Research article

Integration of AI helping teachers in traditional teaching roles

Integración de la IA ayudando a los profesores en roles tradicionales de enseñanza

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Abstract

Introduction: This essay examines the scenario in which a human student is paired with a human teacher and a virtual tutor is introduced to assist the student's learning outside the traditional classroom setting, such as through a computer at home. **Methodology**: With the rise of AI virtual tutors, it is becoming increasingly likely to see these AI teachers taking on a more traditional teaching role. **Results**: Virtual tutors can personalize learning experiences for students by analyzing each student's learning style and pace. **Discussions**: Additionally, they can provide immediate feedback, helping to improve students' understanding of the material and keep them motivated. **Conclusions**: The integration of AI into traditional teaching practices has the potential to revolutionize the educational experience for both students and teachers, providing a more personalized and effective learning environment.

Keywords: personalization; learning; feedback; AI; education; teaching; Generative Artificial Intelligence; technology.

Resumen

Introducción: Este ensayo examina la situación en la que un estudiante humano se empareja con un profesor humano y se introduce un tutor virtual para asistir en el aprendizaje del estudiante fuera del aula tradicional, como a través de una computadora en casa. **Metodología**: Con el auge de los tutores virtuales basados en IA, es cada vez más probable ver a estos profesores de IA asumiendo un papel de enseñanza más tradicional. **Resultados**: Los tutores virtuales pueden personalizar las experiencias de aprendizaje para los estudiantes al analizar el estilo y ritmo de aprendizaje de cada uno. **Discusión**: Además, pueden proporcionar retroalimentación inmediata, lo que ayuda a mejorar la comprensión del

material por parte de los estudiantes y mantenerlos motivados. **Conclusiones**: La integración de la IA en las prácticas de enseñanza tradicionales tiene el potencial de revolucionar la experiencia educativa tanto para estudiantes como para profesores, proporcionando un entorno de aprendizaje más personalizado y eficaz.

Palabras clave: personalización; aprendizaje; retroalimentación; IA; educación; enseñanza; Inteligencia Artifical Generativa; tecnología.

1. Introduction

This essay will specifically look at the situation in which a human student is paired with a human teacher, and a virtual tutor is brought in to assist the student's learning outside of the traditional classroom setting, such as through a computer at home. In essence, this scenario mirrors that of a virtual tutor instructing a virtual student. Some may argue that the most financially practical solution for the student's parents would be to dismiss the human teacher altogether and instead have the virtual tutor provide one-on-one instruction in a virtual environment. This would result in savings from not having to employ a human teacher. This approach may be advantageous for the company creating the virtual tutor, as they could potentially seek to dominate the education sector using this method.

In recent years, with the burgeoning of Generative artificial intelligence (GAI) as Chat GPT (Fernández, 2024), it's becoming increasingly probable to see such AI teachers taking on a more traditional teaching role. Just like physical teachers adapt to their assigned roles in virtual reality environments, this prompts the query about how much Generative Artificial intelligence (GAI) might start assuming teaching roles in face-to-face settings. This raises concerns about the potential threat to the job market for human teachers. By "AI virtual tutor," we mean a pedagogical agent with human-like intelligence that assumes the role of a teacher by providing instruction to a student in a specific domain of knowledge (Alam, 2021).

1.1. Benefits of integrating AI teachers

1.1.1. Personalized Learning Experiences

AI can personalize learning experiences by analyzing each student's learning style, pace, and needs (Pratama et al., 2023; Maghsudi et al., 2021; Ahmad et al., 2022; González-Calatayud et al., 2021). This includes creating adaptive learning algorithms that tailor materials to individual strengths and weaknesses, thus improving student engagement and performance. (Chen et al., 2020; Radianti et al., 2020).

1.1.2. Inmediate Feedback and Support

AI provides immediate feedback, helping students understand the material better and stay motivated (Chen et al., 2020; Shi et al., 2020). This includes real-time progress monitoring and personalized feedback (Radianti et al., 2020; Rastrollo-Guerrero et al., 2020). It helps teachers identify areas where students need extra support, offering targeted assistance.

