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Comprehensive analysis of human and AI task allocation in the education sector: Defining futuristic roles and responsibilities

Rashmi Mishra * and Deepika Varshney

University of Technology and Applied Science, Al Musanna, Oman.

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Abstract

This research explores the integration of AI chatbots in higher education, examining their impact on teaching practices, learning outcomes and student engagement. AI's ability to predict and adapt offers transformative potential for educational environments, shifting skill demands and enhancing accessibility. Using the Technological Pedagogical Content Knowledge (TPACK) framework, we assess the integration of AI tools by educators. At the same time, the Technology Acceptance Model (TAM) gauges teacher's perceptions and Constructivist Learning Theory (CLT) explores AI's support for interactive, student-centered learning. Our developed framework includes the roles and responsibilities of human educators and AI chatbots, strategies for maximizing educational benefits and addressing challenges and best practices for fostering human-AI partnerships and promoting inclusivity. The findings reveal that AI chatbots can significantly reduce administrative burdens on educators, offer personalized learning experiences, and enhance real-time feedback. This study underscores the importance of teacher training and ethical considerations in AI integration. Ultimately, we aim to contribute to the effective integration of AI in education, promoting a balanced synergy between human and technological efforts to enhance educational practices.

Keywords: Artificial intelligence (AI); AI chatbots; Constructivist Learning Theory (CLT); Conversational agent chatbots; Human-AI partnerships; Student-centered learning; Technology Acceptance Model (TAM); Technological Pedagogical Content Knowledge (TPACK).

1. Introduction

Artificial Intelligence (AI) has significantly transformed organizations, societies and individuals by providing systematic reasoning capabilities based on inputs and learning through outcome differences. AI's ability to predict and adapt to environmental changes underscores its potential across various domains, including education. With the advent of AI, the traditional skill of collecting relevant information has become less critical, while the ability to comprehend vast volumes of information has gained importance. This shift highlights the broader impact of AI on human skills and its integration into various aspects of life. AI applications can address challenges arising from a lack of data-driven or technological culture by making technology accessible and comprehensible to non-experts. As a coach, AI supports individuals in achieving goals such as health-related ambitions or skills development. For example, AI-based coaches collaborate with users in planning, monitoring and controlling their thoughts, feelings and actions, thus fostering new practices and skills. Through a mobile app, Apple INC. introduced a feature in its phones to manage and track mood throughout the day, emphasizing the importance of mental well-being as part of overall health. Learning is not confined to traditional settings like classrooms; it extends to employee training and leadership development, which will be planned and integrated with new technologies that are used innovatively. This necessitates a rethinking of learning design to develop critical soft skills such as critical thinking, complex problem-solving, creativity and decision-making. Incorporating new digital resources into various learning environments, including classrooms, meeting rooms and

* Corresponding author: Rashmi Mishra

industry settings, is essential. This research aims to evaluate the role of AI chatbots in higher education and understand their impact on the educational environment and human-technology synergy. By exploring the transformative effects of AI chatbots on teaching practices, learning outcomes and student engagement, this study assesses how well teachers integrate AI tools using the TPACK framework. The research employs the qualitative data methodology for Technology Acceptance Model (TAM) to examine teacher's perceptions of AI chatbots and uses Constructivist Learning Theory to explore how these tools support interactive student-centered learning. The study provides a framework for balancing human and technological efforts, contributing to effective AI integration and enhancing educational practices.

1.1. Research Question

- What are AI chatbot's educational benefits and capabilities in higher education?
- How can a framework for using AI chatbots in education be developed to effectively balance human and AI roles?
- What are the pedagogical goals and contexts for using AI chatbots and how do they address the needs of specific learner groups?
- How can educators collaborate to integrate AI technologies, enhancing human-AI partnerships in education?

2. Research Methods

This research employs a systematic literature review to explore task allocation between humans and AI in education, aiming to define future roles and responsibilities. The interdisciplinary approach incorporates computer science, education, linguistics, psychology and business informatics insights, leading to complementary research procedures and evaluation methods [1]. The methodology involves reviewing peer-reviewed journals, conference proceedings and academic databases to identify key themes and gaps. Qualitative and quantitative data are collected from secondary sources, focusing on administrative tasks, instructional support, personalized learning and student engagement. The data is analysed to determine effective task allocation strategies, categorizing tasks based on their suitability for AI or human execution.

