alenezi, M. Digital learning and digital institution in higher education. *Educ. Sci.* **2023**, *13*, 88. [\[CrossRef\]](#)
- Acevedo-Duque, Á.; Jiménez-Bucarey, C.; Prado-Sabido, T.; Fernández-Mantilla, M.M.; Merino-Flores, I.; Izquierdo-Marín, S.S.; Valle-Palomino, N. Education for sustainable development: Challenges for postgraduate programmes. *Int. J. Environ. Res. Public Health* **2023**, *20*, 1759. [\[CrossRef\]](#)
- Ahel, O.; Schirmer, M. Education for sustainable development through research-based learning in an online environment. *Int. J. Sustain. High. Educ.* **2023**, *24*, 118–140. [\[CrossRef\]](#)
- Rawas, S. ChatGPT: Empowering lifelong learning in the digital age of higher education. *Educ. Inf. Technol.* **2023**, *29*, 6895–6908. [\[CrossRef\]](#)
- Guilherme, A. AI and education: The importance of teacher and student relations. *AI Soc.* **2019**, *34*, 47–54. [\[CrossRef\]](#)
- Darvishi, A.; Khosravi, H.; Sadiq, S.; Gašević, D.; Siemens, G. Impact of AI assistance on student agency. *Comput. Educ.* **2024**, *210*, 104967. [\[CrossRef\]](#)
- Ogata, H.; Flanagan, B.; Takami, K.; Dai, Y.; Nakamoto, R.; Takii, K. EXAIT: Educational eXplainable Artificial Intelligent Tools for personalized learning. *Res. Pract. Technol. Enhanc. Learn.* **2024**, *19*, 019. [\[CrossRef\]](#)
- Flores-Vivar, J.M.; García-Peñalvo, F.J. Reflections on the ethics, potential, and challenges of artificial intelligence in the framework of quality education (SDG4). *Comunicar* **2023**, *31*, 37–47. [\[CrossRef\]](#)
- Zhai, X.; Chu, X.; Chai, C.S.; Jong, M.S.Y.; Istenic, A.; Spector, M.; Liu, J.B.; Yuan, J.; Li, Y. A Review of Artificial Intelligence (AI) in Education from 2010 to 2020. *Complexity* **2021**, *2021*, 8812542. [\[CrossRef\]](#)
- Holmes, W.; Tuomi, I. State of the art and practice in AI in education. *Eur. J. Educ.* **2022**, *57*, 542–570. [\[CrossRef\]](#)
- Palmer, M. Data is the new oil. *ANA Mark. Maest.* **2006**, *3*. Available online: https://ana.blogs.com/maestros/2006/11/data_is_the_new.html (accessed on 7 August 2024).
- Tahiru, F. AI in education: A systematic literature review. *J. Cases Inf. Technol. (JCIT)* **2021**, *23*, 1–20. [\[CrossRef\]](#)
- Schiff, D. Education for AI, not AI for education: The role of education and ethics in national AI policy strategies. *Int. J. Artif. Intell. Educ.* **2022**, *32*, 527–563. [\[CrossRef\]](#)
- Schiff, D.S. Looking through a policy window with tinted glasses: Setting the agenda for US AI policy. *Rev. Policy Res.* **2023**, *40*, 729–756. [\[CrossRef\]](#)
- Hopcan, S.; Türkmen, G.; Polat, E. Exploring the artificial intelligence anxiety and machine learning attitudes of teacher candidates. *Educ. Inf. Technol.* **2024**, *29*, 7281–7301. [\[CrossRef\]](#)
- Celik, I.; Dindar, M.; Muukkonen, H.; Järvelä, S. The promises and challenges of artificial intelligence for teachers: A systematic review of research. *TechTrends* **2022**, *66*, 616–630. [\[CrossRef\]](#)
- Zawacki-Richter, O.; Marín, V.I.; Bond, M.; Gouverneur, F. Systematic review of research on artificial intelligence applications in higher education—where are the educators? *Int. J. Educ. Technol. High. Educ.* **2019**, *16*, 39. [\[CrossRef\]](#)
- Cope, B.; Kalantzis, M.; Sears, D. Artificial intelligence for education: Knowledge and its assessment in AI-enabled learning ecologies. *Educ. Philos. Theory* **2021**, *53*, 1229–1245. [\[CrossRef\]](#)
- Yıldırım, A.; Şimşek, H. *Sosyal Bilimlerde nitel Araştırma Yöntemleri [Qualitative Research Methods in the Social Sciences]*; Seçkin Yayıncılık: Ankara, Turkey, 2018. Available online: <https://hdl.handle.net/11511/70532> (accessed on 7 August 2024).