1.1.3. Enhanced Teaching Strategies and Time Management

AI can streamline administrative tasks like grading, lesson planning, and managing student records, allowing teachers to focus more on individualized instruction (Ahmad et al., 2022; Kabudi et al., 2021; González-Calatayud et al., 2021). This improves overall teaching efficiency and effectiveness (Shi et al., 2020).

1.1.4. Inclusive and Accessible Learning Environment

AI fosters an inclusive learning environment by adapting teaching methods and materials to meet diverse student needs, including those with disabilities (Alam, 2023; Bhutoria, 2022). It can provide support for non-native English speakers and create a dynamic, interactive classroom (González-Calatayud et al., 2021).

1.1.5. Engagement through Interactive Learning Materials

AI can develop interactive and engaging learning materials such as virtual reality simulations, online quizzes, and personalized study guides (Radianti et al., 2020). This promotes student engagement and motivation, enhancing the overall learning experience (Chen et al., 2020; Rastrollo-Guerrero et al., 2020).

1.1.6. Data Analysis for Targeted Instruction

AI assists in analyzing student performance data to identify areas for improvement, providing tailored recommendations and support (Kabudi et al., 2021; Bhutoria, 2022). This leads to more efficient and effective instruction, ultimately improving student outcomes (González-Calatayud et al., 2021).

1.1.7. Administrative Efficiency

By automating routine tasks, AI frees up teachers' time for more direct instructional activities, reducing workload and allowing for more personalized teaching (Shi et al., 2020; González-Calatayud et al., 2021). This includes grading assignments and providing instant feedback to students (González-Calatayud et al., 2021).

In summary, the integration of AI in education offers numerous benefits including personalized learning experiences, immediate feedback, enhanced teaching strategies, a more inclusive environment, interactive materials, data-driven instruction, and improved administrative efficiency, which collectively enhance the educational experience for both students and teachers.

1.2. Increased efficiency in classroom management

Integrating AI into traditional teaching roles significantly increases efficiency in classroom management. This is achieved through several key functions:

Automated Administrative Tasks. AI automates grading, attendance tracking, and assignment organization, saving teachers time and streamlining their workload (Onesi-Ozigagun et al., 2024; Hooda et al., 2022; Grassini, 2023). Automated grading and feedback systems provide timely and personalized responses to students' work (Chen et al., 2020).

Tracking Student Progress. AI can track student progress in real-time, identifying areas for improvement and enabling teachers to provide targeted support and interventions (Hooda et al., 2022; Onesi-Ozigagun et al., 2024).AI systems can analyze student performance data to pinpoint areas where students may be struggling and provide tailored support (Wang et al., 2023).

Resource Management. AI helps in the distribution of resources and educational materials, ensuring each student benefits from a customized learning experience (Chen et al., 2020).It streamlines administrative tasks like lesson planning, allowing teachers to focus more on instructional delivery and student engagement (Grassini, 2023).

Enhanced Instructional Focus. By reducing the time spent on routine tasks, AI allows teachers to dedicate more attention to individualized instruction and personalized learning experiences (Hooda et al., 2022; Grassini, 2023).This shift enables a more efficient use of classroom time and resources, benefiting both teachers and students (Onesi-Ozigagun et al., 2024).

In summary, the integration of AI in classroom management enhances efficiency through automated administrative tasks, real-time student progress tracking, effective resource management, and increased focus on personalized instruction.

1.3. Personalized Learning Experiences for Students

AI technology offers significant benefits in creating personalized learning experiences:

Customized Educational Content. AI algorithms analyze each student's learning style and pace, providing customized lessons and activities to cater to their unique needs (Alam, 2023; Chiu & Chai, 2020).This personalized approach helps students engage more actively and improves academic performance (Wang et al., 2023).

Real-Time Feedback and Support. AI provides real-time feedback and support, creating a dynamic and interactive learning environment (Hooda et al., 2022). By tracking student progress, AI helps teachers quickly identify issues and adjust teaching strategies (Wang et al., 2023).

Targeted Interventions. AI can analyze student data to identify areas where additional support or enrichment is needed, benefiting students of all learning abilities (Maghsudi et al., 2021). Tailored interventions ensure that each student receives the support they need to succeed, fostering engagement and motivation (Chiu & Chai, 2020).

