A Review on Role of AI Chatbots in Education System

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Abstract: AI chatbots have recently made a significant impact on the educational landscape, showcasing their potential to transform educational systems in numerous ways. These chatbots offer immediate assistance by responding to inquiries, providing explanations, and supplying supplementary resources. Additionally, they can function as virtual teaching assistants, aiding educators in various capacities. This paper aims to explore the comprehensive benefits of AI chatbots in education, including the opportunities they present, the challenges they pose, potential limitations, concerns, and the future prospects of their implementation in educational environments. We conducted a thorough review of multiple academic databases, and after applying specific predefined criteria, we identified a final selection of 67 pertinent studies for analysis. The findings of this research highlight the extensive advantages of incorporating AI chatbots in education, as perceived by both students and educators. Our analysis indicates that students primarily benefit from AI-driven chatbots in three main areas: assistance with homework and study, a tailored learning experience, and the enhancement of various skills. For educators, the primary benefits include time-saving support and enhanced teaching methodologies. Nevertheless, our research also underscores significant challenges and critical factors that educators must address with care, including issues related to the reliability, accuracy, and ethical implications of AI applications.

Keywords: Systematic literature review, Artifcial intelligence, AI chatbots, Chatbots in education

I.INTRODUCTION

The traditional education system encounters numerous challenges, such as overcrowded classrooms, insufficient personalized attention for students, diverse learning paces and styles, and difficulties in keeping pace with the rapid advancements in technology and information. As the educational environment continues to transform, the emergence of AI-powered chatbots presents a promising solution to effectively tackle some of these challenges. While certain educational institutions are increasingly embracing AI-powered chatbots due to their relevance, others remain cautious and are hesitant to integrate them into contemporary educational frameworks. As a result, a significant amount of academic research is focused on exploring the role of AI chatbots in education, along with their potential benefits and risks. These AI-powered chatbots are engineered to simulate human conversation through text or voice interactions, delivering information in a conversational format.

II.REVIEW OF LITERATURE

The history of chatbots can be traced back to the 1960s, during which they have undergone significant evolution, influenced by technological advancements and an increasing need for automated communication systems. One of the earliest chatbot programs, ELIZA, was developed by Joseph Weizenbaum at MIT in 1966. ELIZA was capable of generating human-like responses by rephrasing user inputs into questions. Another notable early chatbot, PARRY, was created in 1972 by psychiatrist Kenneth Colby at Stanford University. PARRY was designed to emulate a paranoid patient suffering from schizophrenia, engaging in text-based dialogues and showcasing the ability to display delusional behavior, thereby contributing to the fields of natural language processing and artificial intelligence.

Developed by Richard Wallace in 1995, ALICE (Artificial Linguistic Internet Computer Entity) represented an early instance of a chatbot utilizing natural language processing techniques. It achieved recognition by winning the Loebner Prize Turing Test in 2000–2001, which assessed chatbots on their ability to convincingly mimic human conversation (Wallace, 1995). Subsequently, in 2001, ActiveBuddy, Inc. launched the chatbot SmarterChild, which functioned on instant messaging platforms such as AOL Instant Messenger and MSN Messenger (Hofer et al., 2001). SmarterChild was capable of engaging users in discussions on a wide range of subjects and demonstrated the ability to learn from its interactions, thereby becoming increasingly sophisticated over time. In 2011, Apple unveiled Siri, a voice-activated personal assistant for the iPhone (Aron, 2011). While not a traditional chatbot, Siri illustrated the

possibilities of conversational AI by comprehending and responding to voice commands, executing tasks, and delivering information.

In the same year, IBM's Watson achieved recognition by triumphing over human champions in the quiz show Jeopardy (Lally & Fodor, 2011). This event highlighted the capabilities of natural language processing and machine learning algorithms in comprehending intricate questions and delivering precise responses. More recently, in 2016, Facebook launched its Messenger platform for the development of chatbots, enabling businesses to create AI-driven conversational agents for user interaction. This initiative resulted in a significant increase in chatbots on the platform, facilitating functions such as customer support, news dissemination, and e-commerce (Holotescu, 2016). Furthermore, Google Duplex, unveiled in May 2018, demonstrated the ability to make phone calls and engage in conversations on behalf of users. This innovation illustrated the potential of chatbots to manage complex, real-time interactions in a manner akin to human communication (Dinh & Tai, 2018; Kietzmann et al., 2018).

