frontiers | Frontiers in Education

TYPE Systematic Review
PUBLISHED 04 July 2024
DOI 10.3389/feduc.2024.1379796

OPEN ACCESS

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RECEIVED 31 January 2024
ACCEPTED 17 June 2024
PUBLISHED 04 July 2024

CITATION
Bettayeb AM, Abu Talib M, Sobhe Altayasinah AZ and Dakalbab F (2024) Exploring the impact of ChatGPT: conversational AI in education. *Front. Educ.* 9:1379796. doi: 10.3389/feduc.2024.1379796

Exploring the impact of ChatGPT: conversational AI in education

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Artificial intelligence integration, specifically ChatGPT, is becoming increasingly popular in educational contexts. This research paper provides a systematic literature review that examines the effects of incorporating ChatGPT into education. The study examines four primary research questions: the benefits and challenges of ChatGPT, its impact on student engagement and learning outcomes, ethical considerations and safeguards, and the effects on educators and teachers, based on an analysis of numerous scientific research articles published between 2022 and 2023. The results emphasize the numerous benefits of ChatGPT, such as the opportunity for students to investigate AI technology, personalized assistance, and improved learning experiences. Furthermore, advantages such as enhanced learning and enhanced information accessibility are identified. Nevertheless, ethical considerations and biases in AI models are also highlighted. ChatGPT enhances student engagement by offering personalized responses, prompt feedback, and rapid access to information, resulting in enhanced learning outcomes and the growth of critical thinking abilities. Ethical considerations and safeguards, including user education, privacy protection, human supervision, and stated guidelines, are essential for responsible use. The integration of ChatGPT transforms the role of educators from content delivery to assistance and guidance, thereby fostering personalized and differentiated learning. Educators have to consider ethical considerations while monitoring student usage in order to facilitate this transformation. Educational institutions can increase student engagement, learning outcomes, and the responsible use of AI in education by addressing challenges, establishing ethical guidelines, and leveraging the strengths of ChatGPT. This will prepare students for future challenges.

KEYWORDS

conversational AI, ChatGPT, education, ethical considerations, human supervision

1 Introduction

In the rapidly evolving landscape of artificial intelligence, ChatGPT, a cutting-edge language model developed by OpenAI, has emerged as a trailblazing innovation, captivating the attention of researchers and practitioners alike. This research paper delves into the transformative potential of ChatGPT, exploring its remarkable advancements and impact across various domains (Aljanabi and ChatGPT, 2023; Thorp, 2023). The journey begins with

integrating ChatGPT with other AI technologies, such as computer vision and robotics. ChatGPT propels human-computer interactions to new heights by synergizing these cutting-edge advancements, offering unparalleled personalization and intuitive experiences. As users engage with ChatGPT, its ability to learn from individual preferences empowers the creation of tailored responses, revolutionizing the way humans interact with AI systems (Aljanabi and ChatGPT, 2023). Within the realm of education, ChatGPT's potential to enhance learning experiences takes center stage. This powerful language model fosters dynamic and evolving learning environments by transcending traditional search engine constraints. Students are encouraged to actively participate in interactive sessions actively, promoting deep engagement and reflective thinking. Drawing on its powerful Generative Pre-trained Transformer (GPT-3), ChatGPT analyzes vast amounts of data, providing personalized and relatable responses while seamlessly integrating new knowledge through follow-up question responses. This unique feature opens exciting opportunities for educators to adopt innovative teaching methods and create a more interactive and enriching classroom experience (Ollivier et al., 2023).

ChatGPT's adaptive capabilities enable a more student-centric approach to pursuing personalized learning. Educators can tailor content and teaching methodologies to meet individual needs by analyzing a student's progress and preferences. This not only empowers students to take ownership of their learning journey but also enhances their motivation and overall academic performance. Furthermore, the AI-powered model's capacity to adapt to learners' abilities fosters inclusive education, accommodating diverse learning styles and needs and bridging the gap between educators and students with various backgrounds and skills (Ollivier et al., 2023; Pericles 'asher' Rospigliosi, 2023). However, the integration of AI in education also demands careful ethical considerations. Ensuring responsible data privacy management is paramount, as educational institutions handle sensitive information about students. Transparent communication with students and their parents regarding the use of AI technologies is essential to build trust and address any concerns related to data security. Additionally, educators must be vigilant about potential biases in AI-generated content, as these models are trained on vast datasets that may inadvertently perpetuate stereotypes or cultural preferences. By actively monitoring and addressing these issues, educators can ensure that ChatGPT is a supportive tool for fostering an inclusive and ethical learning environment (Kasneci et al., 2023). The research paper further explores ChatGPT's potential in reshaping academic writing, focusing on fields like healthcare, medical education, biomedical research, and scientific writing. As AI language models generate human-like text, they hold immense promise in streamlining content creation and organizing complex information into cohesive manuscripts. The AI-powered model's ability to assist researchers in drafting, summarizing, and conducting literature reviews simplify the writing process, allowing scientists to focus on the more critical aspects of their research (Bin Arif et al., 2023).

Nevertheless, concerns surrounding the accuracy and integrity of AI-generated scientific writing underscore the need for robust fact-checking and verification processes to uphold academic credibility. The reliance on AI-generated content in scientific literature raises questions about the potential for misinformation and the need to establish mechanisms for transparently identifying and attributing AI-generated contributions in academic publications. Researchers and publishers must work together to ensure rigorous standards for fact-checking and validation when incorporating AI-generated content into scientific papers, safeguarding the quality and reliability of scholarly work (Alkaissi and McFarlane, 2023). Moreover, the paper delves into the critical investigation of using ChatGPT to detect implicit hateful speech. By employing this AI language model to elicit natural language explanations, researchers evaluate its proficiency and compare responses with human-labeled data—shedding light on its potential contributions to address societal issues like hate speech online. However, the study also underscores the importance of exercising caution when utilizing ChatGPT as a data annotation tool, emphasizing the need for responsible application to prevent potential misinformation (DiGiorgio and Ehrenfeld, 2023; Fijačko et al., 2023).

In conclusion, the introduction sets the stage for a comprehensive exploration of ChatGPT's multifaceted impacts, spanning human-computer interactions, educational advancements, and societal challenges. As we embark on this journey, we advocate for the responsible and thoughtful deployment of ChatGPT, recognizing its vast potential while upholding ethical considerations (DiGiorgio and Ehrenfeld, 2023) to ensure a positive and equitable integration of AI language models in diverse applications. By leveraging ChatGPT's capabilities responsibly, we can unlock a new era of personalized and transformative human-AI interactions, ushering in innovative educational practices and advancing society.

The rest of the paper follows this structure: In Section 2, there is a comprehensive review of literature surveys. Moving on to Section 3, the research's approach and technique are outlined. Section 4 is dedicated to discussing the findings and outcomes of this review. Finally, Section 5 presents concluding insights and offers recommendations for future research.

2 Literature review

The potential of conversational AI, in particular ChatGPT, to impact the field of education by influencing how students learn and interact with educational content has attracted increasing attention in recent years. The author Ray (2023) presented a comprehensive review of ChatGPT. The study focuses on ChatGPT's history, technological advancements, and industrial uses. It discusses solutions while addressing ethical challenges, data biases, and safety concerns. The review anticipates what ChatGPT will look like in the future, highlighting improvements in human-AI interaction and research developments. Focusing on teaching and learning, Kohnke et al. (2023) analyze ChatGPT's use in language teaching and learning in their study. The researchers look into the advantages of using ChatGPT, a generative AI chatbot, in language learning. Additionally, they go over the various arguments and ChatGPT's drawbacks. As a final point, the study emphasizes the crucial digital skills that instructors and students must have to use this chatbot to improve language learning in an ethical and efficient manner. Another study was undertaken by Baidoo-Anu and Owusu Ansah (2023) to examine ChatGPT's potential for facilitating teaching and learning. The advantages of ChatGPT, such as personalized and interactive learning, creating prompts for formative assessments, and delivering continuous feedback, are highlighted in their recent work evaluation. However, there are also acknowledged drawbacks, such as the potential for producing inaccurate information, biases in data training, and privacy

issues. The paper makes suggestions for utilizing ChatGPT to improve education. Collaboration between policymakers, researchers, educators, and technological professionals is encouraged to ensure the safe and beneficial use of generative AI technologies for enhanced learning experiences.