Enhanced Student Engagement. Personalized learning paths and customized lesson plans help students take ownership of their learning, leading to improved academic outcomes and deeper understanding (Bhutoria, 2022).AI-driven insights enable teachers to provide more effective and engaging instruction, empowering students to reach their full potential (Kem, 2022).

Overall, AI enables teachers to tailor educational content to individual student needs, provide real-time feedback, and implement targeted interventions, resulting in improved engagement and academic performance.

1.4. Enhanced Accessibility for All Learners

AI integration enhances accessibility in education, making learning more inclusive and effective:

Adaptive Learning Technologies. AI provides personalized learning experiences and adaptive technology that cater to individual learning needs and styles (Celik et al., 2022). It tailors instructional materials to each student's learning style and pace, enhancing accessibility and inclusivity (Lim et al., 2023).

Support for Diverse Learning Abilities. AI offers real-time feedback and support for students with diverse learning abilities, promoting a more equitable education system (Li & Wong, 2021). It helps bridge the gap between students with disabilities and their peers by creating a more inclusive learning environment (Li & Wong, 2021).

Individualized Instruction. AI helps teachers provide more tailored instruction and support by leveraging technology to analyze student performance and create custom lesson plans (Li & Wong, 2021). This individualization improves academic performance and engagement levels among students (Lim et al., 2023).

In conclusion, AI enhances accessibility by providing adaptive learning technologies, supporting diverse learning abilities, and facilitating individualized instruction, leading to a more inclusive and effective educational experience.

2. Challenges in Integrating AI Teachers

One of the main challenges in integrating AI teachers is the potential resistance from educators who may fear losing their traditional teaching roles. This can lead to tension and reluctance to embrace new technology in the classroom (Chan & Tsi, 2023). It is important for educators to overcome these challenges and be open to the potential benefits of AI in teaching, such as more personalized learning experiences and improved academic performance. Additionally, AI can assist in automating administrative tasks, freeing up more time for instructional planning and student support (Alam, 2021).

2.1. Resistance from Teachers and Stakeholders

Despite the benefits, there is significant pushback from traditionalists in the education field who fear the loss of human touch and personalized learning that AI may bring. Some teachers are concerned about job security and the potential replacement of human educators with AI technology (Fitria, 2023). Others worry about the negative impacts on student-teacher relationships and the overall learning experience. However, AI can enhance efficiency in administrative tasks, allowing teachers to focus more on personalized instruction and student engagement (Etiubon & Etiubon, 2023).

Addressing the concerns surrounding the integration of AI in education requires a multi-faceted approach. Firstly, teachers need to overcome their fears and recognize the potential benefits that AI can bring to their teaching practices. This includes understanding that AI is designed to enhance their capabilities rather than replace them. Emphasizing the positive aspects, such as AI's ability to handle administrative tasks and provide personalized feedback, can help alleviate their apprehensions.

Secondly, it is crucial to demonstrate the value of AI in education to all stakeholders, including administrators, parents, and policymakers. This can be achieved through practical demonstrations and case studies showcasing successful AI implementations in classrooms. By highlighting tangible improvements in student engagement, academic performance, and teacher efficiency, stakeholders can be more easily persuaded of AI's benefits.

Lastly, providing proper training for educators is essential to ease the transition to AI-assisted teaching. Comprehensive training programs should focus on how to effectively utilize AI tools and integrate them into existing teaching methodologies. Addressing concerns about job security is also important, as it reassures educators that AI is a supportive tool rather than a

replacement. By ensuring teachers feel confident and secure in using AI, they are more likely to embrace the technology and fully integrate it into their instructional practices.

2.2. Ethical Considerations in AI Implementation

When implementing AI in traditional teaching roles, it is crucial to consider ethical implications and potential consequences. This includes ensuring student data privacy and protecting against biases in AI algorithms (Bahrini et al., 2023; Celik, 2023). Transparency in how AI algorithms make decisions is essential for accountability. Ethical guidelines and regulations should be established to govern the use of AI in education to prevent unintended harm to students and teachers alike.

Key ethical considerations in the implementation of AI in education involve several critical aspects. One essential aspect is ensuring data security and privacy compliance. As AI systems collect and process vast amounts of student data, protecting this information from unauthorized access and misuse is vital. Educational institutions must adhere to stringent data privacy laws and regulations to safeguard student information.