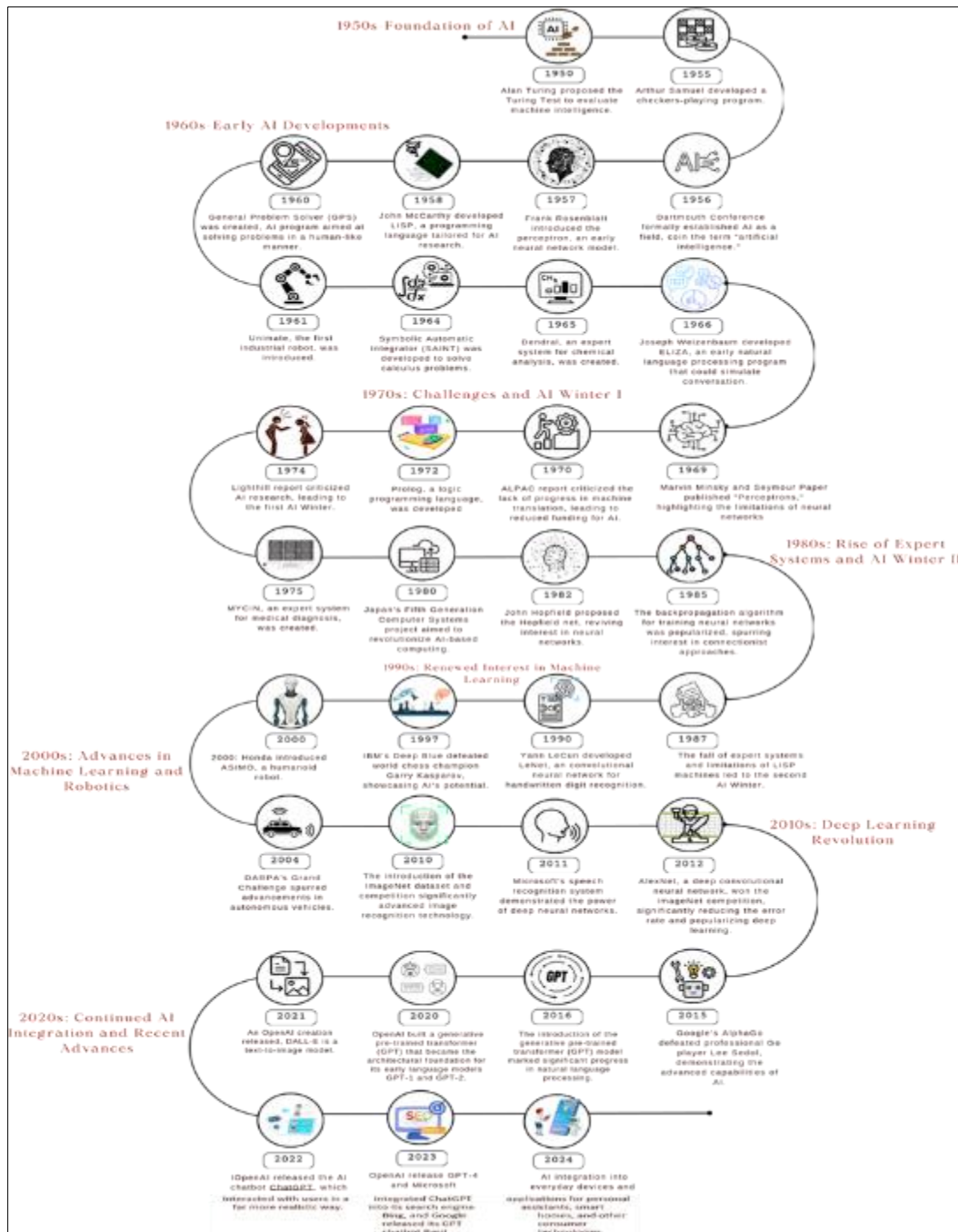
3. Literature review

RQ1: What are AI chatbot's educational benefits and capabilities in higher education?

