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Chatbots and AI in Education (AIEd) tools: The good, the bad, and the ugly

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Abstract

As the application of Artificial Intelligence (AI) continues to permeate various sectors, the educational landscape is no exception. Several AI in education (AIEd) applications, like chatbots, present an intriguing array of opportunities and challenges. This paper provides an in-depth exploration of the use and role of AI in education and research, focusing on the benefits (the good) and potential pitfalls (the bad and ugly) associated with the deployment of chatbots and other AIEDs. The opportunities explored include personalised learning, facilitation of administrative tasks, enriched research capabilities, and the provision of a platform for collaboration. These advantages are balanced against potential downsides, such as job displacement, misinformation, plagiarism, and the erosion of human connection. Ethical considerations, particularly concerning data privacy, bias reinforcement, and the digital divide, are also examined. Conclusions drawn from this analysis stress the importance of striking a balance between AI capabilities and human elements in education, as well as developing comprehensive ethical frameworks for AI deployment in educational contexts.

Keywords: Artificial Intelligence; AI in Education (AIEd); chatbots; data security; education; ethics; personalised learning; privacy; research.

Introduction

During the COVID-19 pandemic, the use of technology in education became a lifeline for many institutions across the globe. Since then, there has been a significant growth in the use and application of technology in education. Rapidly expanding today is a new era of education and research aided by artificial intelligence chatbots following the launch of OpenAI's ChatGPT in November 2022. They are infiltrating the education sector, reshaping traditional approaches to teaching and learning. One of AI's potent implementations in this domain is the use of AI chatbots employed to interact with users, deliver information, clarify doubts, and facilitate a host of other learning-related tasks (Adiguzel et al., 2023; Ifelebuegu, 2023; Pinzolits, 2024).

Before delving into the specifics of AI and its educational implications, it is crucial to understand what chatbots are and how they work. A chatbot is an artificial intelligence program and a human-computer interaction model (Adamopoulou & Moussiades, 2020; Bansal & Khan, 2018). In simpler language, chatbots are software that imitates human-like communication with the user in a chat. They are built upon the transformer-based language model architecture. They can generate a text that closely mirrors human language by predicting the likelihood of a word following a given set of words. They are trained on a diverse range of internet text, allowing them to exhibit broad, context-aware capabilities. Advanced natural language processing algorithms power them and they have the capacity to simulate human-like interactions, making them a valuable tool for various educational and research endeavors. For instance, in education, they can be used to facilitate personalised learning, provide immediate feedback, and manage administrative duties, among other things (Chen et al., 2023; Ifelebuegu, 2023; Popenici, 2023). They can assist with data acquisition, participant interaction, and more in research. Several chatbots are currently employed for literature search, review, content analysis, scientific writing, and revision.

Despite the optimism, the use of chatbots engenders a number of concerns. Potential challenges include issues of privacy and data security, ethical dilemmas, and the risk of over-reliance on technology. Therefore, it is essential to strike a balance between leveraging the potential of this technology and mitigating its drawbacks (Crawford et al., 2023). This study will investigate the good, the bad and the ugly implications of AI and chatbots in education and also

highlight the future perspectives. The study will employ an exploratory research strategy and qualitative research methodology to acquire data for analysis and expert interpretation. The research findings will provide insights, perspectives into the applications of AI chatbots in teaching, learning and research, as well as potential developments and ethical challenges.

Methods

This study is characterised as exploratory and interpretive in nature, aligning with the philosophy of interpretivism. This philosophical approach posits that human behaviour and meaning are products of social construction and subjectivity. It asserts that knowledge and understanding can only be achieved through interpretation and the creation of meaning (Creswell, 2014; Kooli, 2023). In this research method, the investigator strives to comprehend the subjective experiences and viewpoints surrounding the observed phenomena, along with their associated meanings and interpretations. The central focus lies in the social construction of reality, with the researcher aiming to grasp the world through the lens of the phenomena observed (Creswell, 2014).

The study relies exclusively on qualitative data. A thorough analysis of collected secondary and qualitative data is conducted using a thematic analytical framework. This framework is employed to derive themes that align with the study's objectives and inquiries. Given the continuous advancements in artificial intelligence tools and chatbots, this study aims to provide an in-depth exploration of the multiple applications of AI chatbots in education while also addressing the challenges and emerging ethical dilemmas. As such, the primary research approach adopted is exploratory, geared towards investigating the novel phenomenon of using chatbots and other AI educational tools in both teaching, learning and research contexts. The outcomes of this research endeavor are expected to offer valuable insights, prospective viewpoints, and potential developments, all while contributing to the ongoing discourse surrounding the ethical dilemma associated with the transformation of education and research through AI systems and chatbots.

The research procedure followed three primary steps, as previously outlined by Kuhail et al. (2023), which include (1) establishing the review protocol, encompassing the research queries, the approach for addressing them, the search strategy, and the criteria for inclusion and exclusion; (2) executing the study by hand-picking relevant articles, evaluating their quality, and amalgamating the outcomes; and (3) presenting the discovered insights.

Research questions

To address the research objectives, four research questions were developed. The first research question (RQ1) investigates the various existing and emerging AI tools and chatbots used in teaching, learning and research. The second research question (RQ2) explores the beneficial applications of chatbots in education and research (the good). The third research question (RQ3) investigates the negative impacts of AI use in teaching and research (the bad). The fourth research question (RQ4) evaluates the potential ethical challenges associated with the use of AI and chatbots in education and research (the ugly).

Literature search strategy and data collections

An exhaustive and methodical examination of electronic databases was performed. Google Scholar, ScienceDirect and Scopus were selected due to their comprehensive coverage of educational and AI-related literature (Pinzolits, 2024; Tlili et al., 2022, 2023b). Moreover, specialised scientific journals in the field of pedagogy and artificial intelligence were also reviewed. These include the Journal of Applied Learning and Teaching, International Journal of Artificial Intelligence in Education, Education and Information Technologies, Computers & Education, Artificial Intelligence Review, Smart Learning Environments, etc. These were chosen due to their focus on AI and education or special editions with a focus on AI tools and pedagogy. The search time ranges for the articles is from 2018 to 2023. Also, to ensure state-of-the-art information on AI and pedagogy, online sources and blogs were reviewed. Only articles published in English were included, and those related to AI tools and chatbots in education and research.