Moreover, regular monitoring and evaluation of AI systems are necessary to prevent ethical lapses. Ongoing scrutiny helps identify and address any issues that may arise, ensuring that the technology operates as intended without causing harm. By continuously assessing AI's impact, educators and administrators can make informed adjustments to maintain ethical standards.

Another important aspect is involving stakeholders in the decision-making process. Engaging teachers, parents, students, and policymakers in discussions about AI integration ensures that the technology is used responsibly and ethically. Their input can provide valuable insights and help create a balanced approach that considers the needs and concerns of all parties involved.

Additionally, addressing potential biases in AI algorithms and ensuring transparency in decision-making processes are vital. AI systems must be designed to minimize biases that could unfairly disadvantage certain groups of students. Transparency in how AI makes decisions fosters trust and accountability, allowing stakeholders to understand and scrutinize the technology's workings. By prioritizing these ethical considerations, the integration of AI in education can be both responsible and beneficial.

2.3. Ensuring AI Teachers Complement Rather Than Replace Human Teachers

To ensure AI teachers complement rather than replace human teachers, it is essential to integrate them into existing teaching practices and curricula. This integration involves collaboration with human teachers and adapting AI technology to support teacher-student interactions (Chan & Tsi, 2023; Rane et al., 2023).

One approach to achieving this integration is by providing training for teachers on effectively utilizing AI in their teaching practices. By equipping educators with the necessary skills and knowledge, they can seamlessly incorporate AI tools into their instructional methods. This training helps teachers understand how AI can enhance their teaching rather than replace it. Furthermore, AI can assist in grading assignments and providing instant feedback, which increases efficiency and accuracy in the assessment process. This support allows teachers to focus more on personalized instruction and less on administrative tasks.

Another key strategy is leveraging AI to offer real-time feedback and analysis. This capability helps human teachers improve their methods and better cater to individual student needs. AI can provide insights and suggestions based on data analysis, enabling teachers to adapt their approaches to support student learning effectively.

Additionally, AI can support personalized learning experiences by catering to individual learning needs. This ensures that each student receives the attention and support they require to succeed academically. AI can tailor educational content to match the unique strengths and weaknesses of each student, fostering a more inclusive and effective learning environment.

By working together, AI and human teachers can provide a well-rounded learning experience for students, enhancing the overall educational environment. This collaborative approach ensures that AI serves as a valuable resource that complements and augments the role of human educators, rather than replacing them.

Table 1. below outlines key strategies for effectively integrating artificial intelligence (AI) into traditional classroom settings. These strategies include comprehensive training for educators, establishing clear guidelines and expectations, and fostering a collaborative approach between AI and human teachers. Each strategy is designed to enhance the educational experience by leveraging AI's capabilities while maintaining the essential role of human educators.

Table 1.

Strategies for Successful Integration

Strategy	Details
Comprehensive Training for Teachers and Staff	Training teachers on AI tools through workshops, online courses, and support enhances skills, streamlines workloads, and personalizes learning (Alam, 2023; Lee & Perret, 2022; Kim et al., 2022; Chiu & Chai, 2020).
Establishing Clear Guidelines and Expectations	Clear guidelines for AI integration, defined roles, measurable goals, and regular training improve implementation, student performance, and educational efficiency (Dai et al., 2020; Gentrup et al., 2020; Holly et al., 2021).
Collaborative Approach Between AI and Human Teachers	A collaborative approach between AI and human teachers Combining AI and human teachers personalizes learning, assists grading, provides instant feedback, and improves engagement and performance (Zwiers & Crawford, 2023; Cortázar et al., 2021; Zhai et al., 2021).

Source: Own elaboration (2024).

Table 2 on AI integration case studies highlights the transformative impact of AI technologies on traditional classroom settings. It presents three main applications where AI significantly enhances teaching and learning processes.

Table 2.

Case Studies of AI Integration in Traditional Classrooms

Case Study	Benefits	References
AI-Assisted Grading and Feedback Systems	AI grading systems provide personalized feedback, save teachers' time, and improve student performance and engagement..	Checco et al., 2021
Virtual Teaching Assistants and Tutors	AI transforms interactions, provides instant feedback, creates personalized learning, assists grading, improves engagement, bridges in-person and online learning.	Essel et al., 2022
Adaptive Learning Platforms and Intelligent Tutoring Systems	AI personalizes learning, provides targeted feedback, tracks progress, adjusts teaching, identifies weaknesses, offers recommendations, and creates individualized lesson plans..	Taylor et al., 2021; Igbokwe, 2023; Alam, 2023

Source: Own elaboration (2024).