A thorough paper on ChatGPT is presented by Dwivedi et al. (2023), which includes 43 contributions from specialists across various disciplines. They acknowledge that ChatGPT can increase efficiency in the banking, hospitality, and IT sectors. However, concerns include practice disruptions, privacy and security hazards, biases, and false information. According to the paper, research is needed in knowledge, ethics, transparency, digital transformation, education, and learning. The handling of generative AI, biases in training data, appropriate implementation contexts, ideal human-AI collaboration, text accuracy assessment, and ethical and legal issues all need further study. Highlights include concerns about biases, dated data, the need for protective policies, and transformational effects on employment, teaching, and learning.

Education plays a vital role in using ChatGPT, and numerous reviews have focused on its educational impact. For instance, Lo (2023) rapidly reviews ChatGPT's implications for education. The study indicates variable performance levels of ChatGPT across diverse subject categories, ranging from superb to unsatisfactory, by examining 50 publications from useful databases and Google Scholar. The author highlights the difficulties of using ChatGPT as a virtual tutor and instructor assistant. In educational institutions, it is essential to update institutional policies and assessment procedures promptly. To address the effects of ChatGPT on education, it is also crucial to offer instructor training and student instructions. Sok and Heng (2023) address the educational aspect of ChatGPT in their study as they look at the benefits and drawbacks of utilizing ChatGPT in research and education. The study identifies five key advantages of ChatGPT, including developing learning assessments, improving pedagogical practices, providing virtual one-on-one tutoring, facilitating idea formation, and outlining. Academic integrity threats, unfair learning assessments, erroneous information dangers, and risks associated with an overreliance on AI are also presented. The study's conclusion includes a set of recommendations for using ChatGPT in educational and research contexts. Kasneci et al. (2023) focus on the advancements of large language models in AI, specifically focusing on their educational applications. The authors explore the benefits and challenges of using large language models in education, considering the perspectives of both students and teachers. They highlight current research and applications of these models in educational settings. The study delves into the opportunities and challenges these models present for students and instructors. Additionally, the review discusses the potential of these educational technologies, along with the associated challenges, risks, and strategies for mitigation.

Healthcare education holds a pivotal position within any educational system. Therefore, Sallam (2023) has systematically analyzed the prospective views and legitimate concerns regarding using ChatGPT in healthcare education. The author thoroughly analyzes ChatGPT's application in healthcare education, considering both optimistic perspectives and legitimate concerns. Based on a comprehensive analysis of 70 research publications, the author investigates the utility of large language models in healthcare teaching, research, and practice. According to the review, ChatGPT offers several benefits, including improving research equity and variety, improving scientific writing, facilitating healthcare research and training, and encouraging individualized learning and critical thinking in healthcare education. According to the author, ChatGPT's promising uses could lead to paradigm shifts in medical practice, study, and training. Embrace this AI chatbot, nevertheless, is suggested with care given its existing limits.

The related research studies that explore ChatGPT in the field of education are listed in Table 1. Our study, on the other hand, aims to add to the body of knowledge by thoroughly examining the effects of ChatGPT, an AI conversation tool, on education. We aim to give educators, academics, and policymakers valuable insights into the implications of implementing ChatGPT and conversational AI technologies in educational contexts by reviewing literature, reviews, and technical articles. Ultimately, our research intends to support creative and student-centered teaching and learning techniques while facilitating the successful integration of ChatGPT into education. Stakeholders may make intelligent decisions about ChatGPT's deployment and use it to improve educational experiences by knowing its benefits, challenges, and ethical issues. However, in our work, we take a thorough approach to using ChatGPT in education. We do not just discuss biases, outdated data, transparency, and legitimacy; we work to fix them. Our research also focuses on the ethical side, ensuring data privacy, inclusivity, and a good balance between AI and human interaction. We explore the benefits and challenges of ChatGPT in education, giving a clear picture of its potential while being cautious about its risks. We aim to lead the way in responsibly using language models for education, setting our work apart from others in this field.

3 Methodology

The Research survey study in this paper adopts Kitchenham and Charters' Systematic Literature Review (SLR) approach (Kitchenham and Charters, 2007; Hopkins et al., 2023), which consists of three phases: planning, conducting, and reporting, each comprising multiple stages. The planning phase focuses on the review methodology. It encompasses six steps: defining research objectives, devising a search strategy, determining study selection processes, establishing quality evaluation guidelines, outlining the data extraction technique, and synthesizing the collected data. Figure 1 provides a visual representation of these stages.

To refine our research focus, we initially defined our objectives and formulated research questions accordingly. The search strategy involved identifying appropriate search terms that would facilitate the identification of relevant articles related to our investigation. The research methodology employed in this study is illustrated in Figure 2, which presents the resources we searched from and the selection of the paper procedure. Additionally, Figure 3 explains how many papers appear for each keyword in the search phase and the keyword AI the most found.

Moreover, this research survey study aligns with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure transparency and methodological rigor in reporting the systematic literature review process. A PRISMA flow diagram (Figure 4) is provided to illustrate the study selection process, detailing the number of records identified, screened, assessed for

TABLE 1 Related work summary.

Ref.	Application	Highlights
Ray (2023)	General	• Gives a thorough analysis of ChatGPT, covering its history, uses, difficulties, and prospects. • Examines ChatGPT's numerous uses in customer service, healthcare, and education. • Identifies critical issues, such as ethical questions and prejudices, while predicting ChatGPT's future and its interaction with other technologies.
Kohnke et al. (2023)	Teaching and Learning	• This article examines the uses of ChatGPT for language teaching and learning, as well as its advantages and disadvantages. • Emphasizes the significance of digital skills for instructors and students to use ChatGPT as a language learning tool ethically and efficiently.
Baidoo-Anu and Owusu Ansah (2023)	Teaching and Learning	• Identifies potential advantages of ChatGPT in education, including personalized and interactive learning and creating prompts for formative assessment activities, by synthesizing recent work. • Highlights ChatGPT's shortcomings, such as inaccurate information generation, biases in data training, and privacy issues, and offers suggestions for properly utilizing ChatGPT to improve teaching and learning.
Dwivedi et al. (2023)	Multi-disciplinary	• Although generative AI technology can potentially boost productivity, it also presents ethical and job displacement questions. • Due to generative AI, education and research domains will experience substantial changes, making addressing problems like biases, out-of-date data, transparency, and legitimacy essential.
Lo (2023)	Education	• Examines ChatGPT's capabilities across subject domains, prospective educational applications, and issues brought up by researchers within the first three months of its availability. This is done by quickly reviewing the literature. • ChatGPT can help teachers and act as a virtual tutor for students. Still, it has difficulties, including producing inaccurate data and getting around plagiarism checkers that call for policy and evaluation revisions.
Sok and Heng (2023)	Education	• Explains the advantages of using ChatGPT in research and education, such as the creation of learning assessments, improvement of pedagogical practices, provision of virtual one-on-one tutoring, creation of outlines, and idea generation. • Identifies ChatGPT challenges, including academic integrity, unfair learning assessments, erroneous data, and excessive reliance on AI, and offers suggestions for its responsible and practical application in educational and research contexts.
Kasneci et al. (2023)	Education	• Examines the latest research, application, opportunities, and limitations associated with large language models in education. • Discusses essential issues, such as ethical considerations relevant to the language model used in education. It also discusses challenges, mitigation measures, and additional topics.
Sallam (2023)	Healthcare Education	• Reviews the advantages and potential drawbacks of ChatGPT in the context of healthcare education, research, and practice. • Outlines the advantages of ChatGPT in fields like scientific writing, medical research, practice, and learning. It also addresses issues with ethics, copyright, transparency, the law, and the problems of bias, plagiarism, and wrong content.
Ours	Education	• Highlight addressing biases, outdated data, transparency, and legitimacy in ChatGPT's educational use. • Discusses ethical considerations relevant to the use of language models in education, including data privacy management, transparent communication with students and parents, and potential biases in AI-generated content. • Reviews the advantages and challenges of ChatGPT in the context of education, giving a clear picture of its potential while being cautious about its risks. • Provides a comprehensive review of literature surveys. • Addresses four research questions related to paper themes, limitations, advantages, and recommendations concerning ChatGPT's use in education. • Outlines the scope and application of ChatGPT in the study. • Offers concluding insights and recommendations for future research.

eligibility, and included in the review, along with reasons for exclusions at each stage.