The keywords used during the literature search include "AIEd", "chatbots in education", "AI tools for education", "ChatGPT in education", "AI-assisted learning", "personalised learning" and "learning technologies". The listed keywords were used individually and in combination during the search to help maximise the spread and depth of the results (Pinzolits, 2024).

Limitations

In this paper, the authors' expert knowledge in education technologies and pedagogy enters into play, thereby potentially influencing their perspectives. The methodology employed was intended to ensure the most exhaustive and objective review possible while recognising the inherent limitations. Some relevant studies may have been missed despite the exhaustive search strategy, particularly those published in languages other than English or in less accessible databases.

Results and discussion

AI in Education (AIEd) tools

The first research question (RQ1) examines the various AI tools and chatbots used in teaching, learning, and research, both existing and emergent. AI tools and chatbots are already changing the way teaching and research are done in higher education (Calonge et al., 2023; Ifelebuegu, 2023; Pinzolits, 2024). AIEd applications like chatbots have the potential to improve the teaching, learning and research processes in higher education (Kooli, 2023). For example, chatbots can

assist learners, teachers, researchers and administrators alike to enhance their efficiency and effectiveness (Kooli 2023; Kuhail et al., 2023; Pinzolits 2024). Baker and Smith (2019) classified the various AIEds into three categories, namely learner-facing (LF), teacher-facing (TF) and system-facing (SF) tools. Based on the literature review, the authors propose a fourth category called research-facing (RF) AIEDs. Table 1 summarises some of the general, as well as institution-specific chatbots and AIEd tools that find applications in various educational activities.

Table 1. Commonly used chatbots and other AIEds tools.

Generally Available AI Tools and Chatbots		
AI Tools and Chatbots	**Use Case and classification**	**Link/Organisation**
AI-Writer	Generates articles from a simple headline RF, LF, TF	https://ai-writer.com/
Bard	Bard is an AI powered tool that allows creation and collaboration of ideas, boost productivity and bring your ideas to life. Its potential ranges from creating/responding to emails/ interview questions, designing briefs to planning. LF, TF, RF, SF	https://bard.google.com/
Bing Chat	An AI-driven chatbot for seamless communication allowing users to issue requests and receive actionable insights and provide guide to planning. LF, TF, RF, SF	https://www.bing.com/?/ai
Botsify	Allows educators to create their own chatbots for teaching. Teachers can design chatbots for their courses, enabling personalised learning experiences for students. LF, TF, RF, SF	https://botsify.com/
ChatGPT	A game-changing AI-powered tool for several applications including personalised learning, literature review, study support and writing LF, TF, RF, SF	https://chat.openai.com/ for ChatGPT 3.5 and various versions of GPT-4
Chat PDF	Assists researchers in reading and comprehending complex academic papers. Chat PDF employs artificial intelligence to provide a conversational interface, allowing researchers to pose queries about the paper and receive real-time responses. A chat-based interface facilitates the retrieval of information and answers from PDF files. LF, TF, RF, SF	https://www.chatpdf.com/
Claude	Offers vast data processing capabilities, creative writing and assistance in code generation and debugging. LF, TF, RF, SF	https://claude.ai/login
Consensus	Consensus is an AI-powered search engine that also provides answers supported by scientific evidence. It employs AI to extract key findings from peer-reviewed sources and present them in an easily consumable format. RF, LF, TF	https://consensus.app/
Copy.ai	Generates creative writing samples used as examples of various writing styles. LF, TF, RF, SF	https://www.copy.ai/
Duolingo	Web-based and mobile AI-powered platform that provides a gamified approach to language learning, making it engaging and accessible for users of all ages. LF	https://www.duolingo.com/
Ebbot by Learnify	Ebbot helps with administrative tasks in educational institutions. It can answer common questions about course details, schedules, and other relevant information SF	Learnify https://ebbot.com/
Elicit	Elicit is a freely available AI-powered research assistant that employs language models to locate pertinent academic papers, even in the absence of an exact keyword match. In addition, it can summarise and extract key information, assist with a variety of research duties, and integrate with citation managers. LF, RF	
Ernie	Integrates factual information from various sources into pre-trained language models. Allows dialogues, content creation, as well as ability to reason with knowledge and generate multiple modes of output. LF, TF, RF, SF	Baidu https://yiyan.baidu.com/welcome
Essay Writer	Guides students in structuring their essays logically and suggests areas for improvement. RF, LF, TF	https://www.the-good-ai.com/ https://collegeessay.org/ai-essaywriter
Jasper AI	Tool to write and generate images using AI RF, LF, TF, SF	https://www.jasper.ai/art
Jenni AI	Assists students in brainstorming and organizing thoughts prior to writing. LF, TF, RF	https://jenni.ai/
Laser AI	Laser AI is an application that streamlines systematic reviews, specifically Living Systematic Reviews. Its semiautomated data extraction module reduces extraction time without sacrificing quality. RF, LF	https://laser.ai/
Lateral AI	Lateral is an app propelled by artificial intelligence that offers text search, organisation of findings, simple sharing, and document viewing. LF, RF	Lateralio https://ai-finder.net/ai/lateralai
Ludwig	This chatbot helps students and writers with the English language. Users can input sentences to get contextual examples from reliable sources, aiding in understanding and usage. LF, TF, RF, SF	Linux Foundation AI & Data https://ludwig.ai/latest/
PaperPal	An AI tool that assists in the editing of academic texts in line with technical and language quality standards. It uses AI to ensure clarity, coherence, and adherence to academic writing standards. Performs grammar checks and provides real-time corrections. LF, TF, RF, SF	https://paperpal.com/
Plaito	By leveraging AI, Plaito brings the benefits of one-on-one tutoring providing understanding, confidence, clarity, and empowerment to students. LF, RF	https://www.plaito.ai/
Querium	An AI-powered tutoring platform that provides students with personalised learning experiences. It uses machine learning algorithms to assess students' strengths and weaknesses, providing targeted instruction and real-time feedback. LF, TF	https://www.querium.com/
Quillbot	A tool to improve writing, check for grammatical errors, assist with citations and paraphrase previously published text. LF, TF, RF, SF	https://quillbot.com/
Research Rabbit	Research Rabbit is a freely available digital platform that streamlines the literature search and administration for researchers. It integrates with citation managers and provides personalised recommendations, interactive visualisations, and collaboration options. RF, SF	https://www.researchrabbit.ai/
Scholarcy	Scholarcy is an AI application that summarises scholarly content, extracts structured data and knowledge summaries, and reduces the amount of time needed to extract essential information from an article. RF, LF, TF	https://www.scholarcy.com/
SciSpace	AI tool that can be used to read and interrogate a research paper LF, RF, TF	https://scispace.com/
Wisio	A platform propelled by AI that streamlines the scientific writing process. It provides customised text recommendations, citation extraction, translation, and English correction tools. RF, LF, TF	https://www.wisio.app/