3.1. History of AI

Artificial intelligence (AI) has entered all major domains successfully because it can act autonomously without continuous human intervention. In the 1950s, foundational developments included Alan Turing's Test and the Dartmouth Conference, where the term "artificial intelligence" was coined to mark the significant milestones in the history of Artificial Intelligence (AI). The 1960s saw early AI advancements with projects like the Unimate industrial robot and the ELIZA chatbot [2]. However, the 1970s brought challenges, leading to the first AI Winter due to reports criticizing AI's progress. The 1980s experienced a resurgence with expert systems and the revival of neural networks, although the decade ended with another AI Winter due to limitations in these systems. The 1990s renewed interest in AI with the development of LeNet for digit recognition and IBM's Deep Blue defeating chess champion Garry Kasparov. The 2000s saw advances in robotics and autonomous vehicles, exemplified by Honda's ASIMO and DARPA's Grand Challenge [3]. The 2010s marked a profound learning revolution, with significant breakthroughs such as AlexNet's success in image recognition and AlphaGo's victory over a professional Go player [4].

In the 2020s, AI integration into everyday life continued, with significant advancements in various applications. OpenAI built a generative pre-trained transformer (GPT) that laid the architectural foundation for its early language models, GPT-1 and GPT-2. In 2021, OpenAI released DALL-E, a text-to-image model, demonstrating the creative potential of AI. By 2022, OpenAI launched ChatGPT, an AI chatbot that interacted with users in a remarkably realistic way, showcasing the sophistication of modern AI models. The year 2023 marked a milestone for generative AI with the release of GPT-4 by OpenAI, enhancing the capabilities of its predecessors. Additionally, Microsoft integrated ChatGPT into its Bing search engine and Google introduced its GPT-based chatbot, Bard. By 2024, AI had become even more pervasive in consumer technologies, with advancements in personal assistants, smart homes and various other applications. Research focused on making AI more transparent and interpretable to ensure trust and safety in AI systems. This timeline highlights the significant milestones and shifts in AI development, illustrating breakthroughs and challenges over the decades [5].



Source: Made by Author's

Figure 1 Historical evolution of AI

3.2. Theoretical Framework

This research is based on the three complementary theoretical frameworks; Technological Pedagogical Content Knowledge (TPACK), the Technology Acceptance Model (TAM) and Constructivist Learning Theory. The TPACK framework, developed by author Mishra P. and Koehler MJ [6], emphasizes the intersection of technology, pedagogy and content knowledge in teaching. It posits that effective teaching with technology requires a deep understanding of how these domains interact. In AI, TPACK assesses how healthy educators integrate AI tools into their teaching strategies, ensuring that technology enhances learning. This framework highlights the skills and knowledge teachers need to successfully incorporate AI into their instructional practices. The Technology Acceptance Model (TAM), proposed by author Venkatesh V, Davis FD [7,8] examines the factors influencing an individual's acceptance and use of technology. It identifies usefulness and ease of use as critical determinants of technology adoption. Applying TAM to the

current study helps evaluate teacher's perceptions of AI technologies and understand the factors driving their acceptance and intention to use AI in educational settings. This model will identify the potential barriers to AI adoption and suggest strategies to increase teacher's willingness to integrate AI into their classrooms. Constructivist Learning Theory, rooted in the work of Hein GE Bada SO, Olusegun S. [9,10], emphasizes active, student-centered learning where knowledge is constructed through interaction and engagement. In the context of AI, this theory explores how AI tools can support constructivist learning environments. AI has the potential to facilitate personalized learning experiences, provide real-time feedback and create interactive activities that promote deeper understanding and engagement. By aligning AI applications with constructivist principles, this research aims to enhance the effectiveness of AI in supporting active and meaningful learning experiences. These frameworks guide how AI can effectively support and improve educational practices, providing a comprehensive approach to understand and optimize the allocation of tasks between humans and AI in the education sector.