Recently, advanced and capable chatbots have captivated the world with their remarkable functionalities. Notably, ChatGPT and Google Bard stand out as two of the most significant AI-driven chatbots. ChatGPT, an artificial intelligence chatbot created by OpenAI, was first introduced to the public in November 2022. In contrast, its competitor, Google Bard, developed by Google AI, was unveiled in May 2023. Both chatbots are based on large language models and are trained on extensive collections of text and code. They are equipped to generate text, produce a variety of creative content, and offer informative responses to inquiries, although their accuracy may vary. A primary distinction between the two is that Google Bard is trained on a dataset that encompasses internet text, whereas ChatGPT relies on a dataset derived from books and articles. Consequently, Google Bard is more likely to provide current information, while ChatGPT tends to deliver more precise answers to factual questions (AlZubi et al., 2022; Rahaman et al., 2023; Rudolph et al., 2023).

Chatbots have found applications in a variety of sectors, including the field of education. The most recent intelligent AI chatbots operate on web-based platforms that adjust to the interactions of both educators and students, thereby improving the overall educational experience (Chassignol et al., 2018; Devedzic, 2004; Kahraman et al., 2010; Peredo et al., 2011). Within the educational landscape, AI chatbots are utilized for both teaching and learning purposes. These chatbots excel in providing personalized tutoring, assisting with homework, facilitating concept comprehension, preparing for standardized tests, promoting discussion and collaboration, and offering mental health support. Among the widely used AI-driven tools and chatbots in education are:

Bard, which was launched in 2022, is a sophisticated language model chatbot developed by Google AI. It possesses the ability to generate text, translate languages, create various forms of creative content, and offer informative answers to inquiries (Rudolph et al., 2023). Although Bard is still in the developmental phase, it holds significant promise as a beneficial resource for educational purposes.

ChatGPT, also introduced in 2022 by OpenAI, is another advanced language model chatbot capable of generating text, creating a wide range of creative content, and providing informative responses to questions (Dergaa et al., 2023; Khademi, 2023; Rudolph et al., 2023). Nevertheless, as highlighted in the results section of this paper, there are several concerns regarding the application of ChatGPT in educational settings, including issues related to accuracy, reliability, and ethics. Ada, introduced in 2017, is a chatbot designed to offer personalized tutoring to students. It is capable of answering inquiries, providing feedback, and supporting individualized learning experiences (Kabiljo et al., 2020; Konecki et al., 2023). Nevertheless, the Ada chatbot has certain limitations when it comes to comprehending complex queries, which may lead to misinterpretation of context and the delivery of inaccurate responses.

Replika, also launched in 2017, serves as an AI chatbot platform intended to act as a friend and companion for students. It is equipped to listen to students' concerns, offer guidance, and alleviate feelings of loneliness (Pentina et al., 2023; Xie & Pentina, 2022). However, due to the intimate nature of interactions with Replika, there are legitimate concerns surrounding data privacy and security.Socratic, established in 2013, aimed to foster a community that facilitates accessible learning for all students. Presently, it operates as an AI-driven educational platform, having been acquired by Google in 2018. Although it is not a traditional chatbot, it features a chatbot-like interface and functionalities

intended to support students in grasping new concepts (Alsanousi et al., 2023; Moppel, 2018; St-Hilaire et al., 2022). Similar to other chatbot applications, there is a concern that students may become overly dependent on Socratic for their educational needs. This dependency could potentially undermine the importance of critical thinking, as students might prefer to use the platform to find answers rather than develop a true comprehension of the fundamental concepts.

Habitica, which was introduced in 2013, serves as a tool to assist students in cultivating effective study habits. By gamifying the educational experience, it enhances the enjoyment and engagement of students in their learning journey. Students can utilize Habitica to organize their academic responsibilities, including tasks, assignments, and study plans. This transformation of a traditional to-do list into a game-like format encourages students to accomplish their tasks and develop constructive habits (Sales & Antunes, 2021; Zhang, 2023). Nonetheless, the gamified elements of Habitica may unintentionally lead to distractions, particularly for those students who may become more engrossed in the gaming features rather than concentrating on their academic duties.

Piazza, established in 2009, is designed to promote discussion and collaboration within educational environments, especially in classrooms and academic institutions. It offers a platform for students and educators to participate in conversations pose questions, and exchange information pertinent to course materials and assignments (Ruthotto et al., 2020; Wang et al., 2020). Given that the discussions on Piazza are generated by users, the quality and reliability of the responses can fluctuate. This inconsistency may lead to instances where students do not obtain accurate or beneficial information.