Wordtune	Aids students in improving sentence structure and in expressing their ideas more clearly RF, LF, TF	https://www.wordtune.com/
Writely AI	AI-powered writing assistant that helps students enhance their writing skills and produce high-quality content. It utilises natural language processing and machine learning algorithms to provide real-time suggestions for improving grammar, style, and clarity. LF, TF, RF	https://www.writelyai.com/
Examples of organisation-specific chatbots		
ALEKS (Assessment and Learning in Knowledge Spaces)	Provides personalised learning experiences for students.	Carnegie Mellon University https://www.aleks.com/
Deakin University's Genie:	Voice-activated tool helping students with various aspects of university life, from finding resources for assignments to locating lecture halls.	Deakin University Australia
Pounce Chatbot	Georgia State University developed Pounce, an AI-powered chatbot designed to assist students during the enrollment process.	Georgia State University

The chatbots and AIEds represented in Table 1 all find applications in various areas of education.

Literature search and article analysis

A literature review is a crucial component of any research endeavour, but it can be a daunting, time- and energy-intensive undertaking. Researchers utilise diverse databases such as Google Scholar and Scopus to locate, peruse, and evaluate hundreds or thousands of research papers, synthesise existing knowledge, and determine knowledge gaps and research opportunities. Today, AI tools such as Research Rabbit, Scholarcy, SciSpace Lateral, Chat PDF, Elicit, WritelyAI, and Consensus can assist researchers in locating, organising, summarising, analysing, and writing research papers. By summarising a research paper's main points, Chat PDF, for example, can save the researcher a substantial amount of time. ChatGPT, Bard, and other comparable applications can also assist with literature searches and research questions.

Academic writing

Academic writing can be a daunting and tiring process. Reports and papers can take a long time to complete, and achieving excellence requires a substantial amount of effort. However, AI tools can assist students, instructors, and researchers with academic writing. Tools such as Jasper, QuillBot, PaperPal, Worldtune, Jenni, Copy.ai, and AI Writer (see Table 1) can facilitate the writing and editing of texts significantly. Chatbots such as ChatGPT, Claude, Bard, etc., are also effective writing and revision tools.

Administrative tasks

By automating administrative duties such as addressing frequently asked questions, scheduling appointments, and sending out notifications, an AI tool can aid in streamlining day-to-day business operations. The Georgia University Pounce Chatbot and the Deakin University Genie are examples of AIEd that perform administrative duties by responding to student inquiries.

The good

The second research question (RQ2) investigates the beneficial applications of chatbots in education and research (the good). The 'good' part of the paper outlines the advantages that AI chatbots bring to education and research.

AI chatbots hold great promise as an educational tool, particularly in the field of higher education. Recent studies and research have explored the opportunities and challenges of integrating AI chatbots into educational settings (Calonge et al., 2023; Holmes & Tuomi, 2023; Mohammadkarimi, 2023; Nemorin et al., 2023). AI chatbots hold extraordinary potential as educational tools, particularly in their ability to serve as virtual tutors. ChatGPT, for example, has been the subject of several recent studies exploring its potential use in education (Lo, 2023; Grassini, 2023). A study conducted by Kasneci et al. (2023) examined the benefits and risks of implementing ChatGPT as a virtual tutor in education. Willems (2023) also discussed the wider ethical implications of using large language models like ChatGPT in universities. The potential benefits of integrating Chatbots into education are significant (Tlili et al., 2023a; Adiguzel et al., 2023).

The majority of AI-powered chatbots in education assist students and instructors with a variety of tasks, including answering inquiries, providing study materials, monitoring progress, and more. These chatbots can be integrated into educational platforms and learning management systems for student support, instruction, and overall learning enhancement. Using natural language processing and machine learning, these educational chatbots can converse with students and provide individualised, real-time assistance. The sections that follow examine specific applications where they are particularly useful.

Personalised learning

AI chatbots can provide individualised instruction and feedback based on the needs and progress of each student. They are, therefore, revolutionising the concept of personalised learning, a methodology designed to cater to each student's unique needs, abilities, and learning preferences (Ifelebuegu, 2023). ChatGPT's and other AI chatbots' capability to process natural language input and generate human-like text make them a potent tool for individualised education. They can engage in dialogues, answer a wide range of questions, and provide detailed explanations, thereby acting as a virtual tutor available 24/7 for students (Hew et al., 2023; Limna et al., 2023). This immediate accessibility empowers learners to clarify doubts or understand complex concepts at their own pace without feeling time-pressured as they might in traditional classroom settings.

A key feature of personalised learning is the ability to adjust the level of difficulty based on the learner's proficiency. Here, chatbots shine by gauging the complexity of the questions posed by students and tailoring their responses accordingly. The Botsify chatbots, Plaito and Querium (see Table 1) are examples of applications for personalised learning. In language learning, for example, they can provide simpler explanations for beginners while offering more complex answers for advanced learners (e.g. Duolingo app for language learning). Chatbots can also generate practice problems or quizzes, enabling students to test their understanding and receive immediate feedback. Such interactive learning stimulates engagement and promotes active learning, which research suggests can significantly enhance knowledge retention (Gill et al., 2024; Rudolph et al., 2023).