3.3. The digital transformation of the academics and institutions

3.3.1. The use of the AI in the education sector

Artificial Intelligence (AI) has revolutionized academia and industry, dramatically changing our daily lives over the past decade. This new era of AI, though still evolving, faces significant bottlenecks despite its vast advancements [11]. AI chatbots can be implemented as pop-up virtual assistants on websites, integrated into mobile applications via SMS, or as standalone audio-based devices for home use. In education, AI chatbots are being developed and deployed to answer queries about educational programs and university services, assist students in navigating e-learning resources, increase engagement with curricula and provide instant feedback. These applications aim to improve learning outcomes and enhance the student experience [12]. The integration of chatbots in educational settings supports various administrative and academic tasks [13]. Studies show that chatbots manage administrative functions, assist in navigating library resources, evaluate services and support teachers with routine tasks. Chatbots provide information, learning support and personal monitoring for students, helping save time, reduce stress and enhance learning efficiency. However, acceptance, effectiveness and data privacy concerns persist. Since its launch on November 30, 2022, OpenAI's ChatGPT has attracted significant attention in academia and industry [14] capable of responding effectively to a wide range of human questions, ChatGPT provides fluent and comprehensive answers that surpass previous public chatbots in terms of security and usefulness. While many are intrigued by ChatGPT's capabilities and proximity to human expertise, concerns about the potential negative impacts of large language models (LLMs) like ChatGPT, including fake news, plagiarism and social security issues, are emerging. This AI chatbot uses machine learning and natural language processing to interact with users, generating written text responses for various tasks. This technology has the potential to transform classroom experiences and enhance student outcomes.

3.3.2. The role of AI in enhancing educational support and administration

AI models can provide personalized student support through individual or team support, automate administrative tasks and support language learners [15]. In higher education, low teacher-student ratios often hinder immediate and interactive student support. Chatbots, used, offer a potential solution. The study found that chatbots could facilitate responsive, interactive and confidential learning. A follow-up study with attitude and intentions of students using a chatbot to teach demonstrated that chatbots can be engaging and effective educational tools to enhance inclusive learning in higher education. AI has also been employed to automate administrative tasks, such as grading assessments. A study of McNamara DS, Crossley SA, Roscoe R [16] demonstrated that an AI model could grade essays with performance comparable to human graders. Additionally, AI has proven valuable in supporting language learners through machine translation, natural language processing and neural machine translation to assist English language learners in a classroom setting with student essays, providing feedback on grammar and organizing the sentences. AI chatbots can reduce the workload of educators, administrators and university management by supporting students. This allows professionals to focus more on pedagogical research, curriculum development and innovation in higher education.

3.3.3. The use of the chatbots in education: educational chatbots (EC)

In artificial intelligence, hybrid and adaptive methods increasingly make systems more lucrative and user-friendly. A notable development is integrating natural language processing (NLP) with intelligent systems, enabling these systems to learn autonomously and update their knowledge by reading electronic articles online. Users can interact with these systems as they would with another human, often called internet answering engines. Many applications, such as chatbots, have been introduced to provide automatic replies or entertainment. These chatbots use methods like pattern matching, NLP and data mining. They match user input with patterns in their knowledge base, compiled from various sources [17]. Automated conversational agents (CA) [42] are widely used in customer service [4], becoming a common trend. Their use has expanded due to affordability, cost, development options, and integration with social networks and