In this paper, thematic analysis was applied to derive insights from the collected data. Thematic analysis is a widely used qualitative method for identifying, analyzing, and reporting patterns (themes) within data. In this study, thematic analysis was implemented following the steps outlined by Braun and Clarke (Salvagno et al., 2023). These steps include:

1. Familiarization with the data: all collected data, including extracted information from selected papers, were thoroughly reviewed to gain familiarity with the content.

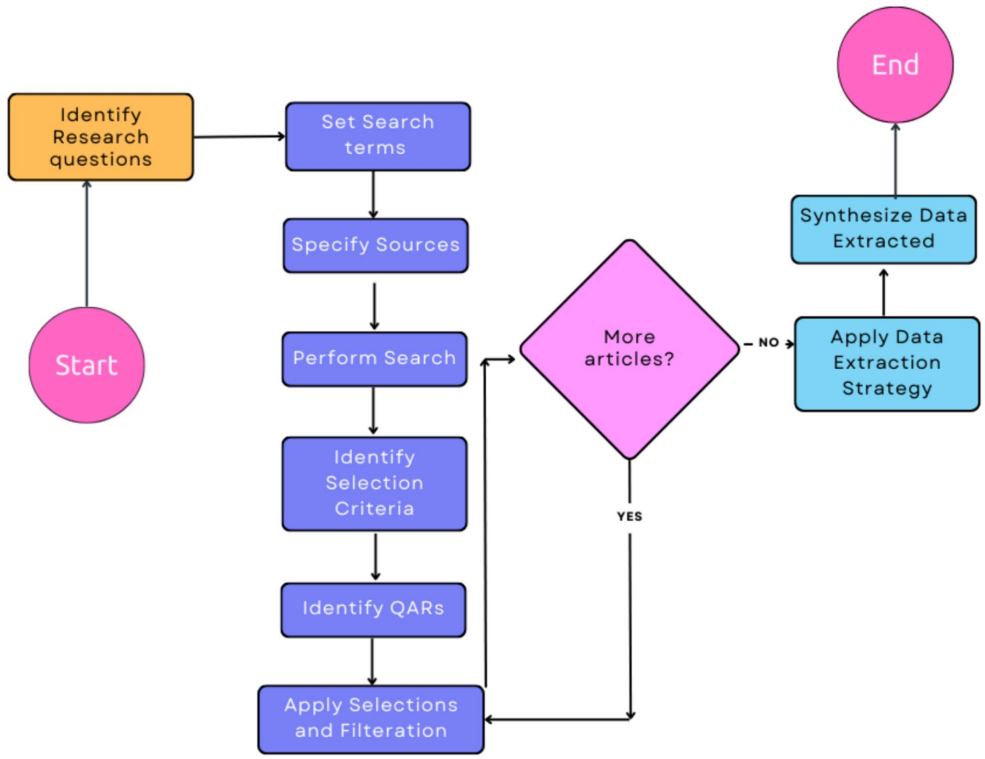

FIGURE 1
The stages of performing systematic literature review.

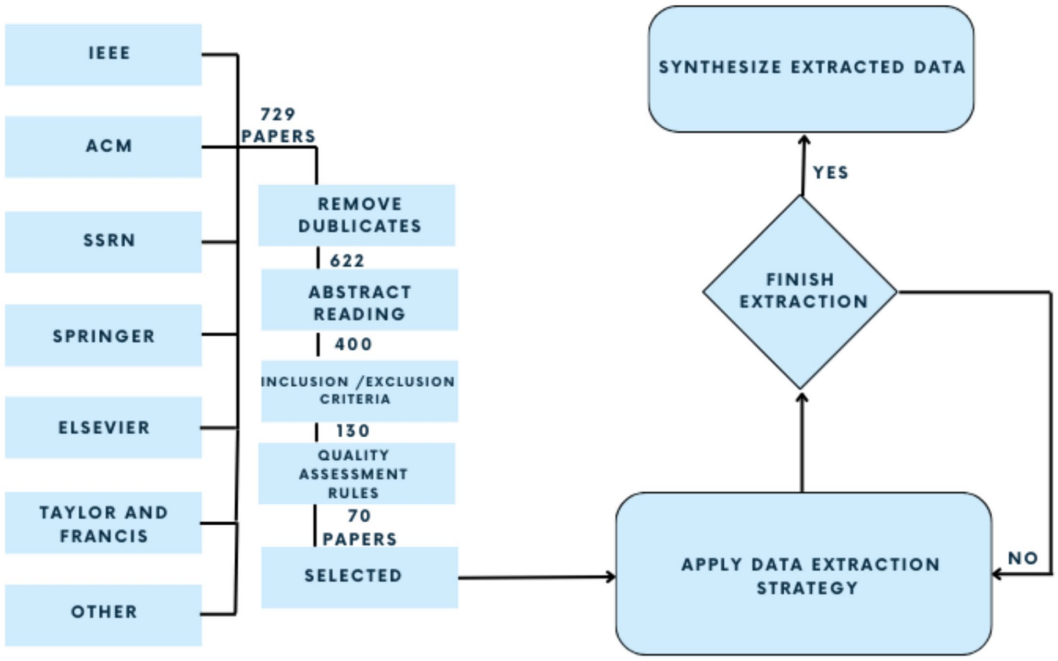

FIGURE 2
Applied research methodology.

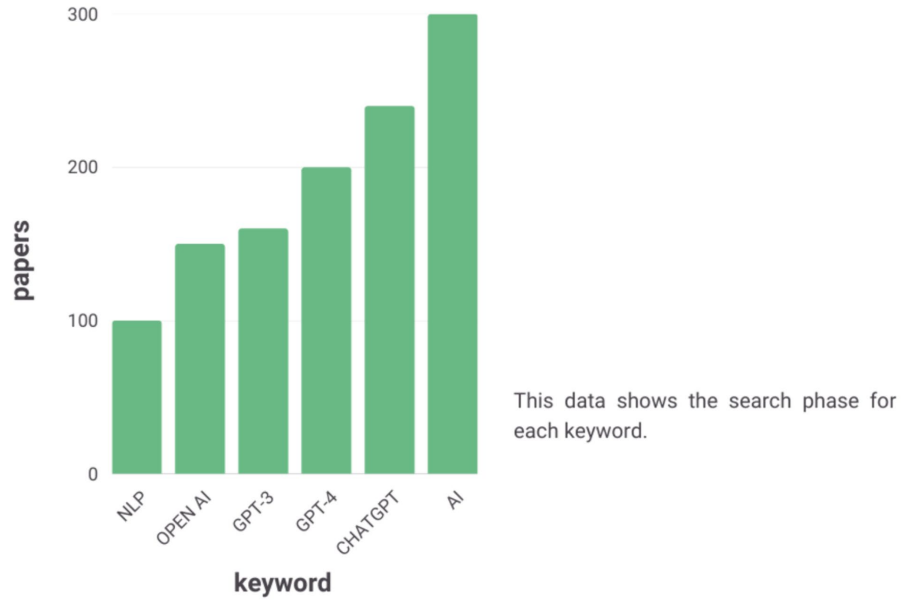

FIGURE 3
Keywords utilized in the searching phase.