3. Methodology

AI integration in education offers numerous benefits, including personalized learning experiences, immediate feedback, enhanced teaching strategies, and an inclusive learning environment. AI tailors educational content to individual student needs, improving engagement and academic performance. It provides real-time feedback and support, helping students understand material better and stay motivated. AI also streamlines administrative tasks, allowing teachers to focus more on personalized instruction and student engagement. Additionally, AI fosters an inclusive learning environment by adapting teaching methods to diverse student needs and creating interactive learning materials. Overall, AI enhances educational efficiency and effectiveness, benefiting both students and teachers.

To ensure a systematic and comprehensive review, this analysis adheres to the PRISMA 2020 protocol (Page et al., 2021), the PRISMA-ScR extension for scoping reviews (Tricco et al., 2018), and the PRISMA-S extension for bibliographic searches (Rethlefsen et al., 2021). During the planning phase, the PRISMA-P protocol (Moher et al., 2015) was utilized. The search strategy, agreed upon by all authors and conducted by one, included databases such as Web of Science (WOS), Dialnet, EBSCO, and ERIC, covering documents from 1980 to the present. Searches were conducted in both English and Spanish, focusing on primary studies about AI and traditional teachers.

The reference selection process for the study on AI teachers and traditional teachers from 1980 to 2024 followed these steps:

1. Initial Sample**:**

   The initial sample included 276 articles related to AI teachers and traditional teachers.

2. Exclusion Based on Publication Year**:**

Years with few articles were excluded, focusing on those from 2004 onwards, resulting in the elimination of 20 articles.

3. Language Filtering:

   Only articles in English were retained, reducing the number to 235 by eliminating 21 articles in other languages.

4. Article Type Filtering:

   Differences were calculated, and non-article documents were excluded, leaving 56 references.

   Only articles and meeting papers were retained, resulting in a final sample of 179 references.

By following these steps, the selection process ensured a focused and relevant set of references pertinent to the study of AI integration in education. This meticulous approach aligns with the objectives of providing a comprehensive review of the current state and future potential of AI integration in educational settings (Figure 1).

Figure 1.

AI Teachers and Traditional Teachers Reference Selection
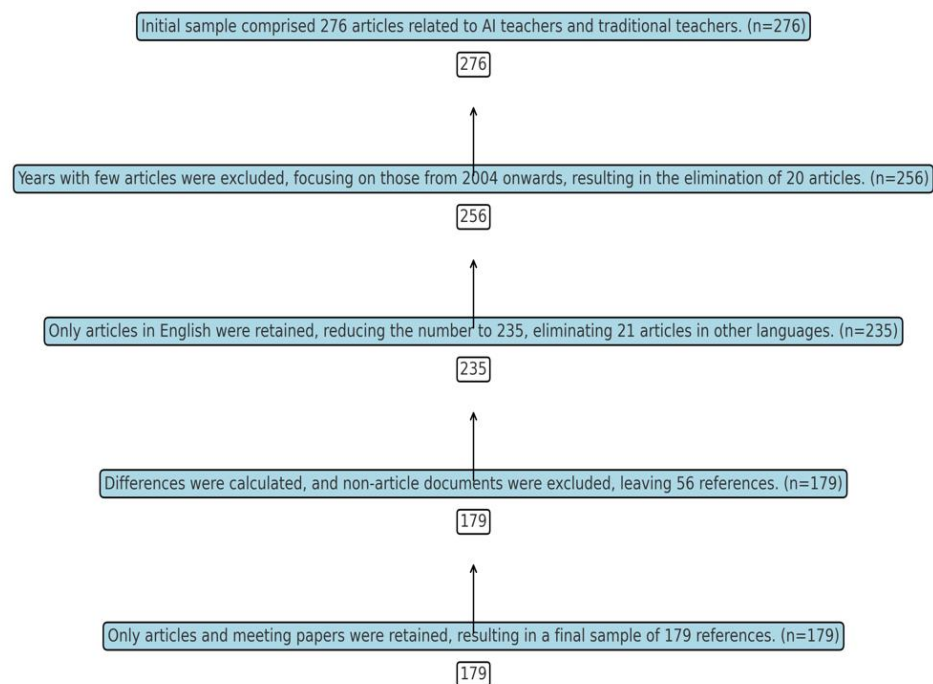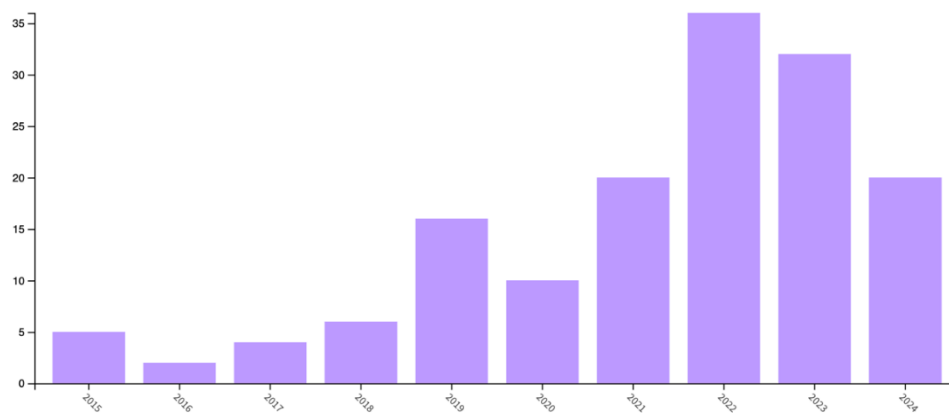