mobile instant messaging apps like WhatsApp, Line, Facebook, and Telegram [18]. These mobile-based chatbots are widely accepted and support collaborative learning [19], multimodal communication [20], real-time feedback [21], personalized learning [22], scalability and interactivity, enhancing knowledge creation and dissemination [23,24,25]. However, ensuring continuous instructor engagement in high-demand activities remains challenging. Chatbots can address this by automatically supporting learning communication and interactions, even for large student numbers [26]. Although chatbots are widely utilized in business areas like customer support, their adoption in the education sector is still in its early stages. In education, chatbots can serve as teachers, tutors, conversational partners, learning analysts, team members, support assistants, or recommendation systems. These roles allow chatbots to improve learning by meeting essential requirements and success factors. The scalability and adaptability of conversational AI offer personalized learning support for all students and encourage collaboration, enhancing educational equality. According to the study [27], higher education increasingly uses chatbots to provide efficient student services and enhance engagement. These chatbots can be categorized as teaching-oriented or service-oriented. Teaching-oriented chatbots, like Coding or math Tutor, help with tasks such as coding assessments, while others, like Bookbuddy and Clive Chatbot, support language learning [28]. In education, chatbots might have different user interfaces or relate to learning management systems (LMS). What distinguishes chatbots used in education from those in other specializations is most likely the integration or self-storage of learning objects and learning paths [1]. Sometimes Conversational chatbots function as mediators between student's loneliness and isolation which lead to lower engagement and greater dropout rates, Studente S, Ellis S, Garivaldis SF [29] study shows this is most common among international students who are away from their homes.

4. Results and discussion

RQ3: What are the pedagogical goals and contexts for using AI chatbots and how do they address the needs of specific learner groups?

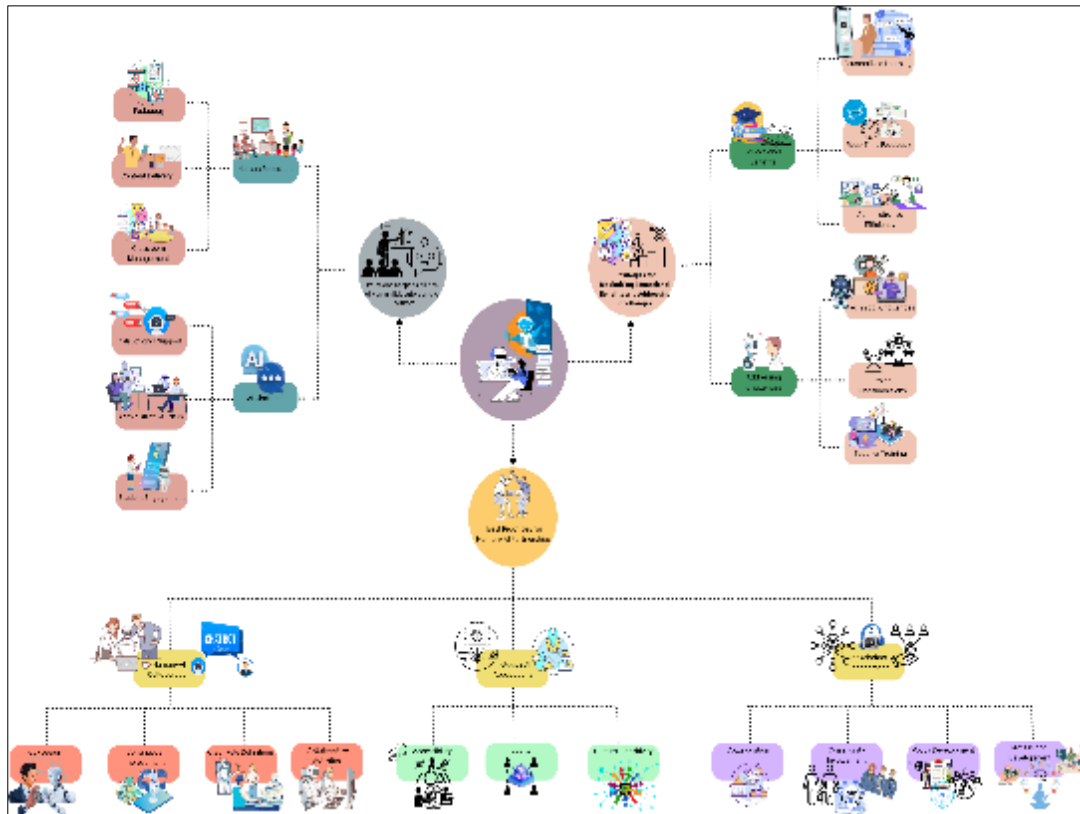
4.1. Opportunities and risks of AI chatbots in higher education