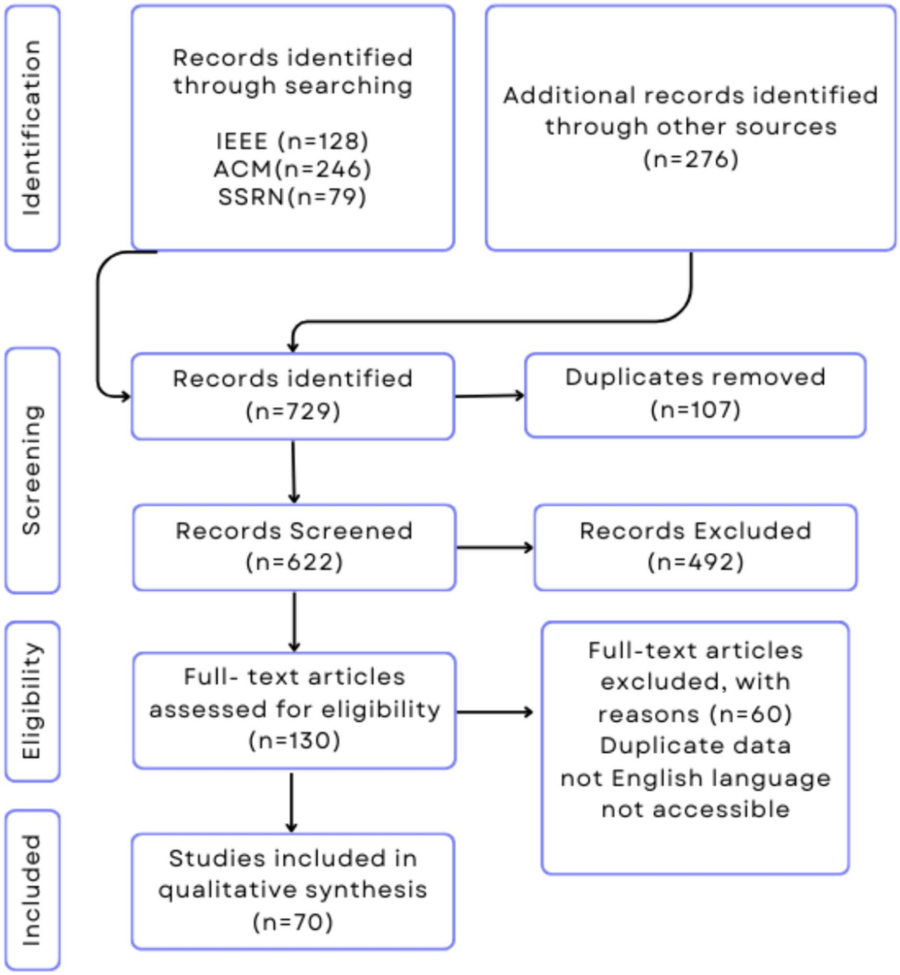

FIGURE 4
PRISMA flow diagram.

2. Generating initial scratches: initial scratches were created to identify interesting features or patterns within the data relevant to the research objectives.
3. Searching for themes: scratches were then organized into potential themes, which represent patterns of meaning across the dataset.
4. Reviewing themes: themes were reviewed to ensure they accurately represent the data and align with the research objectives.
5. Defining and naming themes: each theme was defined and given a clear name (benefits, challenges, ethical…etc.) that succinctly captures its essence.
6. Finalizing the analysis: the final thematic map was created, documenting the relationships between themes and providing a comprehensive overview of the findings.

3.1 Research questions

We aim to investigate the perceived benefits and challenges of using ChatGPT as a conversational AI tool in educational settings. We will explore how ChatGPT influences student engagement and learning outcomes in education. Additionally, we aim to identify the ethical considerations and safeguards that should be implemented when deploying ChatGPT in educational contexts. Furthermore, we will examine how the integration of ChatGPT affects the role of educators and the teaching-learning process. By addressing these research questions, we seek to understand the impact and implications of incorporating ChatGPT into educational environments.

1. What are the perceived benefits and challenges of using ChatGPT as a conversational AI tool in educational settings?
2. How does the use of ChatGPT in education influence student engagement and learning outcomes?
3. What ethical considerations and safeguards should be implemented when deploying ChatGPT in educational contexts?
4. How does the integration of ChatGPT affect the role of educators and the teaching-learning process?

The Populations, Interventions, Comparators, Outcomes, and Study Designs (PICOS) framework for our systematic review is outlined as follows:

- Population: ChatGPT users in educational settings, including teachers and students.
- Intervention: Using ChatGPT in the classroom as a conversational AI tool.
- Comparator: Inferred comparisons are made between educational environments with and without AI tools and between pre- and post-integration outcomes.
- Outcomes: educator adaptation, student engagement and learning outcomes, and ethical considerations.
- Study Designs: The review focuses on various study designs included in the selected papers, ranging from qualitative analyses to mixed-methods approaches

3.2 Search strategy

The search method utilized in this survey can be described in detail as follows:

3.2.1 Search terms

We used specific search terms related to our research questions for the survey. We also explored additional terms from specialized resources and used Boolean operators like "AND" and "OR" to refine the search results. This approach helped us find relevant articles and gather a comprehensive range of literature for our study

- "AI" OR "Artificial intelligence" AND "Chatgpt" OR "NLP"
- "Machine learning" AND "Chatgpt."
- "Academia" AND "Chatgpt"
- "Education" AND "Chatgpt"
- "Large Language models "AND "Chatgpt" AND "artificial intelligence" OR "AI"
- "Open Ai" AND "Chatgpt"
- "GPT4" OR "Chatgpt" AND "education"

3.2.2 Survey resources

To locate the required research articles, we referred to the following digital libraries: IEEE Explorer, Springer, Elsevier Science Direct, ACM Digital Library, and SSRN.

3.2.3 Search phase

The research articles were found in the relevant digital libraries using the earlier search criteria. After applying inclusion and exclusion criteria, 70 sources were included in this study.

3.3 Study selection

After applying the search criteria, we obtained a list of approximately 729 publications. However, we conducted a rigorous screening process to retain only the relevant articles, resulting in a final selection of 70 papers published between 2022 and 2023. The following outlines the steps involved in the filtration and selection process:

- Elimination of duplicate articles obtained from different libraries and authors.
- Application of inclusion and exclusion criteria to remove irrelevant articles and retain those that meet the inclusion criteria.
- Inclusion of high-quality papers that adhere to quality evaluation guidelines.
- Continually search for comparable articles and repeat steps 3 and 4 on the newly identified articles.

Table 2 shows the criteria used during the inclusion and exclusion phases.

3.4 Quality assessment rules

Quality Assessment Rules (QARs) were utilized to assess the obtained articles' suitability in addressing the study questions. A set of

TABLE 2 Exclusion and inclusion criteria.

Exclusion criteria	Inclusion criteria
• Machine learning articles that do not discuss ChatGPT in education or academic integrity are not included. • Articles that do not compare ChatGPT models to know the accuracy of the models. • Do not include any publications that have not been peer-reviewed.	• Machine learning articles regarding ChatGPT in education or academic integrity. • A study comparing the models in ChatGPT. • Only include articles from journals and conferences.

10 QARs was created, with each rule assigned a maximum score of 1 out of 10. The scoring was based on the following formula: "completely responded" = 1, "above average" = 0.75, "average" = 0.5, "below average" = 0.25, and "not answered" = 0. The article's overall score was calculated by summing the points obtained from all 10 QARs. If the total score was five or above, the article was deemed acceptable; otherwise, it was excluded. The selected research articles and their respective QAR scores can be found in Table 9 in Appendix A.

QAR1: Are the research objectives related to ChatGPT clearly stated?

QAR2: Is the ChatGPT model version and architecture identified?

QAR3: Is the scope and application of ChatGPT in the study well-defined?

QAR4: Are the methodologies used to evaluate ChatGPT's performance clearly described?

QAR5: Are the strengths of ChatGPT in the context of the study well explained?

QAR6: Are the limitations of ChatGPT in the context of the study well explained?

QAR7: Are the evaluation metrics and testing results for ChatGPT reported?

QAR8: Are the recommendations and future directions of ChatGPT in the context of the study well explained?

QAR9: Are the evaluation metrics for ChatGPT compared to other methods or models?

