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ChatGPT in Education:
Ethical Considerations and Sentiment Analysis

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ABSTRACT

AI chatbots, e.g. ChatGPT, are becoming increasingly popular in education as a means to enhance student learning experiences and improve teaching efficiency. This study utilizes NVivo 12 Plus to examine the role of AI chatbots in education, ethical considerations, and sentimental analysis regarding the utilization of ChatGPT in education. ChatGPT has revolutionized education, but their use raises ethical concerns. They can enhance language learning, but may lead to plagiarism and information overload. Students may not develop discrimination skills and may rely on ChatGPT, leading to concerns about academic dishonesty and a failure to develop cognitive and analytical skills. The use of ChatGPT in clinical education also raises accountability and liability concerns regarding the use of patient information for educational purposes. Guidelines should be established to ensure privacy rights are upheld. Finally, the positive sentiment category was populated by predominantly positive sentiments, followed by neutral and negative sentiments. Future research on ChatGPT in education should focus on its application effectiveness in various educational settings and ethical considerations.

KEYWORDS

AI Chatbots, ChatGPT, Education, Ethical Considerations, Sentimental Analysis

INTRODUCTION

In the field of education, the significance of AI chatbots is threefold (Farazouli et al., 2023). Firstly, AI chatbots can personalize the learning experience for each student by adapting to their unique needs and learning styles. Secondly, AI chatbots can provide students with anytime, anywhere access to learning resources, thus increasing the efficiency of the education process. Finally, AI chatbots can help educators monitor students' progress and identify areas where they need additional support.

Despite their potential benefits, the use of AI chatbots in education is also associated with ethical concerns (Babu & Sharmila, 2023). One of the main ethical issues is the replacement of human-to-human interactions with AI chatbots in the classroom. This can lead to a loss of human connection and social skills in students, as well as a decrease in critical thinking skills since AI chatbots may provide ready-made answers instead of challenging students to think for themselves (Kooli, 2023).

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Additionally, AI chatbots may be biased or limited by their training data, leading to unintentional discrimination or exclusion of certain groups of students.

Sentimental analysis is a technique that can be employed to assess students' emotional states and monitor their progress in ChatGPT-based educational systems (Sudheesh et al., 2023). By analyzing textual data, sentimental analysis can determine the sentiment or emotional tone of the text. This analysis can help educators identify patterns or trends in sentiment across large datasets and provide insights into how individuals or groups are feeling or reacting to particular events or topics (M. Kim, 2021). Sentimental analysis can also be used to assess students' emotional states and monitor their progress throughout the learning process.

The research gap in this field lies in addressing the ethical concerns associated with the use of AI chatbots in education while leveraging their potential benefits (Jeyaraman et al., 2023). One approach to address this gap is to develop ChatGPT models that prioritize human-to-human interactions in the classroom while also leveraging the benefits of AI chatbots (Cai et al., 2023). Further research is needed to explore the effectiveness of sentimental analysis in assessing students' emotional states and monitoring their progress, as well as to ensure that ChatGPT models are bias-free and do not discriminate against any group of students (Sharma & Sharma, 2023).

This study utilizes NVivo 12 Plus to examine the role of AI chatbots in education, ethical considerations, and sentimental analysis regarding the utilization of ChatGPT in education. Through an accumulation of pertinent data, including articles, reports, research papers, news articles, interviews, and social media platforms, the research project is established (Heyman & Heyman, 2023). The data is subsequently categorized into nodes or groups linked to the aforementioned topics (Fan et al., 2022). The textual data is subject to a range of textual analysis techniques, such as word frequency analysis, theme analysis, and coding. These analytical methods yield relevant information and patterns. Additionally, sentimental analysis is conducted on the text data using NVivo 12 Plus' sentimental analysis feature to identify positive, negative, or neutral sentiment related to the topic (Kaushal & Yadav, 2023). Based on these findings, conclusions are drawn regarding the role of AI chatbots in education, ethical issues regarding ChatGPT usage, and sentimental analysis. The results are shared through collaboration with other researchers using NVivo 12 Plus' exportation of projects or presentation decks.