- Legard, R.; Keegan, J.; Ward, K. In-depth Interviews. In *Qualitative Research Practice*; Richie, J., Lewis, J., Eds.; Sage: London, UK, 2003; pp. 139–168.
- Patton, M.Q. *Qualitative Evaluation and Research Methods*; SAGE Publications, Inc.: London, UK, 1990.
- Miles, M.B.; Huberman, A.M. *An Expanded Sourcebook Qualitative Data Analysis*, 2nd ed.; Sage Publications: London, UK, 1994.
- Di Vaio, A.; Hassan, R.; Alavoine, C. Data intelligence and analytics: A bibliometric analysis of human–Artificial intelligence in public sector decision-making effectiveness. *Technol. Forecast. Soc. Chang.* **2022**, *174*, 121201. [\[CrossRef\]](#)
- Tien, J.M. Internet of things, real-time decision making, and artificial intelligence. *Ann. Data Sci.* **2017**, *4*, 149–178. [\[CrossRef\]](#)
- Ingvavara, T.; Panjaburee, P.; Srisawasdi, N.; Sajjapanroj, S. The use of a personalized learning approach to implementing self-regulated online learning. *Comput. Educ. Artif. Intell.* **2022**, *3*, 100086. [\[CrossRef\]](#)
- Bulathwela, S.; Pérez-Ortiz, M.; Holloway, C.; Cukurova, M.; Shawe-Taylor, J. Artificial Intelligence Alone Will Not Democratise Education: On Educational Inequality, Techno-Solutionism and Inclusive Tools. *Sustainability* **2024**, *16*, 781. [\[CrossRef\]](#)

32. St-Hilaire, F.; Vu, D.D.; Frau, A.; Burns, N.; Faraji, F.; Potochny, J.; Robert, S.; Roussel, A.; Zheng, S.; Glazier, T.; et al. A New Era: Intelligent Tutoring Systems Will Transform Online Learning for Millions. *arXiv* **2022**, arXiv:2203.03724.
33. Barua, P.D.; Vicnesh, J.; Gururajan, R.; Oh, S.L.; Palmer, E.; Azizan, M.M.; Kadri, N.A.; Acharya, U.R. Artificial Intelligence Enabled Personalised Assistive Tools to Enhance Education of Children with Neurodevelopmental Disorders—A Review. *Int. J. Environ. Res. Public Health* **2022**, *19*, 1192. [\[CrossRef\]](#)
34. Apoki, U.C.; Hussein, A.M.A.; Al-Chalabi, H.K.M.; Badica, C.; Mocanu, M.L. The Role of Pedagogical Agents in Personalised Adaptive Learning: A Review. *Sustainability* **2022**, *14*, 6442. [\[CrossRef\]](#)
35. Oliveira, P.F.; Matos, P. Introducing a Chatbot to the Web Portal of a Higher Education Institution to Enhance Student Interaction. *Eng. Proc.* **2023**, *56*, 128. [\[CrossRef\]](#)
36. Zhou, X.; Schofield, L. Using social learning theories to explore the role of generative artificial intelligence (AI) in collaborative learning. *J. Learn. Dev. High. Educ.* **2024**. [\[CrossRef\]](#)
37. Tan, S.C.; Lee AV, Y.; Lee, M. A systematic review of artificial intelligence techniques for collaborative learning over the past two decades. *Comput. Educ. Artif. Intell.* **2022**, *3*, 100097. [\[CrossRef\]](#)
38. Papaioannou, G.; Volakaki, M.-G.; Kokolakis, S.; Vouyioukas, D. Learning Spaces in Higher Education: A State-of-the-Art Review. *Trends High. Educ.* **2023**, *2*, 526–545. [\[CrossRef\]](#)
39. Kabashkin, I.; Misnevs, B.; Zervina, O. Artificial Intelligence in Aviation: New Professionals for New Technologies. *Appl. Sci.* **2023**, *13*, 11660. [\[CrossRef\]](#)
40. Nalli, G.; Smith, S. Comparison of the Effectiveness and Performance of Student Workgroups in Online Wiki Activities with and without AI. *Eng. Proc.* **2023**, *56*, 248. [\[CrossRef\]](#)
41. Parra, J.L.; Chatterjee, S. Social Media and Artificial Intelligence: Critical Conversations and Where Do We Go from Here? *Educ. Sci.* **2024**, *14*, 68. [\[CrossRef\]](#)
42. Whalen, J.; Mouza, C. ChatGPT: Challenges, Opportunities, and Implications for Teacher Education. *Contemp. Issues Technol. Teach. Educ.* **2023**, *23*, 1–23. Available online: <https://www.learntechlib.org/primary/p/222408/> (accessed on 7 August 2024).