AI tools have the potential to significantly enhance student learning by facilitating rapid knowledge assimilation and providing personalized support. However, significant concerns exist about their misuse in writing assessments and dissertations, which can lead to plagiarism and academic integrity issues [45]. This misuse can hinder the development of critical thinking, problem-solving and creativity skills, which are essential for professional and personal success [30,31]. Another big problem is the digital divide [42]. Regardless of financial class, language, color, geography, physical limitations, cultural background, gender, or other characteristics traditionally linked to injustices, it is imperative to guarantee equitable access to cutting-edge technologies and learning tools for all children. One ongoing concern is how generative AI will affect tests and evaluations. Ensuring that student submissions are their work is increasingly difficult with the availability of tools like ChatGPT, which can generate content that evades current plagiarism detection software. This necessitates more personalized assessments that draw on student's unique experiences and abilities [32]. Traditional anti-plagiarism tools like Turnitin are inadequate for detecting AI-generated content, highlighting the need for new strategies to ensure academic integrity [45].

Even with these obstacles, ChatGPT and other AI technologies have much potential to improve education. They can help with language acquisition, automate administrative chores, offer individualized assignment feedback and give basic educational resources. AI can also improve online education by enabling personalized help and enhancing learning activities participatory and engaging nature [33].

However, integrating AI into education raises ethical concerns, such as the potential replacement of human teachers and the impact on marginalized groups such as low-income populations and rural communities. Developing guidelines and policies to ensure the ethical use of AI tools in education is crucial [41]. AI's lack of transparency and the potential for generating biased or inaccurate outputs further complicate its integration [34,35]. The opaque nature of AI decision-making processes, often called a "black box," limits the ability to understand how conclusions are reached, undermining trust in AI-generated content.

On the positive side, conversational agents (CA) chatbots can support the development of inclusive learning environments for students with a range of needs, such as those with disabilities, who live in different environments, or who have different learning styles. However, this technology must be modified to ensure it efficiently fulfills educational purposes [36,37]. Teachers could refine their exam questions to require more complex thought, draw on current and local information and make connections between knowledge and personal experiences. Alternative formats such as podcasts, peer feedback, debates and interviews can provide more authentic assessments. Asking students to rate and comment on an AI-generated answer or compare it with their work, can also develop critical thinking skills [4].



Source: Made by Author's

Figure 2 Model for Integrating AI Chatbots in Education

5. Conclusion

We need to shift our attention from fighting with emerging technology to embracing it; there is no doubt that there are concerns and worries among people about losing their jobs due to automation, but thinking about the scenario is the same as what happened during the Industrial Revolution. People have learned how to operate a machine, which means a new job opportunity has emerged, and the nature of the job has changed. We have looked at the important effects of open-source AI technologies like ChatGPT in the context of education and found ways to work with and improve productivity with these tools.

To prepare students for the future, we must teach them how to interact with chatbots and artificial intelligence. However, we must warn the students that this bot relies significantly on its data and algorithms and is not connected to the Internet; if these factors are erroneous, the tool's output could be misleading or inaccurate. Therefore, before accepting the answers from the bot as legitimate answers to their queries or assignments, students should carefully double-check them and consult other sources. Opinions regarding using and identifying language model-generated text may vary across students and teachers. For this, the why question should come first rather than the how. Numerous tools, such as phone numbers, Wikipedia, GPS and calculators, are integrated into systems and do not require memorization. This made us think about why we teach our kids particular knowledge and abilities and what talents they need in the current scenario. They must be able to evaluate and critically assess the automatically generated responses. People must be taught to use these instruments to their full potential without stumbling across drawbacks. Because of the growing popularity of smartphones and messaging apps, literature studies have explored the growing application of chatbots in education. Experimentation is required to grasp the implications fully. Chatbots promote collaborative learning, improve engagement in the classroom, give information and ease communication. As a result, students embrace chatbots highly, emphasizing their capacity to provide flexible learning schedules and environments, allow for the repetition of tasks and provide access to various information types.