Furthermore, the tool can adapt to each learner's interests, making the learning experience more engaging and relevant. For example, if a student is interested in space exploration, chatbots can contextualise mathematical problems or scientific explanations within that theme, thereby fostering a deeper connection to the material.

In summary, chatbots, as a tool for personalised learning, hold great promise. They combine the power of AI with the principles of individualised education to provide a flexible, accessible, and engaging learning experience. However, it is essential to remember that it should supplement, not replace, the invaluable role of human educators in nurturing curiosity, empathy, and critical thinking in students.

Homework assistance

The increasing sophistication of AI chatbots presents a valuable opportunity for enhancing the educational experience. One emerging role of AI in education is serving as a homework assistant, providing round-the-clock support to students (Chan, 2023; Limna et al., 2023). Chatbots can assist students in a variety of subjects, offering explanations, facilitating problem-solving, and giving examples for clearer understanding (Radziwill & Benton, 2017). In mathematics, for instance, it can guide students through problem-solving processes, demystifying complex principles. GPT4 (see Table 1) helps answer questions for children and assist them with homework. For language-based assignments, it can suggest essay ideas or help refine grammar and sentence structure.
One of AI chabots' most significant advantages is their availability. Unlike human tutors, who are bound by time constraints, chatbots can be accessed at any time, making it a flexible tool for students who study outside conventional hours or balance multiple responsibilities (Ifelebuegu, 2023; Ray, 2023).

Furthermore, AI chatbots can foster self-directed learning. They encourage students to find solutions themselves, nurturing critical thinking skills and promoting independent problem-solving (Bruff et al., 2013). It also allows students to revisit concepts or problems without fear of judgement, promoting a conducive and stress-free learning environment (D'Mello, 2016).

However, it is essential to note that while AI chatbots are a powerful tool, they are not without flaws. They can occasionally provide incorrect or misleading information, which underscores the importance of supplementing it with other reliable educational resources. Additionally, the potential misuse of AI tools, such as using them to generate complete essays, must be addressed to ensure academic integrity (Ifelebuegu, 2023).

In conclusion, when used responsibly, chatbots can serve as an effective homework assistant, supplementing traditional learning methods with a flexible, supportive, and personalised approach, and students must understand that the tool should be used for assistance and not as a means to do their work for them.

Answering queries

AI chatbots are versatile tools capable of answering a wide range of queries, whether they pertain to academic topics, technical issues, or general information. As a large language model trained on extensive data, they have the ability to understand and process natural language queries, thereby providing responses that closely mimic human-like conversation. In educational settings, chatbots serve as a valuable resource for learners, educators, and researchers alike. Students can use them as a virtual tutor to ask questions about complex subjects or clarify concepts that they might find challenging (Kasneci et al., 2023; Kuhail et al., 2023). For educators, chatbots can answer queries related to lesson planning, curriculum development, or even pedagogical strategies, offering insights drawn from a broad knowledge base. Researchers can employ them to understand complex topics, navigate scholarly literature, or brainstorm ideas (Olujimi & Ade-Ibijolla, 2023)

In addition to their utility in academic contexts, chatbots also serve a broader purpose as information assistants. They can provide information on a vast array of topics, from answering trivia questions to explaining current events or scientific phenomena. This makes them handy tools for anyone seeking immediate, convenient access to information. Chatbots' potential as a tool for answering queries is vast, offering a highly accessible, interactive, and broad-ranging resource for information seekers in various contexts.

Content generation

AI chatbots' ability to generate content is multi-faceted and versatile. They can be harnessed in the educational domain for the creation of learning materials such as worksheets, quizzes, and even lesson plans. This can be particularly beneficial for educators, saving them time and allowing them to focus on their core teaching activities (Huang & Liang, 2021; Lo, 2023). In the realm of research, they can be used to generate summaries of complex papers, abstracts, or literature reviews. This function can support researchers by simplifying the process of digesting extensive amounts of information (Hill-Yardin et al., 2023; Sarrison, 2023).

Furthermore, in content marketing or blogging, chatbots like ChatGPT, Bard and Ernie can help generate ideas, draft articles, and even suggest edits. It can be an excellent tool for brainstorming and outlining, which can speed up the content creation process (De Bruyn, 2020). However, while a chatbot can be a valuable tool for content generation, it is essential to remember that its output needs careful supervision. It is not entirely flawless, and its output should be reviewed for accuracy, coherence, and appropriateness.

Language learning

Primarily, chatbots can serve as language practice partners, available round the clock. Learners can engage in conversation with the AI, practising their speaking and comprehension skills in a low-pressure environment. They offer instant feedback, allowing learners to correct mistakes and enhance their language proficiency over time (Huang et al., 2022; Jeon et al., 2023). Duolingo (see Table 1) is a classic example of a commonly used language learning AIEd tool. Additionally, chatbots and other AIEd tools can provide grammatical explanations and context-based examples, assisting learners in understanding intricate language rules. they can also help learners expand their vocabulary by introducing new words and phrases within a conversational context, making them easier to remember.

Moreover, AIEds like Duolingo and ChatGPT's capacity for multi-language dialogue makes them useful tools for learners of diverse languages. Their ability to provide translations can be particularly beneficial for beginners who are developing their foundational vocabulary and comprehension skills (Belda-Medina & Calvo-Ferer, 2022; Jeon et al., 2023). However, while chatbots offer numerous advantages, it is crucial to use them responsibly and in conjunction with other language learning methods. It is also necessary to keep in mind that they represent AI and are not human, and may not perfectly capture nuances of cultural context or colloquial language use.

Administrative tasks

Educational institutions can use chatbots to automate various administrative tasks, such as answering frequently asked questions, scheduling appointments, or sending out notifications. Georgia University's Pounce chatbot and Deakin University's Genie (see Table 1) are examples of currently used chatbots for institution-specific administrative tasks. Ebbot from Learnify also help educational institutions with basic to more complex administrative tasks.