43. Balcombe, L. AI Chatbots in Digital Mental Health. *Informatics* **2023**, *10*, 82. [\[CrossRef\]](#)
44. Kozak, J.; Fel, S. The Relationship between Religiosity Level and Emotional Responses to Artificial Intelligence in University Students. *Religions* **2024**, *15*, 331. [\[CrossRef\]](#)
45. Nichifor, E.; Brătucu, G.; Chițu, I.B.; Lupșa-Tătaru, D.A.; Chișinău, E.M.; Todor, R.D.; Albu, R.-G.; Bălășescu, S. Utilising Artificial Intelligence to Turn Reviews into Business Enhancements through Sentiment Analysis. *Electronics* **2023**, *12*, 4538. [\[CrossRef\]](#)
46. Rousi, R. Me, My Bot and His Other (Robot) Woman? Keeping Your Robot Satisfied in the Age of Artificial Emotion. *Robotics* **2018**, *7*, 44. [\[CrossRef\]](#)
47. Nguyen, A.; Ngo, H.N.; Hong, Y.; Dang, B.; Nguyen BP, T. Ethical principles for artificial intelligence in education. *Educ. Inf. Technol.* **2023**, *28*, 4221–4241. [\[CrossRef\]](#) [\[PubMed\]](#)
48. Nurhaliza, S.; Setiawan, B. AI for Societal Benefit: Ethical, Educational, and Operational Perspectives. *Int. J. Appl. Mach. Learn. Comput. Intell.* **2024**, *14*, 20–25. Available online: <https://neuralslate.com/index.php/Machine-Learning-Computational-I/article/view/97> (accessed on 7 August 2024).
49. Dieterle, E.; Dede, C.; Walker, M. The cyclical ethical effects of using artificial intelligence in education. *AI Soc.* **2024**, *39*, 633–643. [\[CrossRef\]](#) [\[PubMed\]](#)
50. Alam, A. Harnessing the Power of AI to Create Intelligent Tutoring Systems for Enhanced Classroom Experience and Improved Learning Outcomes. In *Intelligent Communication Technologies and Virtual Mobile Networks*; Springer Nature: Singapore, 2023; pp. 571–591. [\[CrossRef\]](#)
51. Onesio-Ozigagun, O.; Ololade, Y.J.; Eyo-Udo, N.L.; Ogundipe, D.O. Revolutionizing education through AI: A comprehensive review of enhancing learning experiences. *Int. J. Appl. Res. Soc. Sci.* **2024**, *6*, 589–607. [\[CrossRef\]](#)
52. Yun, P.P. A reflection of the development of AI-supported pedagogies using the Lesson Study method. In *Implementing a 21st Century Competency-Based Curriculum Through Lesson Study*; Routledge: London, UK, 2024; pp. 186–201.
53. Pender, H.L.; Bohl, L.; Schönberger, M.; Knopf, J. An AI-based lesson planning software to support competence-based learning. In Proceedings of the 8th International Conference on Higher Education Advances (HEAd'22), Valencia, Spain, 15–17 June 2022; pp. 1033–1041. [\[CrossRef\]](#)
54. Sayed, W.S.; Noeman, A.M.; Abdellatif, A.; Abdelrazek, M.; Badawy, M.G.; Hamed, A.; El-Tantawy, S. AI-based adaptive personalized content presentation and exercises navigation for an effective and engaging E-learning platform. *Multimed. Tools Appl.* **2023**, *82*, 3303–3333. [\[CrossRef\]](#)
55. Baidoo-Anu, D.; Ansah, L.O. Education in the era of generative artificial intelligence (AI): Understanding the potential benefits of ChatGPT in promoting teaching and learning. *J. AI* **2023**, *7*, 52–62. [\[CrossRef\]](#)
56. Dempere, J.; Modugu, K.; Hesham, A.; Ramasamy, L.K. The impact of ChatGPT on higher education. *Front. Educ.* **2023**, *8*, 1206936. [\[CrossRef\]](#)
57. Chan, C.K.Y. A comprehensive AI policy education framework for university teaching and learning. *Int. J. Educ. Technol. High. Educ.* **2023**, *20*, 38. [\[CrossRef\]](#)

58. Ng DT, K.; Lee, M.; Tan, R.J.Y.; Hu, X.; Downie, J.S.; Chu, S.K.W. A review of AI teaching and learning from 2000 to 2020. *Educ. Inf. Technol.* **2023**, *28*, 8445–8501. [[CrossRef](#)]
59. Thomas KFChiu, B.L.; Moorhouse, C.; Sing, C.; Murod, I. Teacher support and student motivation to learn with Artificial Intelligence (AI) based chatbot. *Interact. Learn. Environ.* **2023**. [[CrossRef](#)]

Disclaimer/Publisher’s Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.