THEORETICAL FRAMEWORK

We use NVivo 12 Plus to study the role of AI chatbots in education, ethical issues in the use of ChatGPT in education, and sentimental analysis for several reasons. NVivo 12 Plus provides a robust platform for mixed methods data analysis, which combines both quantitative and qualitative data types (Kaushal & Yadav, 2022). This approach is particularly useful when studying complex topics like the ones mentioned, as it allows researchers to capture a more comprehensive understanding of the subject matter (Bufoni et al., 2017). By integrating numerical data (such as usage statistics or sentiment scores) with textual data (such as journal articles or social media posts), researchers can gain a deeper understanding of the role of AI chatbots in education, ethical issues related to ChatGPT usage, and public sentiment towards these topics (Sudheesh et al., 2023).

NVivo 12 Plus includes powerful text analysis tools that enable researchers to explore and understand large amounts of textual data (Hanjongim, 2009). These tools allow the identification of key terms, themes, and concepts within the text, as well as the extraction of meaningful quotes and codes. This analysis can provide insights into how AI chatbots are being used in education, ethical issues related to ChatGPT usage, and public sentiment towards these topics. By analyzing textual data, researchers can gain a better understanding of people's opinions, experiences, and viewpoints (Durian, 2002). NVivo 12 Plus includes a sentimental analysis feature that allows researchers to identify positive, negative, or neutral sentiment within text data. This feature can be used to analyze sentiment expressed towards AI chatbots in education or ethical issues related to ChatGPT usage,

providing insights into public sentiment and opinion (Sudheesh et al., 2023). By analyzing sentiment, researchers can gain a better understanding of people's reactions and emotions towards these topics.

NVivo 12 Plus allows researchers to import and integrate data from a variety of sources, including articles, reports, research papers, news articles, interviews, and social media platforms (Bufoni et al., 2017). This ability to bring together diverse data sources allows for a more comprehensive understanding of the role of AI chatbots in education, ethical issues, and sentimental analysis related to ChatGPT usage. By incorporating multiple data sources, researchers can capture a broader perspective and consider a wider range of viewpoints. NVivo 12 Plus supports collaborative research by allowing multiple researchers to work simultaneously on the same project (Elliott, 2022). This feature facilitates efficient data organization, analysis, and interpretation, leading to more robust and reliable research outcomes. By collaborating with other researchers, teams can share resources, expertise, and perspectives, enabling a more comprehensive and rigorous approach to studying complex topics like the ones mentioned (Chen & You, 2019).

LITERATURE REVIEW

AI chatbots, e.g. ChatGPT, are becoming increasingly popular in education as a means to enhance student learning experiences and improve teaching efficiency (Birenbaum, 2023). AI chatbots have the potential to significantly enhance student learning experiences and improve teaching efficiency in education (Baker et al., 2023). However, it is essential to carefully consider their use, taking into account data privacy, bias issues, and potential unintended consequences.

The Use of AI Chatbots in Education

AI chatbots have gained popularity in education due to their ability to personalize learning and provide on-demand assistance (Temsah et al., 2023). A literature review on the subject explores the benefits and challenges of using AI chatbots in education (Chan & Hu, 2023). One of the primary benefits is the personalization of learning. AI chatbots can analyze student data and provide individualized feedback, leading to improved student engagement and performance (Wu & Yu, 2023). They also offer a convenient and efficient means of delivering content and answering student questions.

However, there are concerns about the use of AI chatbots. One issue is the potential for bias and stereotyping in AI systems, which can lead to unintended consequences such as marginalizing certain groups of students (Baker et al., 2023). Another challenge is data privacy, as AI chatbots collect student data, raising concerns about data misuse and privacy breaches (Abd-alrazaq et al., 2023). Despite these challenges, AI chatbots have significant potential in education. They can enhance the learning experience by providing personalized feedback and on-demand assistance (Chang et al., 2023). However, it is essential to address concerns regarding bias, data privacy, and the role of human teachers to ensure that AI chatbots are used effectively in education (Oca et al., 2023).

Ethical Issues in the Use of ChatGPT in Education

ChatGPT, a powerful AI-based chatbot, has gained popularity in various fields, including education (Adeshola & Adepoju, 2023a). While it has numerous educational applications, its use raises several ethical concerns (Crawford et al., 2023). This literature review explores the ethical issues surrounding the use of ChatGPT in education. One of the primary ethical concerns with the use of ChatGPT in education is the potential for plagiarism (Jarrah et al., 2023). Since ChatGPT can generate original text, students may use it to produce written work without proper attribution or understanding of the content (Jarrah et al., 2023). This could lead to unethical practices and a decline in academic integrity. Therefore, it is essential to educate students on the importance of proper citation and to provide opportunities for them to develop their own writing skills.