These AIEd tools can automate many such tasks, leading to enhanced efficiency and productivity. For instance, they can be utilised for drafting emails or other forms of communication, utilising their natural language processing capabilities to construct coherent, professional, and contextually appropriate messages (Kooli, 2023; Ifelebuegu, 2023). In the realm of schedule management, chatbots can assist in setting up meetings, sending reminders, or creating task lists. Integrating it with calendar applications or project management tools can help keep track of important dates and deadlines, ensuring smooth administrative functioning. Furthermore, they can be valuable assets in customer service, capable of answering frequently asked questions or providing information about products or services. This can significantly reduce the response time and improve the customer service experience (Rasul et al., 2023). However, it is important to note that while chatbots can effectively handle many administrative tasks, human supervision is necessary to ensure accuracy and to handle tasks that require human judgment or decision-making.

Research

Researchers can use AIEd like chatbots to summarise articles, generate hypotheses, or even draft sections of a paper. However, due to potential inaccuracies, it is essential to thoroughly check and verify any outputs from the AI. The emergence of OpenAI's ChatGPT has opened up new possibilities for the use of AI in research. With its extensive training on diverse datasets, ChatGPT and other AIEd tools can offer a vast amount of information and ideas, making it a valuable tool for researchers in various disciplines (Kooli, 2023).

One of the most significant ways chatbots can assist in research is by aiding in literature review and content analysis. Researchers can use the model to summarise long texts, articles, or papers, saving considerable time and effort. They can also provide an overview of multiple articles, helping researchers grasp the broader narrative or trends in their research domain (Tlili et al., 2023a). Another area where chatbots can prove useful is generating ideas and brainstorming. Researchers can ask chatbots to generate ideas or hypotheses on a particular subject, leveraging its broad knowledge base to foster creativity and explore diverse perspectives.

Furthermore, some chatbots can be employed to draft research proposals or write preliminary versions of research papers. It can suggest structures, write introductions, or even create abstracts, which can then be further refined by the researchers (Davies, 2016). They can also aid in explaining complex concepts or methods, particularly in areas such as statistics or computational methods, making them more accessible for researchers who may not be experts in these areas.

However, while AIEds like chatbots offer substantial benefits, it is crucial for researchers to use them responsibly and not rely on them blindly. Outputs should always be cross-checked for accuracy, and key decisions, especially ethical ones, should be made by the researchers themselves.

Inclusive education

Chatbots can be used to create more inclusive learning environments (Chen et al., 2023; Han & Lee, 2022). For example, some chatbots can provide additional support for students with disabilities or learning difficulties or assist in translating materials for students who speak different languages. While AI applications like ChatGPT and Duolingo

have numerous potential benefits in education and research, it is crucial to use them responsibly and in a way that complements rather than replaces human input. The role of educators remains paramount in providing students with a comprehensive, empathetic, and enriched learning experience. Similarly, in research, human expertise, critical thinking, and ethical judgment are essential and cannot be replaced by AI.

Collaboration

Chatbots can act as a platform for collaboration among students. In group projects, they can assist with brainstorming sessions by generating ideas or suggesting solutions based on the given input, facilitating a more dynamic and productive collaboration. In an educational setting, chatbots can facilitate collaborative learning by serving as a tool where students can interact, share ideas, and solve problems together. For instance, they can be used to pose questions or provide prompts that encourage group discussions, fostering critical thinking and problem-solving skills (Brynjolfsson & McAfee, 2014; Tlili et al., 2023a; Gill et al., 2024). They can also assist in collaborative projects by generating ideas, drafting collaborative documents, or managing tasks. They can serve as a neutral platform where ideas are pooled and refined, promoting a sense of equal contribution among team members (Davenport & Ronanki, 2018).

Furthermore, chatbots can enable international collaborations by bridging language gaps. With the multilingual capabilities of some of them, they can translate conversations in real time, making interactions seamless and inclusive.

Professional development for educators

Educators can utilise AIEd, such as chatbots, for their own learning and development (Molala & Mbaya, 2023). They can interact with the tool to deepen their knowledge in certain areas, generate ideas for class activities, or even assist in administrative tasks such as grading or scheduling. Continuing Professional Development (CPD) is crucial for educators to keep up with evolving educational trends and pedagogies. Chatbots can be a valuable tool in facilitating this process. Firstly, chatbots can provide personalized learning opportunities for educators. By interacting with the AI, teachers can learn at their own pace and focus on areas they wish to improve or explore, ranging from subject matter expertise to teaching strategies. Additionally, they can serve as a source of up-to-date information. Given their extensive training on a vast corpus of text, they can provide insights into recent educational trends, research, and pedagogical techniques, helping teachers stay abreast of the latest developments (Jama et al., 2023).

Additionally, chatbots can assist in the creation and evaluation of instructional materials. They can generate content for lesson plans, quizzes, or worksheets, and provide feedback on existing materials, making the process more efficient and effective (Holmes et al., 2022). However, while chatbots can be a useful tool for CPD, they should be used responsibly, with educators verifying information and applying professional judgment.

Interdisciplinary learning

With their ability to generate information across a wide array of topics, chatbots can promote interdisciplinary learning, allowing students to see connections between different fields of study (Zhu et al., 2023). They can provide relevant information from various disciplines, thereby fostering a holistic approach to learning. OpenAI's ChatGPT and many more chatbots present unique opportunities for promoting interdisciplinary learning, an approach that integrates knowledge and methods from different disciplines, providing students with a more comprehensive understanding of complex real-world problems. Primarily, chatbots, with their vast knowledge base across diverse subjects, can help link concepts from different fields, facilitating an integrative learning experience. Students can query the AI on how concepts from one discipline relate to another, fostering cross-disciplinary thinking. Chatbots can also aid in developing interdisciplinary learning materials; for instance, they can generate content that blends concepts from different subjects or provides interdisciplinary exercises or problem sets. In summary, Chatbots can play a key role in promoting interdisciplinary learning, fostering an integrated understanding of knowledge and nurturing students' ability to tackle complex, multifaceted problems.