Suggestion

- RQ2: How can a framework for using AI chatbots in education be developed to balance human and AI roles effectively?

With the growing prevalence of large course sizes and online learning scenarios, it is crucial to enhance visible learning and individual support for learners provided by teachers or human tutors. AI chatbots can effectively support Learning theories and empirical studies emphasize the significance of learner-centered approaches, a culture of inquiry, continuous feedback and formative assessments. These educational practices provide continuous feedback and monitoring, enabling a more personalized learning experience. Integrating chatbots into the learning environment can help to develop critical competencies such as critical thinking, decision-making, clear communication, collaboration and technological awareness, aligning with international frameworks for 21st-century learning [39]. This integration necessitates thoughtful planning and a commitment to leveraging AI's capabilities to enhance educational outcomes. The collaboration between humans and AI in higher education is now a foreseeable future. Therefore, securing funding and implementing policy changes are essential to develop, test and apply sophisticated computational tools that further enhance student learning. Emerging roles for chatbots, such as academic advisors, career counsellors, mentors and research assistants, highlight the need for ongoing research and development to integrate these tools into educational institutions [Click or tap here to enter text.](#)

- Preparing Educators for AI-Enhanced Teaching: Insights from the TPACK Framework

To effectively integrate AI into education, teachers must develop skills and knowledge across the three key areas outlined in the TPACK framework [6]: Technological, Pedagogical and Content Knowledge. Here is a breakdown of what teachers need to train and become adaptable to AI in education. First, teachers need to enhance their Technological Knowledge (TK). This includes understanding various AI tools and educational applications, such as chatbots and intelligent tutoring systems. Teachers should be proficient in integrating these technologies seamlessly into the classroom, ensuring they can set up and manage AI tools effectively. Additionally, digital literacy is crucial, encompassing learning management systems, virtual classrooms and online resources. Teachers should also be able to analyze and interpret data provided by AI systems to make informed instructional decisions and personalize learning for their students.

Next, teachers must build their Pedagogical Knowledge (PK) . This involves understanding diverse teaching strategies that can be enhanced by AI, such as personalized learning, flipped classrooms, and blended learning models. Effective classroom management strategies are essential to ensure that technology enhances rather than disrupts learning. Teachers should also be familiar with using AI for formative and summative assessments, providing immediate feedback and adapting instruction based on data. Ethical considerations, including data privacy, security and addressing biases in AI algorithms, are also critical .

Regarding Content Knowledge (CK) teachers need a deep understanding of their subject matter to leverage AI tools that effectively provide content-specific support. This includes developing and adapting curricula integrating AI tools, ensuring they align with learning objectives and standards. Teachers should also be familiar with AI applications relevant to their subjects, such as language learning chatbots for language teachers or AI-driven simulations for science educators.

Furthermore, Pedagogical Content Knowledge (PCK) is vital. Teachers should have strategies for teaching specific content using AI and understand how AI can support the teaching and learning of subjects. They should be skilled in designing lessons and learning activities incorporating AI tools to enhance understanding and engagement with the content.

Technological Pedagogical Knowledge (TPK) involves understanding how to use AI tools to enhance pedagogical practices. This includes using AI for differentiated instruction or facilitating collaborative learning. Teachers must be adaptable and continually update their teaching methods to integrate new AI technologies effectively.

Technological Content Knowledge (TCK) requires familiarity with AI tools that provide content-specific support and the skills to use AI to deliver content innovatively, such as through virtual labs, AI simulations, or interactive AI-driven tutorials.

Finally, Technological Pedagogical Content Knowledge (TPACK) represents a comprehensive integration of technological, pedagogical and content knowledge. Teachers should aim to create a cohesive and effective learning

experience using AI. Ongoing professional development is essential to stay updated with the latest AI technologies and their applications in education, ensuring continuous improvement and adaptation.