Source: Own elaboration (2024).

4. Results

In this section, the data obtained are presented in an organized and systematic manner, using tables, figures, and statistical analyses to illustrate the main findings. This section focuses on presenting the results objectively, avoiding premature interpretations or conclusions, and highlighting how these findings align with or deviate from the expectations based on the objectives or hypotheses posed.

This figure 2 shows the number of publications and citations over the years. There is a significant increase in publications and citations from 2018, with notable peaks in 2021 and 2022. This indicates a growing interest and relevance in research on the integration of artificial intelligence in the educational context.
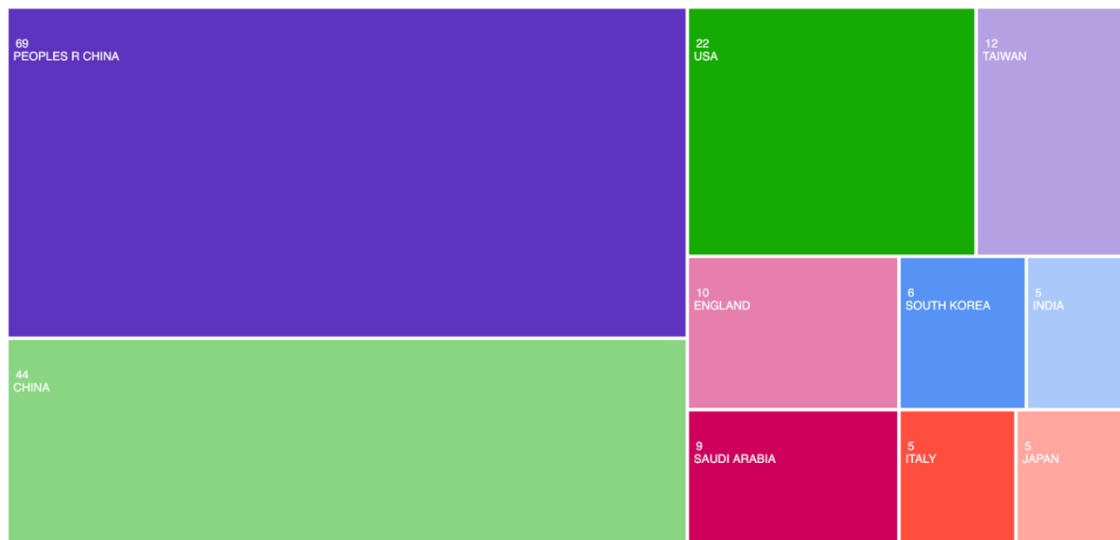
Figure 2.