Another ethical issue is the potential for AI chatbots to perpetuate biases and stereotypes (Gross, 2023). AI systems are trained using historical data that may contain biases, and these biases can be

perpetuated in ChatGPT's responses. This can have unintended consequences, such as marginalizing certain groups of students or reinforcing negative stereotypes. Therefore, it is crucial to ensure that ChatGPT is developed and used in a transparent manner, considering diverse inputs and perspectives. The issue of data privacy is also a key ethical concern with ChatGPT (Gupta et al., 2023). As AI chatbots collect student data for personalized learning experiences, there is a risk of data misuse or privacy breaches. It is essential to have clear policies and procedures for handling student data, including the storage, retrieval, and deletion of information. Parents and students should be informed about the data-collection practices and given an opportunity to opt out if necessary.

The role of ChatGPT in replacing human teachers is also an ethical consideration (Jeon & Lee, 2023). While AI chatbots can provide valuable resources and support, they should not be seen as a substitute for skilled human teachers (Ashton et al., 2023). Teachers play a crucial role in nurturing students' personal and social development, which chatbots cannot replicate. Therefore, it is essential to strike a balance between the use of AI chatbots and traditional teaching methods to ensure that students receive a well-rounded education.

Sentimental Analysis in the Use of ChatGPT in Education

Sentimental studies on the use of ChatGPT in education primarily focus on the emotional and affective dimensions of learning experiences enhanced by the use of ChatGPT (Sudheesh et al., 2023). ChatGPT is a natural language processing (NLP) model that can generate human-like text, making it an effective tool for education (Alawida et al., 2023). ChatGPT has been found to improve students' affective outcomes. It was reported that using ChatGPT to engage students in critical thinking tasks led to higher levels of enjoyment, self-efficacy, and positive affect compared to traditional teaching methods (Rusandi et al., 2023). ChatGPT's ability to personalize feedback and engage students in active learning was seen as a key factor in these positive outcomes.

Other research has focused on the emotional dimensions of ChatGPT use in education. For example, a study by Barrot (2023) found that using ChatGPT in writing instruction increased students' feelings of accomplishment and reduced their anxiety levels. ChatGPT's ability to provide individualized feedback and support student writing processes was seen as a major factor in these emotional shifts. Despite these benefits, there are also challenges in using ChatGPT for sentimental studies in education (Sudheesh et al., 2023). One challenge is ensuring that ChatGPT's responses are culturally sensitive and appropriate for diverse learners (Siche & Siche, 2023). Another challenge is ensuring that ChatGPT does not contribute to biases in student learning experiences (Gross, 2023). Therefore, sentimental studies on the use of ChatGPT in education have shown positive effects on students' affective outcomes and emotional dimensions of learning. However, further research is needed to address challenges related to cultural sensitivity and bias in ChatGPT's use for sentimental studies in education (Adeshola & Adepoju, 2023b).

METHODS

We employed a mixed research design that incorporated both quantitative and qualitative data analysis techniques to explore roles, ethical considerations, and sentimental analyses in ChatGPT-based education. Utilizing NVivo 12 Plus as a data analysis tool, we were able to efficiently collect, code, and analyze data. Following the data collection phase, the information was carefully coded and categorized based on the research objectives. Subsequently, we employed statistical methods to analyze the data, extracting valuable insights into the ethical issues associated with ChatGPT-based education.

We firstly gathered relevant textual data that covered a wide range of sources from the online database, i.e. Web of Science. To ensure that the data is representative of the target population or theme, we obtained 182 results from All Databases for: ethic* (Topic) and educat* OR learn* OR teach* (Topic) and ChatGPT* (Topic) on November 26, 2023. The type of publications included Review Article (n = 33), and Open Access (n = 115). The publication years ranged from 2022 (n =

1), 2023 (n = 179), to 2024 (n = 1). The publication/source titles included Cureus (n = 11), Annals of Biomedical Engineering (n = 8), Cureus Journal of Medical Science (n = 7), JMIR Medical Education (n = 5), Frontiers in Artificial Intelligence (n = 3), Healthcare (n = 3), Healthcare Basel Switzerland (n = 3), International Journal of Educational Technology in Higher Education (n = 3), Sustainability (n = 3), Aesthetic Palstic Surgery (n = 2), American Journal of Pharmaceutical Education (n = 2), Archives of Budo Science of Martial Arts and Extreme Sports (n = 2), Education and Information Technologies (n = 2), Energy Material Advances (n = 2), Indian Journal of Pastic Surgery (n = 2), International Journal of Management Education (n = 2), International Journal of Surgery (n = 2), and Journal of Chemical Education (n = 2), and Online Journal of Communication and Media Technologies (n = 2), etc.