Self-paced learning

Chatbots can support self-paced learning by allowing students to interact with it whenever they want. Its 24/7 availability makes learning more flexible and accessible, allowing students to learn at their own pace and on their own schedule. AI applications like ChatGPT, Bard, Ernie, etc., can significantly enhance self-paced learning, a learning model where learners control the speed and the sequence of their learning (Opara et al., 2023). Firstly, they can provide learners with 24/7 access to information and help. Students can interact with the AI at any time, asking questions or seeking explanations as needed, which enables learning at their own pace. Secondly, they offer personalised learning pathways. A chatbot can adapt its responses based on previous interactions, tailoring the information to the learner's existing knowledge and understanding. This can foster deeper and more effective learning (Kaplan & Haenlein, 2016). Additionally, chatbot capabilities extend beyond content delivery. They can generate practice problems, provide immediate feedback, or even guide reflective practices, reinforcing learning and supporting mastery of concepts (Kaplan & Haenlein, 2016).

Motivation and engagement

The novelty and interactive nature of chatbots like ChatGPT can boost student motivation and engagement. They can make learning more fun and interesting and thereby encourage students to participate more actively in their

education (Deng & Yu, 2023; Kuhail et al., 2023). Firstly, the chatbots' interactive nature can enhance learners' engagement. They can provide immediate responses to queries, fostering an active learning environment where learners can explore concepts at their own pace and triggering intrinsic motivation. Secondly, AIEd applications can offer personalised learning experiences, tailoring their interactions to individual learner's needs and interests. This personalisation can enhance the relevance of learning content, fostering a deeper connection with the subject matter and increasing motivation (Kooli, 2023). Furthermore, ChatGPT can introduce elements of gamification, such as challenges or quizzes, into the learning process. These elements can create a fun and competitive environment, boosting learner engagement and motivation (Shim et al., 2023).

Feedback provision

Chatbots can be utilised to provide instant feedback on certain tasks, such as multiple-choice quizzes or language exercises. This immediate response can enhance the learning process by allowing students to quickly identify and correct their mistakes. Chatbots can provide instant feedback to learners, correct mistakes, explain correct answers, and offer strategies for improvement. The immediacy of this feedback is beneficial for learning, as it allows learners to adjust their understanding and strategies promptly (Baskara, 2023). Moreover, the AI can offer personalised feedback based on the learner's performance. By tailoring the feedback to the learner's needs and progress, chatbots can help improve individual learning outcomes. Also, feedback provided by AI tools and chatbots is non-judgmental. This objective nature can create a safe learning environment where learners feel comfortable making mistakes and taking risks, which can foster a growth mindset (Lo, 2023; Ray, 2023). However, while automated feedback from AI, like chatbots, can be valuable, it should be supplemented with human feedback. Educators can provide context-specific feedback and address socio-emotional aspects of learning that AI systems might miss (Holmes et al., 2022).

Mental health support

While not a replacement for professional help, chatbots like ChatGPT can be used as a first step in providing support for students who may be dealing with stress or anxiety. They can provide basic advice, suggest coping strategies, or simply act as a non-judgmental listener. However, it is critical to ensure that students are directed to appropriate professional resources for further assistance (Aminah et al., 2023; Farhat, 2023; Rathnayaka et al., 2022).

Chatbots can provide a safe and non-judgmental space for students to express their feelings and concerns. Since they can respond to queries and prompts with empathy and understanding, students might find it easier to open up and discuss their mental health challenges with it. Chatbots can offer resources, strategies, and advice for managing stress, anxiety, and other common mental health issues. They can also direct students to professional help when necessary.

Admission process support

The process of guiding students through the enrolment procedure is a crucial aspect of operating a successful educational institution. Since the process varies from institution to institution, the applicants find it tiresome. Everyone desires straightforward and speedy solutions, so assisting your students in obtaining these will increase conversions. AI-powered chatbots that can be trained and programmed to understand a prospect's admission lifecycle can greatly facilitate the admissions process (Fitria et al., 2023; Nguyen et al., 2021). Without involving a human, these algorithms administer an entrance exam, monitor student performance, shortlist those who qualify, inform them about the next steps and course options, and answer all of their queries. This expedites the procedure by eliminating the typical waiting time required by a human agent.

In conclusion, it is essential to emphasise that while chatbots can be a useful instrument in many fields of education and research, they cannot replace human interaction and discernment. The utilisation of AI tools must always be governed by responsible practices that prioritise the welfare and growth of students. In addition to the numerous benefits, it is essential that we comprehend the potential risks and ethical considerations as we continue to investigate the integration of AI in education.

The bad

The third research question (RQ3) investigate the negative impacts of AI use in teaching and research (the bad). The 'bad' part of the paper investigates the challenges and limitations associated with the use of AI chatbots in education and research. These include concerns related to privacy and data security, as chatbots often handle sensitive personal information. The paper also raises issues of equity and accessibility since the benefits of this technology may not be available to all due to digital divides. While chatbots and other AIEd can be valuable tools in education and research, they are not without potential downsides. The following are some areas where the use of chatbots and AI tools could be problematic.

Reinforcement of bias

Chatbots like ChatGPT are only as unbiased as the data they are trained on. If the training data contains biases, the model can potentially learn and reproduce these biases. In an educational context, this could result in students receiving biased or skewed information. Chatbots are usually trained on a vast corpus of internet text data. While this allows the AI to generate human-like text, it also presents a significant risk of bias reinforcement (Kooli, 2023; Talanquer, 2023).

Firstly, chatbot training data includes content from the internet; they are exposed to biases that exist in these texts. These biases can be based on race, gender, religion, and more. When generating responses, the AI may unknowingly perpetuate these biases, thus reinforcing them (Caliskan et al., 2023). Secondly, AI systems like chatbots are sensitive

to the input they receive. If users interact with the AI using biased language or ideas, it could adapt to these biases, further propagating them in its responses (Zhao et al., 2020). While efforts have been made to "debias" AI, these measures can only reduce, not completely eliminate, bias. Moreover, the lack of transparency in AI algorithms, often referred to as the 'black box' problem, makes it difficult to understand and correct bias in AI responses (Ray, 2023).