Chatbots are predominantly utilized in the field of education to facilitate the learning of a range of subjects, such as mathematics, computer science, foreign languages, and engineering. Although many chatbots adhere to fixed conversational frameworks, a number of them adopt personalized learning strategies that cater to the specific needs of individual students, integrating principles of experiential and collaborative learning. The development of chatbots faces several challenges, including inadequate training datasets, insufficient focus on usability heuristics, ethical dilemmas, evaluation techniques, user perceptions, programming difficulties, and issues related to data integration.

III.METHODOLOGY

A systematic review adheres to a stringent methodology, which encompasses predefined search criteria and systematic screening processes to guarantee the inclusion of pertinent studies. This thorough approach ensures that a diverse array of research is evaluated, thereby reducing the potential for bias and offering a holistic overview of the effects of artificial intelligence in education. Initially, we establish the research questions along with the relevant search strategies, followed by filtering the search results according to predefined inclusion and exclusion criteria. Subsequently, we analyze the selected articles and synthesize the findings, culminating in a report and discussion of the results. To enhance the clarity of the discussion section, we utilized a Large Language Model (LLM) for stylistic recommendations. Research Questions In light of the limitations identified in prior literature reviews, we have formulated three research questions for further exploration.

1. What are the primary benefits of utilizing AI chatbots in education from the perspective of students?

2. What are the significant benefits of employing AI chatbots in education from the perspective of educators?

3. What are the principal concerns expressed by academics regarding the implementation of AI chatbots in education?

An examination of the literature addressing these research inquiries, particularly with a focus on modern AI-driven chatbots, can yield a more profound comprehension of the influence, efficacy, and possible constraints of chatbot technology within the educational sector. This understanding will also inform the future development and application of such technologies. This paper aims to elucidate how educational chatbots can be effectively employed to improve learning experiences and meet the specific needs and challenges faced by both students and educators. The literature search was performed across several databases, including the ACM Digital Library, Scopus, IEEE Xplore, and Google Scholar. A search string was formulated utilizing Boolean operators, structured as follows: ("Education" or "Learning" or "Teaching") and ("Chatbot" or "Artificial

intelligence" or "AI" or "ChatGPT"). The initial search resulted in a total of 563 publications from the four databases. Subsequently, search filters were applied according to predefined inclusion and exclusion criteria, followed by a meticulous data extraction process.

IV.RESULTS

In this section, we present the results of the reviewed articles, focusing on our research questions, particularly with regard to ChatGPT. ChatGPT, as one of the latest AI-powered chatbots, has gained signifcant attention for its potential applications in education. Within just eight months of its launch in 2022, it has already amassed over 100 million users, setting new records for user and trafc growth. ChatGPT stands out among AIpowered chatbots used in education due to its advanced natural language processing capabilities and sophisticated language generation, enabling more natural and humanlike conversations. It excels at capturing and retaining contextual information throughout interactions, leading to more coherent and contextually relevant conversations. Unlike some educational chatbots that follow predetermined paths or rely on predefned scripts, ChatGPT is capable of engaging in open-ended dialogue and adapting to various user inputs. Its adaptability allows it to write articles, stories, and poems, provide summaries, accommodate diferent perspectives, and even write and debug computer code, making it a valuable tool in educational settings (Baidoo-Anu & Owusu Ansah, 2023; Tate et al., 2023; Williams, 2023).

V.CONCLUSION

The extensive integration of chatbots and their growing availability has elicited diverse responses across various sectors, resulting in significant confusion within the educational field. A discernible trend has emerged among educators and students: while students express enthusiasm for the incorporation of chatbots, educators tend to hold more critical views. This scenario, however, offers a distinctive opportunity, accompanied by unprecedented challenges. As a result, there has been a marked increase in research focused on examining the effects of chatbots in educational settings. This article provides a systematic review of the most recent literature, aiming to identify both the potential benefits and obstacles related to the use of chatbots in education. Through this review, we have identified critical gaps in the current research that require further exploration. Addressing these gaps will be essential for optimizing the deployment of chatbots and maximizing their potential benefits for both educators and students. Continued research will be crucial in understanding the long-term effects, variations influenced by student characteristics, pedagogical approaches, and the overall user experience linked to the integration of chatbots in educational contexts.

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