QAR10: Does the study contribute to understanding ChatGPT's potential and limitations in the academic community or industry?

3.5 Data extraction strategy

The compiled list of articles was the basis for extracting the relevant information to address the research questions. Each article's title, publication year, publication type, publisher source, description, keywords, paper theme related to RQ1, limitations associated with RQ2, advantages/opportunities associated with RQ3, and recommendations related to RQ4 were among the data retrieved from each paper. However, it is essential to note that not all articles addressed all the research questions.

3.6 Synthesis of extracted data

The extracted data for each research question were synthesized to analyze and summarize the findings related to paper themes, limitations, advantages, and recommendations. For RQ1, the paper themes were identified by categorizing the main topics explored in each publication. RQ2 involved examining the limitations mentioned in the articles to identify common challenges or shortcomings associated with using ChatGPT in education. In addressing RQ3, the advantages or opportunities of using ChatGPT in education were synthesized to understand the positive impacts and potential benefits. For RQ4, recommendations were gathered, combining qualitative insights and quantitative data, to provide practical suggestions for deploying and implementing ChatGPT in educational settings. Synthesis of this data gave a comprehensive understanding of the paper's themes, limitations, advantages, and recommendations concerning ChatGPT's use in education.

4 Results and discussion

The outcomes and findings of this survey will be discussed in the following subsection for each RQ.

4.1 Benefits and challenges of using ChatGPT in education

In this RQ, we aim to investigate the benefits and challenges of using ChatGPT, which researchers have widely studied. After reviewing each selected research article and analyzing it, we plotted a bar chart of the frequency of each benefit and challenge we found in each paper, represented in Figures 5, 6. According to Figure 5, based on the analysis of the selected research articles, the most frequent benefit identified in the papers is that ChatGPT enhances learning. This indicates that researchers have found evidence suggesting that using ChatGPT in various applications positively impacts learning (Kasneci et al., 2023). This benefit could refer to how ChatGPT can be used as a virtual tutor or assistant to provide users with personalized and interactive learning experiences (Hopkins et al., 2023). Another benefit often associated with using ChatGPT, which could be included in the analysis, is improved access to information. ChatGPT can act as a conversational interface, allowing users to ask questions and receive relevant information quickly and conveniently.

With ChatGPT, users can access a wide range of information without the need to navigate through complex interfaces or conduct extensive searches (O'Connor and ChatGPT, 2023). The conversational nature of ChatGPT allows for natural language queries, making it easier for users to express their information needs and obtain the desired information more conversationally and interactively. Additionally, ChatGPT can be integrated with various data sources and APIs, enabling it to retrieve real-time information or access specific databases. This can be particularly beneficial in domains where up-to-date information is crucial, such as news, weather updates, etc.

Overall, improved access to information is a significant advantage of ChatGPT, as it simplifies retrieving data and enables users to obtain relevant answers more efficiently.

According to Figure 6, which represents the frequency of challenges associated with ChatGPT, it is observed that the most common challenges identified in the research articles are:

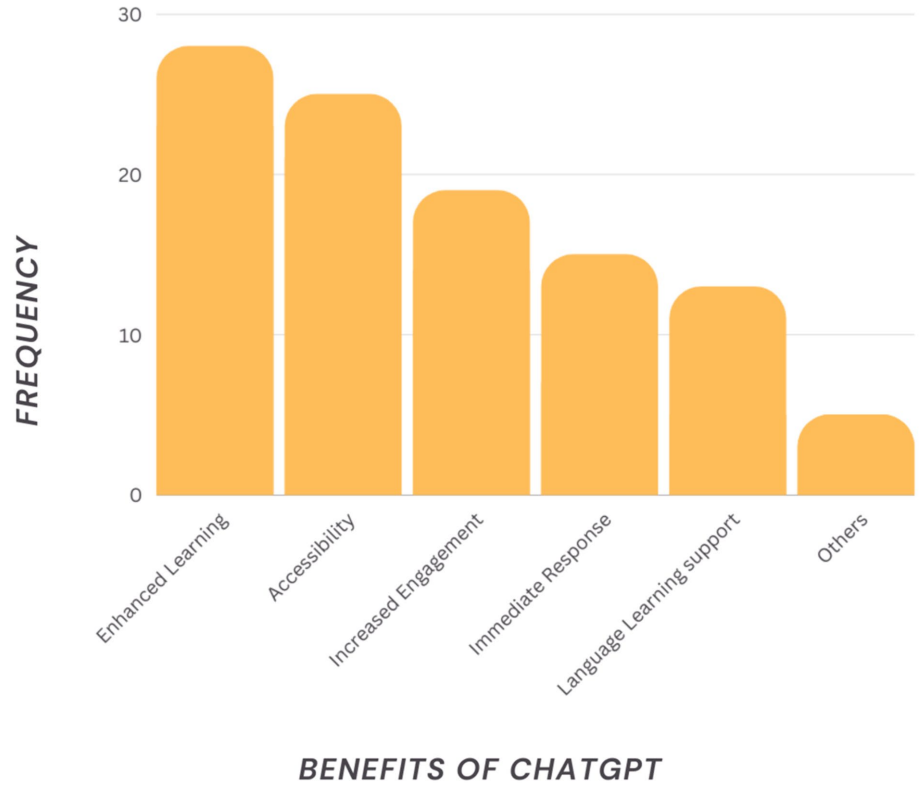

FIGURE 5
The benefits of ChatGPT.

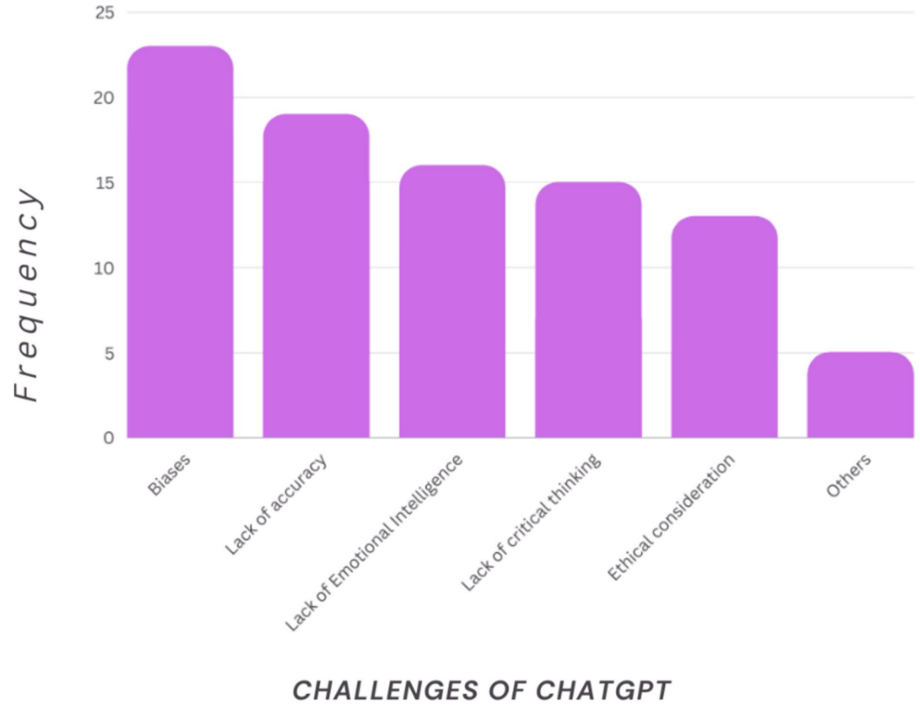

FIGURE 6
The challenges of ChatGPT.

ChatGPT faces several challenges that must be addressed to improve its performance and ethical considerations. One such challenge is the presence of biases in AI models, including ChatGPT. Language models are trained on vast amounts of text data, which may inadvertently contain tendencies in the data sources. These biases can lead to unfair or discriminatory responses generated by ChatGPT. Addressing biases requires careful data curation, identification, and mitigation techniques to ensure fairness and inclusivity in the AI model's responses.