We obtained 103 publications by entering (TITLE-ABS-KEY (chatgpt) AND TITLE-ABS-KEY (educat* OR teach* AND learn*) AND TITLE-ABS-KEY (ethic*)) into the search column of the database SCOPUS. The publications were classified into Article (n=60), Conference Paper (n=11), Review (n=10), Note (n=7), Book Chapter (n=5), Editorial (n=4), Letter (n=3), Conference Review (n=2), and Book (n=1). The organizations included The University of Hong Kong (n=4), Monash University (n=3), The University of Jordan (n=3), University of Tasmania (n=2), The Education University of Hong Kong (n=2), University of Michigan, Ann Arbor (n=2), Charité – Universitätsmedizin Berlin (n=2), Virginia Polytechnic Institute and State University (n=2), CQUniversity Australia (n=2), University of South Australia (n=2), Applied Science Private University (n=2), Jordan University Hospital (n=2), American University of Sharjah (n=2), Qatar University (n=2), Universidad Privada del Norte (n=2), Innopolis University (n=2), TBS Business School (n=2), Universidad Tecnológica del Perú (n=2), Sikkim University (n=2), and Berliner Institut für Gesundheitsforschung (n=2), etc.

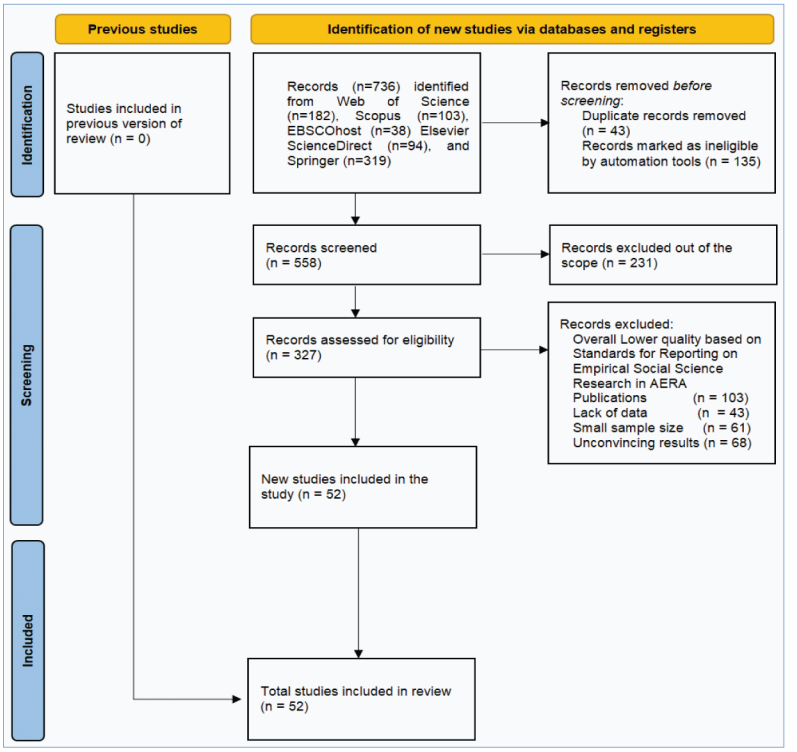
We obtained 38 results from EBSCOhost by entering AB (education OR teach OR learn) AND AB ChatGPT AND AB ethic into the search column. The main sources included teachers college record (n=4), American music teacher (n=3), American journal of bioethics (n=2), hispania (n=2), immunology & cell biology (n=2), and International journal of information management (n=2). We obtained 94 results for Title, abstract, keywords: ethic OR education OR learn OR teach/Title: chatgpt in Elsevier ScienceDirect. The article type included Review articles (n=7), Research articles (n=49), Conference abstracts (n=1), and Case reports (n=1), etc.