The reinforcement of bias by AI has serious implications for education and research. It can lead to the perpetuation of stereotypes, misinformation, and discriminatory practices, undermining the goals of fairness, equality, and objectivity in these fields (Eubanks, 2018). Therefore, while chatbots can be valuable tools in education and research, it is crucial for users to be aware of their potential for bias reinforcement. Continuous monitoring and adjustment of the AI's responses, as well as educating users about AI bias, can help mitigate this risk.

Overreliance

With the emergence of AI in education, however, there are also concerns about its potential negative effects on students. Some experts contend that AI-based learning platforms could inhibit critical thinking and reduce human interaction, which is essential for learning (Mhlanga, 2023; Zanetti et al., 2019). The convenience of using chatbots and similar AIEd applications can lead to overreliance, which can be detrimental. Students may become overly dependent on these AI tools for learning, potentially limiting their problem-solving and critical thinking skills. Similarly, educators may be tempted to overuse AI tools for administrative tasks or content creation, leading to decreased personal interaction and human connection in education. When students lean heavily on AI for answers, they may not develop the necessary skills to independently analyse and solve problems.

Additionally, overreliance on AI could negatively impact the social aspects of learning. Education is not just about information transmission but also about human interaction, socialisation, and collaboration. If AI becomes the primary source of learning, these essential aspects could be undermined (Brynjolfsson & McAfee, 2014). While AI systems like chatbots provide valuable support for education and research, overreliance on these tools can pose challenges to critical thinking, social learning, and the cultivation of a fair and unbiased learning environment.

Misinformation

Misinformation is another significant concern in the use of AIED applications like chatbots in education and research. Chatbots rely on extensive data, including vast amounts of internet text, to generate responses. However, the internet is replete with misinformation, and this could potentially seep into the AI's outputs (Adetayo, 2023). For instance, if a chatbot encounters factually incorrect or misleading data during its training, it could inadvertently propagate these errors in its interactions with users. If learners or researchers rely on this information without cross-verifying, it could lead to the spread of misinformation.

Furthermore, the potential for chatbots to generate new content based on the patterns it has learned adds another layer to this problem. This feature, while innovative, could result in the creation and dissemination of unfounded information. To mitigate these risks, it is crucial to combine the use of AI with critical thinking and information literacy skills. Users must be encouraged to scrutinize AI-generated content and cross-reference information from multiple sources.

Plagiarism

The use of chatbots and other AIEd applications in education and research raises serious concerns about plagiarism. Although these tools can be instrumental in helping students understand complex concepts or aiding researchers in generating ideas, the ease with which they generate human-like text could potentially encourage plagiarism (Chaka, 2023; Ifelebuegu, 2023; Kleebayoon & Wiwanitkit, 2023; King, 2023). In an academic context, plagiarism is the presentation of someone else's work or ideas as one's own without proper attribution. If students use text generated by a chatbot such as ChatGPT in their assignments without proper citation, it could be considered plagiarism. Also, chatbots could facilitate 'contract cheating' where students submit AI-generated work as their own. This is a significant concern as it undermines the educational objectives of fostering original thinking and academic integrity (Mohammadkarimi, 2023).

On the flip side, AI can also be used to detect plagiarism, using algorithms to match text patterns and identify potential instances of academic dishonesty. However, it is imperative that educators reinforce the importance of academic honesty and proper citation practices in the digital age.

Data privacy

Data privacy is a critical concern in the deployment of AI-powered chatbots like ChatGPT in education and research. These systems often require access to extensive user data to personalise and enhance their services. However, the collection, storage, and use of these data bring about significant privacy implications. In the context of education, personal data might include students' grades, learning patterns, personal interests, and even their social interactions. When an AI tool is granted access to this information, there is an inherent risk of data breaches or misuse. If data is not adequately protected, sensitive information could be exposed, leading to significant harm to the individuals involved (Baskara, 2023; Yang et al., 2023). Moreover, the use of data in AI systems can raise questions about consent. It is essential that users, including students and educators, fully understand what data are being collected, how they are being used, and how they can control their data. Without informed consent, the use of AI in education could violate fundamental privacy rights (Gupta & Jain, 2023).

Depersonalisation of education

The increased use of AI in education could lead to a decrease in human interaction, which is a crucial part of learning. It could lead to less personal, more standardised education and reduce the development of social skills and emotional intelligence in students (Kuhail, 2023; Tlili et al., 2023a).

Accessibility and digital divide

Accessibility is an essential consideration in deploying AI systems like chatbots in education and research. These systems have the potential to democratise education by making high-quality learning resources accessible to all, irrespective of geographical location or socioeconomic status (Bostrom & Yudkowsky, 2014). However, despite this potential, disparities in access to technology can lead to a digital divide, where individuals without access to the necessary technology are left behind. This could exacerbate existing educational inequalities, creating a divide between those who can benefit from AI-enhanced learning and those who cannot.

Furthermore, the accessibility of AI systems for individuals with disabilities is another significant issue. AI tools must be designed to be accessible and inclusive, considering the needs of all potential users. This includes providing features such as text-to-speech for visually impaired individuals or predictive text for those with motor impairments (Khowaja et al., 2023). In conclusion, while AI, like ChatGPT, can be a powerful tool, these limitations need to be acknowledged and managed in educational and research contexts.

The ugly

The fourth research question (RQ4) evaluates the potential ethical challenges associated with the use of AI and chatbots in education and research (the ugly). The 'ugly' part delves into more severe concerns about the use of AI chatbots, focusing on the ethical dilemma of AI use in education and research. The potential for misuse of AI chatbots in education and research settings is examined. This section also highlights the need for comprehensive ethical guidelines and effective regulatory measures to ensure the responsible use of AI chatbots in education and research.

Ethical implications

The use of AI-powered chatbots raises important ethical questions. Issues around fairness, accountability, and transparency must be addressed. Moreover, there is a risk of AI systems perpetuating or even amplifying biases present in their training data, potentially leading to biased outcomes or discriminatory practices.