Another significant challenge is the need for more accuracy in ChatGPT's responses. While language models generate text based on patterns observed in their training data, they need proper understanding or knowledge. Consequently, they may need accurate or correct information in certain situations. Achieving higher accuracy involves advancing training methodologies, accessing reliable and diverse datasets, and developing mechanisms to verify and fact-check the data generated by ChatGPT (Ahn, 2023).

The lack of emotional intelligence is another challenge for ChatGPT. It may need help understanding and appropriately responding to emotional cues expressed during conversations. Emotions play a vital role in human communication, and the absence of emotional intelligence in ChatGPT hinders its ability to provide sensitive responses. Enhancing emotional intelligence requires incorporating affective computing techniques, sentiment analysis, and the capability to recognize and respond to users' emotional states.

Additionally, ChatGPT models often lack critical thinking abilities. While they can generate coherent responses, they may need help with complex queries requiring deeper analysis, reasoning, or inference. Advancing essential thinking capabilities involves exploring techniques such as knowledge incorporation, logical reasoning, and the ability to handle abstract or ambiguous queries (Zielinski et al., 2023) effectively.

Ethical considerations are a multifaceted challenge when using ChatGPT. Transparency ensures users know they interact with an AI system and understand its limitations and capabilities. Accountability involves addressing responsible development, deployment, and use of AI models like ChatGPT. Safeguarding user privacy and data protection is essential for maintaining user trust. Additionally, measures must be in place to prevent the malicious use of biased applications of ChatGPT.

Addressing these challenges requires collaborative efforts from researchers across various disciplines, including AI, ethics, psychology, linguistics, and more. It involves refining model architectures, improving training methodologies, incorporating external knowledge sources, developing robust evaluation metrics, and implementing guidelines and regulations for responsible AI development and deployment.

By actively working on these challenges, researchers aim to enhance the benefits of ChatGPT while mitigating its limitations. This approach paves the way for more reliable, accurate, and ethically conscious conversational AI systems.

4.2 Student engagement and learning outcomes influence of ChatGPT in education

The use of ChatGPT in education has the potential to influence student engagement and learning outcomes greatly. By analyzing the provided paragraph and considering the available literature, it becomes evident that ChatGPT's advanced capabilities contribute to enhanced educational experiences. One significant factor is the program's ability to provide personalized student interaction. Through tailored responses and prompt feedback, ChatGPT creates an interactive learning environment that captures students' attention and encourages active participation (Looi, 2023).

Moreover, ChatGPT's extensive knowledge base allows it to quickly generate accurate and relevant information. This accessibility to a wide range of knowledge empowers students to explore diverse perspectives and engage in critical thinking. ChatGPT supports students in understanding complex concepts by providing comprehensive and up-to-date information, thereby improving their learning outcomes.

Furthermore, ChatGPT's availability and quick response time significantly impact student engagement (Zielinski et al., 2023). Unlike traditional methods, where students may need to search for information through web browsing or rely on human assistance, ChatGPT provides immediate answers and guidance. This convenience saves time and keeps students actively engaged in learning, as they can access information whenever needed.

However, it is crucial to acknowledge the limitations and challenges associated with using ChatGPT in education. At the same time, the program's impressive capabilities should be seen as a partial substitute for human educators. The importance of human interaction, guidance, and mentorship must be supported. Maintaining a balance between AI and human involvement is essential to ensure a holistic learning experience that addresses academic and socio-emotional needs.

Furthermore, the accuracy and reliability of the information generated by ChatGPT should be carefully considered. As with any AI system, "garbage in, garbage out" applies. If the program is trained on inaccurate or biased data, it may produce misleading or incorrect information (Ahn, 2023). Therefore, it is crucial to validate and verify the information provided by ChatGPT through reputable sources and critical analysis.

In conclusion, the use of ChatGPT in education has the potential to influence student engagement and learning outcomes positively. Its personalized interaction, prompt responses, and access to a wide range of knowledge contribute to an enriched learning experience. However, it is essential to balance AI and human involvement and critically evaluate the information provided by ChatGPT. By harnessing AI's power while embracing human educators' invaluable role, we can create a learning environment that maximizes student engagement and fosters meaningful learning outcomes. Based on the selected articles, we categorized the factors previously discussed and presented them in Table 3. Table 3 summarizes the main points discussed in the paragraph, highlighting the factors influencing student engagement and learning outcomes when using ChatGPT in education.

4.3 Ethical considerations and safeguards in deploying ChatGPT in education

When deploying ChatGPT or similar AI chatbots in educational contexts, it is crucial to establish a comprehensive framework of ethical considerations and safeguards to ensure responsible and

TABLE 3 Influence of ChatGPT in education.

Factors	Influence	Ref
Personalized interaction	Tailored responses and prompt feedback	Khan et al. (2023)
	Interactive learning environment	Salvagno et al. (2023)
	Captures attention and encourages participation	Looi (2023)
Access to knowledge	Quick generation of accurate and relevant info	Susnjak (2022)
	Empowers exploration and critical thinking	Zhai (2023)
	Supports understanding of complex concepts	Lee (2023)
Availability and response time	Immediate answers and guidance	Badini et al. (2023)
	Saves time and keeps students engaged	Khan et al. (2023)
	On-demand access to information	Susnjak (2022)
Limitations and challenges	Not a complete substitute for human educators	Khan et al. (2023)
	Importance of human interaction and mentorship	Huang et al. (2023)
Accuracy and reliability	Verification and validation of information	Yang et al. (2023)
	Potential for misleading or incorrect info	Yang et al. (2023)
	Critical analysis and reputable sources are needed	Yang et al. (2023)

beneficial use. Clear guidelines and policies should be developed to outline the appropriate use of AI-generated content, including any limitations or restrictions. This helps establish a standardized approach to the deployment of ChatGPT and ensures that its use aligns with ethical principles.

Human supervision plays a vital role in the responsible deployment of ChatGPT. Teachers or educators should be actively involved in the process (Huang et al., 2023), providing guidance and oversight to ensure the accuracy and integrity of the content generated by the AI chatbot. Their involvement helps prevent the dissemination of misinformation or biased information, as they can intervene when necessary and provide additional context or clarification to the students.

Proper training and awareness programs should be provided to teachers and educators using ChatGPT. They should be familiarized with the capabilities and limitations of the AI chatbot and trained to understand the potential biases (Khan et al., 2023) and errors that can arise from AI-generated content. By being well-informed, they can effectively utilize the tool and address ethical concerns.

Encouraging critical thinking and evaluation skills among students is crucial when utilizing ChatGPT in an educational context. Students should be taught to approach the information generated by the AI chatbot with a discerning mindset, questioning and verifying its accuracy through independent research and analysis. This empowers them to develop critical thinking skills and avoid mindlessly accepting information provided by AI systems.

Privacy and data protection should be paramount when deploying ChatGPT in an educational setting. Educational institutions must prioritize students' privacy and ensure their personal information is securely stored and protected. Data encryption, access controls, and compliance with relevant data protection regulations should be in place to safeguard student data.

Regular monitoring and evaluation of the use of ChatGPT should be conducted to assess its effectiveness and address any ethical concerns that may arise. This monitoring can involve reviewing the interactions between students and the AI chatbot, analyzing the quality and accuracy of the generated content, and gathering feedback from both students and teachers. By actively monitoring its performance, institutions can identify and address issues, refine the system, and enhance the overall user experience.

Transparency, source attribution, user education, and regular review and auditing processes are additional components that contribute to the ethical deployment of ChatGPT (Khan et al., 2023). Transparently informing users that they are interacting with an AI chatbot and establishing clear attribution guidelines for sources the system uses promote transparency and academic integrity. User education programs should be implemented to familiarize students with AI chatbots' capabilities and limitations and encourage responsible use. Regular review and auditing processes help ensure ongoing adherence to ethical guidelines and provide opportunities for improvement and refinement.