We obtained 319 results from SpringerLink by searching for articles, journals, books, authors, videos via the search terms “chatgpt and education and learn and teach and ethic” filtered by the disciplines such as computer science, education, and philosophy. The obtained publications included Book (n=341), Conference Proceedings (n=198), Article (n=114), Chapter (n=67), Conference Paper (n=26), Reference Work Entry (n=12), and Reference Work (n=3). The sub-disciplines included Artificial Intelligence (n=140), Computer Applications (n=108), Computers and Education (n=72), User Interfaces and Human Computer Interaction (n=52), Computer Systems Organization and Communication Networks (n=50), and Computer Communication Networks (n=47).

As described in the above flow chart (Figure 1), we firstly obtained academic publications from various databases, after which some of them were removed due to duplication and ineligibility. Then, some of the remaining publications were removed if they fell out of the scope of this study. They were removed if they were of lower quality based on Standards for Reporting on Empirical Social Science Research in American Educational Research Association (AERA) publications. Lack of data, small sample sizes, or unconvincing results would also cause removal of publications. Finally included studies also considered newly recent publications and previous review studies. Finally, we included 52 research articles for this study.

Considering the purpose and focus of the analysis, we identified relevant sources (n = 52) that might provide insights into the target topic. We also limited to selected publications to those with higher quality according to the Standards for Reporting on Empirical Social Science Research in AREA. AREA provides guidelines for the presentation and conduct of empirical social science

Figure 1. The flow chart of literature inclusion and exclusion



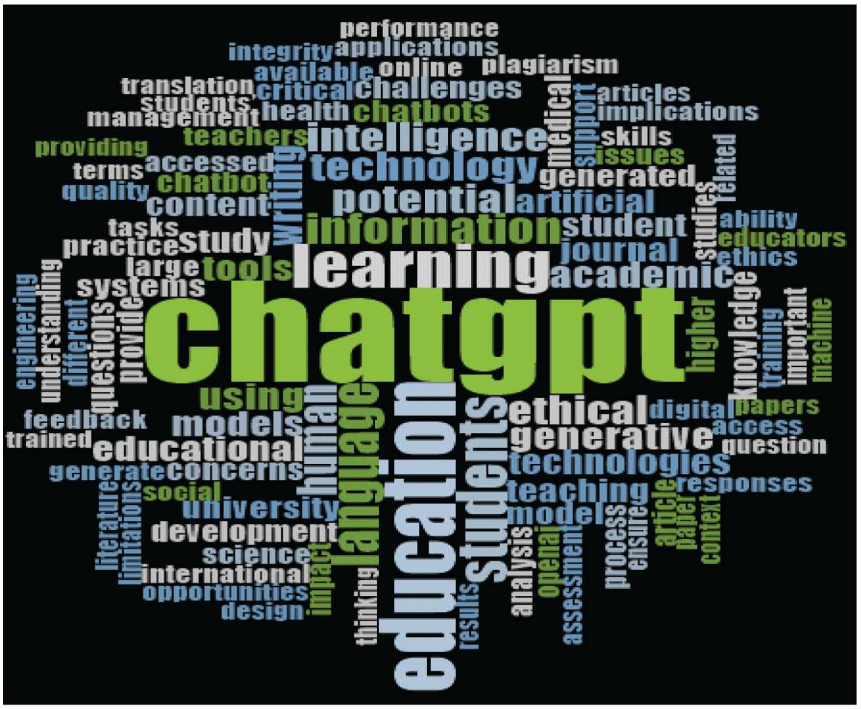
research in AERA's journals and other publications. The AERA Standards aim to ensure the quality, transparency, and replicability of research reports in the field of education, including requirements for problem formulation, design and logic, source of evidence, measurement and classification, analysis and interpretation, generalization, ethics in reporting, title, abstract, and headings. Assisted with NVivo 12 Plus, we examined term frequency analysis, and coding, the role of AI chatbot in education, ethical issues, and sentimental analysis in the use of ChatGPT in education.