The integration of chatbots in education presents various ethical dilemmas, some of which have been covered in a previous section. First, there is the issue of data privacy. As students interact with chatbots, vast amounts of personal data, including learning behaviours and preferences, are collected. How these data are stored, used, and potentially shared poses significant privacy concerns. Unauthorised access or misuse could have repercussions on a student's academic and personal life.

Next, the authenticity of interactions comes into play. Relying on chatbots for educational feedback might deprive students of genuine human interaction, which is crucial for emotional and social development. It could also influence students' perceptions of what constitutes meaningful communication (Mohammadkarimi, 2023).

Additionally, the potential biases in AI and chatbots, stemming from their training data, can inadvertently reinforce stereotypes or skewed perspectives. In an educational context, this could lead to misinformation or narrow-minded thinking. Addressing these ethical dilemmas requires careful consideration, ensuring that while technology aids education, it does not compromise students' growth, security, or values.

Threats to jobs

Job displacement due to AI is a pressing concern in today's rapidly advancing technological landscape. As artificial intelligence systems become more sophisticated, they increasingly perform tasks previously handled by humans—often more efficiently and at a lower cost. Automation and AI can streamline repetitive tasks, analyse vast datasets with precision, and even perform complex operations in fields like finance, medicine, and manufacturing. While this offers substantial economic benefits and productivity gains, it simultaneously poses challenges for the workforce. Many low-skilled jobs, particularly those involving routine, repetitive tasks, are at the highest risk of being automated. This shift has the potential to exacerbate income inequalities, as those without the skills to navigate an AI-augmented job market might face unemployment or underemployment.

In education, roles such as administrative staff, learning support, and even some teaching roles could be affected. For instance, if an AI system like ChatGPT can handle student inquiries effectively, answer routine questions, and provide personalised learning resources, the need for some human roles might be reduced (Khogali & Mekid, 2023). However, it's crucial to note that AI is not likely to replace educators entirely. The role of a teacher involves far more than providing information as it includes fostering a positive learning environment, providing emotional support, and nurturing critical and creative thinking, tasks that AI is currently incapable of fully replicating (Chan & Tsi, 2023). Therefore, while AI may alter the landscape of jobs in education and research, it also provides opportunities for new roles and requires upskilling and reskilling for effective integration and usage in these sectors.

The erosion of human connection

The integration of AI systems like chatbots into education and research also raises concerns about the potential erosion of human connection. Education is inherently a

social endeavour, and the human touch in teaching and learning processes plays a crucial role in fostering empathy, understanding, and collaboration (Kamalov & Gurrib, 2023). AI, while proficient at managing information and facilitating personalised learning, cannot replicate the nuances of human interaction, such as body language, tone of voice, or emotional understanding. The overreliance on AI systems might result in a diminished emphasis on these human elements of communication and social interaction in an educational setting (Abbas et al., 2023).

Moreover, the role of educators extends beyond imparting knowledge; they also provide emotional support and mentorship and foster a sense of community, aspects that an AI like ChatGPT currently cannot fully replicate. While AI systems can provide numerous benefits, they should be used as a supplement to human interaction, not a replacement. Balancing the use of AI tools with the need for human connection and interaction is key to ensuring a rich, engaging, and holistic educational experience.

Technical failures

Technical failures in the context of AI chatbots in education can pose significant disruptions to the learning process. Chatbots rely on complex software, servers, and often cloud-based infrastructures. When any component of this intricate system faces issues, the chatbot can malfunction or become entirely unresponsive. For instance, a server outage can render a chatbot inaccessible, depriving students of essential learning resources at crucial moments, like just before an exam or assignment deadline. Moreover, bugs in the chatbot's code or issues in its underlying AI algorithms can lead to the dissemination of incorrect or misleading information, which, if undetected, can impede accurate learning. These technical failures not only hinder academic progress but can also erode trust in digital learning tools. Students and educators might become reluctant to rely on such tools, fearing unpredictability. In worst-case scenarios, consistent technical issues can exacerbate educational inequities, especially if alternative resources are not readily available to all students.

The potential 'ugliness' of using AI in education highlights the need for caution, regulation, and continuous evaluation. It is crucial that the deployment of such technologies is guided by ethical principles and a deep understanding of the possible long-term implications. While AI tools like ChatGPT offer many exciting opportunities for education, it is essential to ensure that their use enhances rather than detracts from the core values of education.

Conclusion and future perspectives

In conclusion, artificial intelligence, exemplified by chatbots and other AIEDs, is experiencing an unprecedented surge in its incorporation into the educational and research sectors. Multiple dimensions of the education sector are being transformed by these tools. These advancements offer numerous benefits to students, educators, and researchers alike. They personalise the educational experience by democratising access to immense stores of information, expediting administrative duties, and opening the door to novel and more thorough research methodologies. These beneficial changes—the good—are transforming pedagogical strategies and research paradigms.

On the other hand, there are concerns that require critical consideration. As AI becomes more pervasive, concerns regarding job displacement grow. The potential exists for these tools to inadvertently spread false information or reduce education to rote memorisation based on AI responses. In addition, an excessive reliance on digital tools may diminish the irreplaceable value of human connection and mentoring in the learning process, thereby introducing the bad and the ugly. Moreover, when the ethical dimension is considered, the challenges of data privacy become paramount. With AI systems trained on enormous datasets, the unintentional reinforcement of societal biases in educational tools becomes an urgent concern.

As we chart the course for the future of education, it is crucial that we strike a balance between the potential benefits of AI and its potential drawbacks by considering how we can leverage AI's potential while mitigating the associated risks. A blend of human and AI collaboration may present the best path forward, combining the benefits of AI with the creativity, empathy, and contextual understanding that characterises human interaction. Critical to the responsible use of AI is ongoing research and dialogue, not only among technologists but also among educators, policymakers, and learners. Comprehensive frameworks for the ethical use of AI in education, clear policies on data privacy, ongoing professional development for educators, and digital literacy education for learners are all essential components of responsible AI use.

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