Publications

 Source: Own elaboration (2024).

This figure 3 represents the geographical distribution of publications related to artificial intelligence in education. It highlights that China and the United States lead in the number of publications, followed by other countries such as Taiwan, England, and Saudi Arabia. This distribution reflects the global interest in using artificial intelligence to improve educational processes.

Figure 3.

Countries

Source: Own elaboration (2024).

This figure 4, illustrates the predominant research areas in the study of artificial intelligence applied to education. The main areas include Computer Science, Educational Research, Engineering, Mathematics, and Psychology. This suggests a multidisciplinary nature in the approach to artificial intelligence in education, integrating various perspectives and methodologies.

Figure 4.

Reseach areas

Source: Own elaboration (2024).

5. Discusión

The integration of AI in education has significant implications for the future of teaching and learning.

5.1. Implications for the Future of Education

AI can revolutionize student assessment by providing real-time feedback and tailoring instruction to individual needs. AI systems analyze student data to identify areas needing additional support, leading to improved learning outcomes (Raj & Renumol, 2022). This technology enables teachers to create personalized learning plans, enhancing the overall efficiency and effectiveness of the learning environment. AI can also streamline grading and feedback processes, allowing for quicker assessment and student performance improvement.

By handling administrative tasks, AI allows educators to focus more on teaching and student engagement. AI algorithms can adapt teaching methods to individual learning styles, providing a more personalized experience. This shift towards a technologically advanced classroom environment increases efficiency and effectiveness, allowing teachers to focus on individual student development (Adıgüzel et al., 2023).

5.2. Redefining the Role of Teachers in the Digital Age

With AI integration, teachers can focus more on personalized instruction and student engagement, improving the learning experience. AI streamlines administrative tasks and provides insights into student performance, enhancing personalized learning through tailored recommendations (Rogowsky et al., 2020). Automating grading and feedback tasks allows teachers to address individual needs and foster critical thinking skills, creating a more engaging learning environment (Essa et al., 2023).

5.3. Addressing Concerns About Job Displacement

To address job displacement concerns, retraining programs are essential. These programs help teachers effectively incorporate AI technology into their roles. Upskilling in AI enhances teaching methods and provides personalized learning experiences, ensuring teachers remain valuable in the classroom (Kim & Park, 2020; Skalka et al., 2021). AI streamlines administrative tasks, allowing teachers to focus more on individual student needs. Embracing technology helps educators stay relevant, ultimately improving classroom efficiency and effectiveness.

5.4. Harnessing the Potential of AI to Improve Educational Outcomes

AI enhances traditional teaching roles by providing personalized learning experiences. AI algorithms generate personalized learning plans that cater to individual strengths and weaknesses, improving academic performance and engagement (Sorour et al., 2024). AI assists teachers in providing personalized feedback, allowing students to progress at their own pace. Interactive lessons and real-time feedback facilitated by AI improve educational outcomes (Alsaleh, 2020).

AI streamlines administrative tasks and provides valuable data analytics for educators. Adaptive learning algorithms tailor instruction based on individual needs, making the learning process more efficient. By harnessing AI's potential, teachers can optimize their strategies, meet diverse student needs, and focus on meaningful interactions and critical thinking skills.

In conclusion, AI integration in education offers significant benefits, including personalized learning experiences, real-time feedback, streamlined administrative tasks, and improved outcomes. Adapting to these changes and addressing potential challenges enhances the learning environment and supports students' academic success.

6. Conclusions

In conclusion, the integration of AI in traditional teaching roles has the potential to revolutionize the education system and enhance the learning experience for both students and teachers. This advancement can lead to more personalized learning opportunities and improved efficiency in educational practices. AI integration can help teachers adapt to the changing landscape of education and enhance student engagement. By providing personalized learning experiences tailored to individual student needs, AI can assist teachers in increasing student achievement and retention.

Furthermore, AI can streamline administrative tasks and provide valuable insights into student performance, improving efficiency and effectiveness in the classroom. This integration has the potential to enhance learning experiences, ultimately leading to better educational outcomes. Additionally, AI can assist teachers in grading assignments, providing real-time feedback, and personalizing instruction, catering to individual student needs and abilities. By leveraging AI, teachers can focus more on individual student progress and development, creating a more engaging and interactive learning environment.

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