RESULTS

Term Frequency Analysis

We cleaned and preprocessed the textual data to remove noise, irrelevant information, and any potential biases. This involved tasks like removing stop words, punctuation, and special characters; stemming or lemmatization; and handling of special cases like typos or language variations. Preprocessing helped to remove noise and irrelevant information, improve the quality of the data, and facilitate more accurate analysis. Specifically, we removed some functional words such as *in, towards, hence, including, after, therefore, out, before, whereas, whether, unless,* and *at*, as well as time indicators and names such as *January, March, 2023, 2022, 2021, 2020, Johnson, Wharton, Jones, Jordan, Kelly, Robert, Routledge,* and *shneiderman,* etc. We also removed some typos, special characters, and stemming such as *genai, gasevic, holmes, Holstein, hughes, hwang, intell, jutlp, Kaplan, kshetri, lafford, marcus, martin, mccarthy, mckinsey, mededu, mogaji, mollick, multi, mvondo, patienten, plast, pract, Ramesh, renderx, richter, sallam, sharma, sundar, susnjak, termiesch, ukfpo, wilby, wynter,* and *zawacki,* etc.

Figure 2. Word cloud after data reprocessing



Through NVivo 12 Plus, we can import textual data, define nodes or folders where the analysis should be conducted, and select appropriate options to customize the analysis. The term frequency report generated by NVivo 12 Plus provides detailed information about the frequency of each term, enabling users to identify key themes, topics, or sentiments present in the text. This analysis can be further refined by creating filters or conducting additional searches based on the term frequency data, allowing for a more nuanced understanding of the text. By utilizing NVivo 12 Plus for term frequency analysis, researchers can efficiently extract meaningful insights from textual data, ultimately enhancing their understanding of the subject matter.

In the Word Cloud analysis shown in Figure 2, the words that emerged with the highest frequency were "education" (Count = 7259, weighted percentage = 0.49%), "ChatGPT" (Count = 5595, weighted percentage = 2.09%), "learning" (Count = 5359, weighted percentage = 0.44%), "concerns" (Count = 2320, weighted percentage = 0.16%), "ethical" (Count = 1668, weighted percentage = 0.62%), "prompt" (Count = 991, weighted percentage = 0.09%), integrity (Count = 925, weighted percentage = 0.1%), performance (Count = 817, weighted percentage = 0.05%), and personalized (Count = 809, weighted percentage = 0.05%). These words, in particular, appeared to be the most prominent and frequently occurring in the dataset under analysis, leading to the focus of this study on ethical issues of the use of ChatGPT in education.

In the above Word cloud, ChatGPT, education, and ethics are highly interconnected topics that deserve a thorough examination. In the following discussion, we will address each of these topics in order to provide a comprehensive analysis of their interplay. ChatGPT, a chatbot developed by OpenAI, has gained significant popularity due to its powerful language processing capabilities. Recently, ChatGPT has been incorporated into various fields, including education, to enhance teaching and learning experiences. In education, ChatGPT can be used as a tool to assist students in writing assignments or in clarifying concepts. Additionally, it can help teachers in grading assignments and

assessing students' understanding of concepts. However, the use of ChatGPT in education raises ethical concerns.

However, when applying ChatGPT to education, it is essential to maintain a balance between benefits and potential drawbacks. Teachers should guide students to use ChatGPT as a tool to enhance their learning capabilities rather than as a substitute for their thinking and analytical skills. Furthermore, educators need to ensure that privacy and ethical concerns are addressed when using these technologies. The integration of ChatGPT and word cloud analysis into education has enormous potential to transform teaching and learning experiences. However, it is essential to carefully consider ethical and privacy issues raised by its use and provide appropriate guidance to students and educators alike. By addressing these concerns and leveraging the benefits of ChatGPT, we can create an optimal educational environment that fosters student growth and development.

Coding and Analyzing

We utilized NVivo 12 Plus' coding features to assign codes to text segments or nodes based on their relevance to the research question or theme (Hanjongim, 2009). This step involved reading through the text, assigning codes to important or relevant concepts, phrases, or entities, and creating an index to organize and categorize the textual data. Descriptive coding or free coding was employed to identify the basic relative content, with the primary objective being data comprehension rather than interpretation (King et al., 2010). The coding process was conducted on a line-by-line basis in order to ensure that all significant information was captured. To establish the reliability and validity of the coding, two members of the team independently coded the text (Wan, 2002). Subsequently, the coding results were cross-checked through in-depth discussions. When disagreements persisted, a third party was invited to join the discussion. The coding results are showcased in Table 1.