Professional development programs should include workshops and seminars on AI tools, integration strategies and ethical considerations to support teachers in developing these skills [45]. Online courses and webinars can offer flexible learning opportunities on AI technologies and their educational applications. Collaborative learning opportunities can encourage teachers to share best practices and experiences in integrating AI. Hands-on training can provide practical experience with AI tools in actual or simulated classroom settings. Mentorship and coaching can offer support from experienced educators who have successfully integrated AI into their teaching. By focusing on these areas, teachers can become proficient in using AI technologies to enhance their teaching and adapt to the evolving educational landscape.

- Framework Model for Integrating AI Chatbots in Education

RQ4: How can educators collaborate to integrate AI technologies, enhancing human-AI partnerships in education?

The framework model for integrating AI chatbots in education consists of three main sections: Roles and Responsibilities of Human Educators and AI Chatbots, Strategies for Maximizing Educational Benefits and Addressing Challenges and Best Practices for Fostering Successful Human Partnerships and Promoting Inclusive AI Applications.

- Roles and Responsibilities of Human Educators and AI Chatbots

Human educators play a crucial role in pedagogy by designing and delivering instructional content, fostering critical thinking and problem-solving skills and providing emotional and motivational support. They are also responsible for content delivery, which includes creating and curating course materials, conducting assessments and offering personalized feedback. Additionally, they manage classroom dynamics, address behavioural issues and facilitate group activities and discussions.

AI chatbots, on the other hand, assist with instructional support by delivering content, providing automated feedback and facilitating personalized learning experiences. They handle administrative tasks such as attendance tracking, scheduling and grading, thereby reducing the administrative burden on educators. Furthermore, AI chatbots enhance student engagement through interactive and adaptive learning experiences, offering real-time assistance and monitoring student progress.

- Strategies for Maximizing Educational Benefits and Addressing Challenges

To maximize the educational benefits of AI chatbots, it is essential to focus on personalized learning, where chatbots tailor experiences to individual student needs and learning styles. AI's real-time feedback can provide instant insights on assignments and assessments, while administrative efficiency is achieved by automating routine tasks.

Addressing challenges involves ensuring reliable technology infrastructure and dealing with AI chatbot integration and maintenance issues. Ethical considerations are paramount, including data privacy and security, addressing biases in AI algorithms and maintaining transparency. Additionally, providing professional development and training for educators is crucial to equipping them with the skills needed to use AI chatbots effectively in their teaching practices.

- Best Practices for Fostering Successful Human-AI Partnerships and Promoting Inclusive AI Applications

Successful human-AI collaboration involves co-design, where educators participate in designing and developing AI chatbots to ensure they meet educational needs. Continuous improvement is achieved by regularly evaluating and updating AI functionalities based on feedback from educators and students. Clear role definitions and collaborative activities between human educators and AI chatbots are essential for enhancing learning outcomes.

Inclusive AI applications focus on accessibility, ensuring AI chatbots are available to all students, including those with disabilities. Equity involves equal access to AI tools and resources, while cultural sensitivity ensures chatbots are inclusive of diverse backgrounds. Implementing mechanisms for continuous feedback from users is also crucial for improving inclusivity.

Stakeholder engagement emphasizes collaboration among educators, administrators, technologists, and policymakers to support AI chatbot integration. Engaging the wider educational community, including parents and guardians, helps them understand and support using AI chatbots. It is also essential to develop guidelines and policies for ethical and

effective AI integration and provide ongoing professional development opportunities for educators Click or tap here to enter text.. By structuring the framework in this way, the model systematically addresses the roles and responsibilities of human educators and AI chatbots, implements strategies to maximize benefits and address challenges and promotes best practices for successful human-AI partnerships and inclusive AI applications in education.

Future research

Future research should focus on identifying the specific roles and responsibilities of humans versus AI in education, optimizing their collaboration for the personalized tutor of the learner. Additionally, studies should develop innovative methods for integrating AI into pedagogy, enhancing teaching and learning processes. Investigating AI's social impact and ethical concerns in education are crucial, including data privacy, bias and equitable access. Further studies in these areas will ensure a well-rounded and efficient integration of AI in educational environments, promoting a technically advanced and ethically responsible atmosphere.

Compliance with ethical standards

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Disclosure of Conflict of Interest

The authors hereby declare no conflict of interest.

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