By integrating these ethical considerations and safeguards, educational institutions can foster responsible use of AI chatbots, maintain ethical standards, and enhance the overall learning experience for students. By establishing clear guidelines, providing human supervision, promoting critical thinking skills, prioritizing privacy, conducting regular monitoring, and upholding transparency, institutions can harness the benefits of AI technology while mitigating potential risks and ethical concerns—also, a scientific paper talks about academic integrity consideration (Helberger and Diakopoulos, 2023). After analyzing the ethical considerations discussed within the selected articles, the results are shown in the following tables. These tables provide an alternative representation of the ethical considerations and safeguards discussed in the paragraph. Table 4 focuses on ethical considerations, such as clear guidelines, human supervision, training, critical thinking, and privacy. Table 5 highlights the corresponding safeguards and actions, including monitoring, transparency, user education, and regular review and auditing processes.

4.4 ChatGPT effects on educators and teachers

The integration of ChatGPT in teaching and learning can significantly impact educators' roles and the entire teaching-learning

TABLE 4 Ethical Considerations in Deploying ChatGPT in Education.

Ethical considerations	Safeguards and actions	Ref
Clear guidelines and policies	Develop clear usage guidelines for AI-generated content	Kasneci et al. (2023)
	Define limitations and restrictions for ChatGPT's use	Khan et al. (2023)
	Establish standardized deployment practices	Zhai (2023)
Human supervision	Ensure active involvement of teachers or educators	Looi (2023)
	Provide guidance and oversight for AI-generated content	Sun and Hoelscher (2023)
	Intervene to prevent misinformation or bias	Azari (2022)
Training and awareness	Train teachers on ChatGPT capabilities and limitations	Lecler et al. (2023)
	Educate educators about potential biases and errors	Lee (2023)
	Address ethical concerns during ChatGPT's use	Zhu et al. (2023)
Encouraging critical thinking	Foster critical thinking skills among students	Yang et al. (2023)
	Teach students to question and verify AI-generated info	de Angelis et al. (2023)
	Promote independent research and analysis	Susnjak (2022)
Privacy and data protection	Prioritize student privacy and data protection	Haleem et al. (2022)
	Implement secure storage and compliance with regulations	de Angelis et al. (2023)
	Apply data encryption and access controls	Azari (2022)

TABLE 5 Safeguards in deploying ChatGPT in education.

Safeguards	Actions and Strategies	Ref
Regular monitoring and evaluation	Monitor student interactions with ChatGPT	AlAfnan et al. (2023)
	Assess quality and accuracy of AI-generated content	Aydın and Karaarslan (2023)
	Collect feedback from students and educators	Bishop (2023)
Transparency and attribution	Clearly inform users about AI chatbot interactions	McGee (2023b)
	Establish guidelines for source attribution	Aydın and Karaarslan (2022)
	Promote transparency and academic integrity	Megahed et al. (2023)
User education programs	Conduct educational programs on ChatGPT's capabilities	Ante and Demir (2023)
	Educate students on responsible and critical use	Alshater (2022)
	Address potential ethical concerns and challenges	Shahriar and Hayawi (2023)
Regular review and auditing	Conduct regular reviews of ChatGPT's performance	Lubowitz (2023)
	Audit ethical adherence and identify areas for improvement	IEEE Spectrum (2023)
	Refine and enhance ChatGPT based on feedback and analysis	Gozalo-Brizuela and Garrido-Merchan (2023)

process. ChatGPT can revolutionize traditional instructional practices with its interactive and conversational capabilities and open new possibilities for personalized and engaging learning experiences.

One of the critical ways ChatGPT affects educators' roles is by shifting their focus from being the primary sources of information to becoming facilitators and guides (DiGiorgio and Ehrenfeld, 2023). Instead of simply delivering content, educators can now assist students in navigating their interactions with ChatGPT. They can provide guidance on formulating practical questions, help students interpret and analyze the responses generated, and facilitate meaningful discussions based on the information provided. This transition empowers educators to take on a more active role in supporting and scaffolding student learning experiences.

Moreover, the integration of ChatGPT enables personalized and differentiated learning. Students can ask questions in their own words and receive tailored responses based on their specific formulations. This feature allows educators to address individual student needs and provide targeted support. By analyzing the responses generated by ChatGPT, educators can gain insights into students' understanding and adapt their instructional strategies, fostering personalized learning experiences that cater to each student's unique requirements.

In addition to personalized learning, ChatGPT promotes the development of inquiry and questioning skills among students. Educators can guide students in formulating practical questions and help them interpret and analyze the responses they receive. Conversations with ChatGPT encourage students to think critically, evaluate information, and refine their questioning techniques. This process enhances their ability to ask thoughtful and relevant questions and cultivates a deeper understanding of the subject matter.

Educators integrating ChatGPT into their teaching practices must monitor and assess how students use this technology as a learning tool. Educators can gain valuable insights into students' learning

TABLE 6 Impact of ChatGPT on teachers' role.

Aspect	Description	Ref
Shift in focus	Educators transition from being primary sources of information to becoming facilitators and guides.	Kasneci et al. (2023)
Guidance and assistance	Educators assist students in formulating effective questions, interpreting responses, and facilitating discussions.	Salvagno et al. (2023)
Active role	Educators actively support and scaffold student learning experiences.	Pavlik (2023)
Personalized learning	ChatGPT enables tailored responses based on students' specific questions, allowing educators to address individual needs.	Haleem et al. (2022)
Insights and adaptation	Educators analyze ChatGPT responses to gain insights into students' understanding and adapt instructional strategies.	Fijačko et al. (2023)
Inquiry and questioning	Educators guide students in formulating questions, promoting critical thinking and deeper subject understanding.	Huh (2023)
Monitoring and feedback	Educators observe students' utilization of ChatGPT, provide feedback, and address misconceptions for enhanced learning.	Khan et al. (2023)
Ethical considerations	Educators guide responsible and ethical use of ChatGPT, fostering digital literacy and ethical decision-making.	Mhlanga (2023)

TABLE 7 Student-centric benefits of ChatGPT integration.

Aspect	Description	Ref
Personalized learning	Students receive tailored responses based on their specific questions, addressing individual learning needs.	Ollivier et al. (2023)
Differentiated instruction	ChatGPT allows for targeted support and individualized assistance, catering to diverse student requirements.	Zhai (2023)
Inquiry and questioning	Students engage in critical thinking, refine questioning techniques, and cultivate a deeper understanding.	Huang et al. (2023)
Active learning	Interactive conversations with ChatGPT promote active participation and engagement in the learning process.	Sun (2022)
Timely feedback	Students receive immediate feedback from ChatGPT, aiding in the timely clarification of doubts and queries.	Susnjak (2022)

processes by observing the types of questions asked, the quality of responses received, and the level of student engagement. This monitoring enables educators to provide timely feedback, address misconceptions, and ensure that students are effectively leveraging ChatGPT to enhance their learning outcomes.

It is important to note that the integration of ChatGPT also raises ethical considerations. Educators must guide students in using AI technologies like ChatGPT responsibly and ethically. This involves discussing privacy, data security, and potential biases in the training data that may impact the responses generated. By facilitating conversations around these ethical considerations, educators play a vital role in fostering digital literacy, responsible AI usage, and ethical decision-making.

In conclusion, the integration of ChatGPT in teaching and learning has transformative implications for the role of educators and the teaching-learning process. By shifting the focus from content delivery to facilitation and guidance, educators can empower students to participate in their learning actively. The personalized and differentiated nature of ChatGPT allows educators to address individual student needs, while its conversational capabilities promote inquiry and questioning skills. However, educators must also be mindful of the ethical considerations associated with using AI technologies and guide students in their responsible and ethical usage. With thoughtful integration and guidance, ChatGPT has the potential to revolutionize interactive learning environments and create engaging and personalized educational experiences. Also, this paper suggests what faculty should do to improve the educational role (McGee, 2023a). Based on the most frequent impact discussed in the selected articles, we categorize the aspects in Tables 6, 7. Table 6 represents the impact of ChatGPT on educators' positions, and Table 7 represents ChatGPT integration's benefits.

4.5 Findings

The first set of findings underscores the potential of integrating ChatGPT with other AI technologies to enhance human-computer interactions, enabling personalized responses and intuitive experiences (Aljanabi and ChatGPT, 2023). This integration has transformative impacts across various domains (Thorp, 2023). In education, ChatGPT fosters dynamic learning environments, promoting deep engagement and reflective thinking among students, thus creating opportunities for innovative teaching methods (Ollivier et al., 2023).

ChatGPT's adaptive capabilities enable personalized learning experiences tailored to individual student needs, fostering inclusive education, and enhancing motivation and academic performance (Pericles 'asher' Rospigliosi, 2023). It also plays a significant role in academic writing processes, assisting researchers in drafting, summarizing, and conducting literature reviews (Bin Arif et al., 2023). Concerns regarding the accuracy and integrity of AI-generated scientific writing are addressed, emphasizing the importance of robust fact-checking and verification processes (Alkaissi and McFarlane, 2023).

Exploration of ChatGPT's potential in detecting implicit hateful speech is noted, with caution urged in its utilization as a data annotation tool to prevent potential misinformation (Fijačko et al., 2023). Ethical considerations loom large in the discussion surrounding

TABLE 8 Summary of key findings.

Ref.	Key Findings
Aljanabi and ChatGPT (2023)	• Integration of ChatGPT with other AI technologies enhances human-computer interactions. • Personalized responses and intuitive experiences are facilitated.
Thorp (2023)	• ChatGPT's advancements have transformative impacts across various domains. • This sets the stage for a comprehensive exploration of its potential.
Ollivier et al. (2023)	• ChatGPT fosters dynamic learning environments. • It promotes deep engagement and reflective thinking among students. • Opportunities for innovative teaching methods are created.
Pericles 'asher' Rospigliosi (2023)	• ChatGPT's adaptive capabilities enable a student-centric approach to personalized learning. • Educators can tailor content and teaching methodologies to individual student needs. • This fosters inclusive education and enhances student motivation and academic performance.
Kasneci et al. (2023)	• ChatGPT enhances learning by providing personalized and interactive experiences.
Bin Arif et al. (2023)	• ChatGPT streamlines academic writing processes in various fields. • It assists researchers in drafting, summarizing, and conducting literature reviews.
Alkaissi and McFarlane (2023)	• Concerns regarding the accuracy and integrity of AI-generated scientific writing are addressed. • Robust fact-checking and verification processes are advocated to uphold academic credibility.
Fijačko et al. (2023)	• ChatGPT's potential in detecting implicit hateful speech is explored. • Caution is urged in utilizing it as a data annotation tool to prevent potential misinformation.
DiGiorgio and Ehrenfeld (2023)	• Responsible deployment of ChatGPT's capabilities and consideration of ethical implications are emphasized. • Positive and equitable integration of AI language models in diverse applications is advocated while upholding ethical standards.
Hopkins et al. (2023)	• ChatGPT improves access to information through its conversational interface and integration with various data sources.
O'Connor and ChatGPT (2023)	• Improved access to information simplifies data retrieval and enables users to obtain relevant answers more efficiently.
Ahn (2023)	• Challenges with ChatGPT include biases in AI models, the need for accuracy in responses, lack of emotional intelligence, and the absence of critical thinking abilities.
Zielinski et al. (2023)	• Ethical considerations include transparency, accountability, privacy protection, and preventing biased applications of ChatGPT.
Looi (2023)	• ChatGPT in education enhances student engagement and learning outcomes through personalized interaction and quick access to accurate information.
Huang et al. (2023)	• Human supervision is crucial for responsible deployment of ChatGPT in education to ensure accuracy and integrity of the content generated.
Khan et al. (2023)	• Training programs for educators are necessary to understand the capabilities and limitations of ChatGPT and address potential biases in AI-generated content.
Helberger and Diakopoulos (2023)	• Ethical considerations include promoting critical thinking skills among students and safeguarding privacy and data protection.
McGee (2023a)	• ChatGPT integration in teaching shifts educators' roles from content delivery to facilitation and guidance, promoting personalized and differentiated learning experiences.
Ours	• Identifies benefits of using ChatGPT in education, including enhanced learning and improved access to information. • Challenges such as biases in AI models and the need for ethical considerations are highlighted, emphasizing the importance of transparency and accountability in deployment.

ChatGPT's deployment, with responsible usage and ethical implications emphasized (DiGiorgio and Ehrenfeld, 2023).

Despite its benefits, challenges with ChatGPT include biases in AI models, the need for accuracy in responses, lack of emotional intelligence, and the absence of critical thinking abilities (Ahn, 2023). In education, human supervision is deemed crucial to ensure the accuracy and integrity of generated content (Huang et al., 2023). Training programs for educators are necessary to understand the capabilities and limitations of ChatGPT and address potential biases in AI-generated content (Khan et al., 2023).

Ethical considerations extend to promoting critical thinking skills among students and safeguarding privacy and data protection (Helberger and Diakopoulos, 2023). Integration of ChatGPT in teaching shifts educators' roles from content delivery to facilitation and guidance, promoting personalized and differentiated learning experiences (McGee, 2023a). Overall, Table 8 presents a synthesis of findings from various research papers, each contributing to our understanding of the applications and implications of integrating ChatGPT in different contexts.

5 Conclusion

This systematic literature review studied the impact of ChatGPT in education by reviewing 70 scientific research articles published between 2022 and 2023. The review focused on several perspectives, including the benefits and challenges of ChatGPT, student engagement, learning outcomes, ethical considerations, safeguards, and the effects of ChatGPT on educators and teachers. By synthesizing the findings and observations from these articles, valuable insights were gained regarding the efficient use of ChatGPT in educational settings.

In response to the first RQ, it aims to explore the positive impacts of ChatGPT in education, focusing on enhanced learning and improved information access. It also addresses challenges, including biases in AI models, accuracy issues, emotional intelligence, critical thinking limitations, and ethical concerns. The goal is to identify methods to enhance ChatGPT's performance while promoting ethical and responsible use in educational settings.

This second RQ investigates ChatGPT's impact on education. It examines personalized interaction, quick knowledge access, and immediate responses to student engagement and learning outcomes. While AI's advantages are recognized, maintaining balance with human educators is essential. Ensuring information accuracy from ChatGPT is also emphasized. The goal is an enriched learning experience, maximizing student engagement and meaningful outcomes through effective AI-human collaboration.

Moving on to the third RQ, Deploying AI chatbots in education demands an ethical framework with content guidelines, preventing misinformation. Teacher supervision ensures accuracy, while training raises AI awareness and tackles biases. Empowering critical thinking enables students to verify information independently. Privacy and data protection are paramount, and regular monitoring addresses ethical concerns. Transparency, education, and reviews foster responsible AI use for a positive and secure learning experience.

Finally, the fourth RQ focused on the effects of ChatGPT on educators and teachers. They assist students in personalized learning with ChatGPT, fostering critical thinking and understanding. Educators monitor usage, offer feedback, and address ethical considerations, promoting digital literacy. Thoughtful integration creates engaging and personalized learning environments, empowering students and enhancing the overall educational experience.

In conclusion, this systematic literature review highlights the potential benefits, challenges, ethical considerations, and effects of integrating ChatGPT in education. It underscores the importance of addressing challenges, establishing ethical guidelines, and leveraging the strengths of ChatGPT while recognizing the vital role of human educators. By doing so, educational institutions can harness the advantages of ChatGPT to enhance student engagement, improve learning outcomes, and foster responsible and ethical use of AI technology in education.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

AM: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Writing – review & editing. MA: Conceptualization, Formal analysis, Funding acquisition, Investigation, Project administration, Software, Supervision, Validation, Writing – review & editing. AS: Data curation, Formal analysis, Methodology, Resources, Software, Visualization, Writing – original draft. FD: Conceptualization, Formal analysis, Methodology, Project administration, Supervision, Validation, Writing – original draft, Writing – review & editing.

Funding

The author(s) declare that financial support was received for the research, authorship, and/or publication of this article. This work was supported by University of Sharjah, OpenUAE Research and Development Group.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/feduc.2024.1379796/full#supplementary-material

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