Interpretive coding was employed in the second stage, with the aim of classifying the free codes. This process was primarily guided by a comprehensive review of relevant literature, while continuously comparing and analyzing the relationships between the codes. The main objective of this step was to derive deeper interpretive meanings (King et al., 2010: 154). The third step was to classify the free codes and define overarching themes based on the data set of ethical issues in ChatGPT-based education. This process involved broader themes that often covered many different cases and revealed the core concepts and elements of the research. Braun and Clarke (2006) referred to this as a "define and refine" process. Each tentative theme was reviewed one by one, along with the raw word text and free and interpretive codes associated with each theme.

Finally, we solicited three themes, i.e. chatbot, education, and ethical. The theme "chatbot" included numerous sub-themes, and we delved into several sub-themes such as 10 chatbot models, 37 chatbot application cases, AI-powered chatbots, chatbot integration, chatbot interfaces, chatbot performance, chatbot response times, chatbot usage frequency, chatbot usage satisfaction, classroom chatbots, customized chatbots, evaluating chatbot efficacy, humanized chatbots, model-powered chatbot, real-time chatbot systems, specific chatbot interface, specific-purpose chatbots, text-based chatbot system, traditional chatbots, visual chatbot development platforms.

The Role of AI Chatbots in Education

AI chatbots have emerged as a powerful tool in education, revolutionizing the way students learn and teachers teach. By analyzing vast amounts of data, AI chatbots can personalize the educational experience for each student, adapt to their unique needs, and maximize their potential (Zhong, 2022). AI chatbots in education serve multiple roles (Jeon et al., 2023). One of the primary roles is to act as a virtual tutor or coach. These chatbots can provide individualized feedback and guidance to students on a range of topics, including subject-specific questions, homework assistance, and exam preparation. By analyzing student responses and tracking their progress, AI chatbots can identify areas where students need extra help and suggest personalized learning paths. AI chatbots also play

Table 1. The coding spectrum

Overarching Themes	Interpretive codes	Free codes	Files	References
Chatbot	AI chatbot, chatbot response times, educational chatbots	chatbot models, chatbot application cases, advanced chatbot, AI-based chatbots, AI-enabled chatbots, AI-powered chatbots, basic chatbot technology, chatbot application, chatbot approach, chatbot cases, chatbot creation, chatbot development, chatbot interfaces, chatbot performance, chatbot services, chatbot systems, chatbot usage frequency, chatbot usage satisfaction, classroom chatbots, current chatbot systems, customized chatbots, evaluating chatbot efficacy, existing chatbots, humanized chatbots, intelligent chatbot, visual chatbot development platforms, well-educated chatbot	28	92
Education	AI-powered education, computer-based education, healthcare/ medical education	academic education applications, AI-powered education platforms, AI education policy, aspiring educators, blended education, business education, character education, chemistry education, clinical education, coding education, common bioethics education goals, computer science education, creative education, dental education, design education, diabetes education, distance education processes, education research community, education scenarios, education—ChatGPT, engineering education, formal ethics education, healthcare education, literacy education, medical education, moral education, quality education.	48	257
Ethical	ethical concerns, clinical ethics, ethical guidelines	Ethical considerations, biomedical ethics, conflicting ethics appeals, ethical action, ethical awareness, ethical boundaries, ethical challenges, ethical codes, ethical focus, ethical integrity, ethical judgments, ethical obligations, ethical ramifications, ethical tension, formal ethics education, plagiarism ethical concerns, traditional ethics education.	50	221

a role in flipped classrooms, where students engage with prerecorded lectures or videos prior to class(Bernstein et al., 2023)

During class time, teachers and students can focus on deeper discussions and hands-on activities. AI chatbots can support these flipped classrooms by acting as a knowledge navigator, providing on-demand answers to students' questions and guiding them through complex concepts.

AI chatbots can enhance language learning by providing immersive language experiences (Young & Shishido, 2023). They can simulate real-life dialogues and engage students in conversation, improving their language skills and cultural understandings. By tailoring language exercises and cultural insights to each student's proficiency level, AI chatbots create a more engaging and effective language learning environment. AI chatbots can act as a learning companion, providing continuous support and encouragement to students. These chatbots can offer positive feedback, reminders, and encouragement throughout the learning process, helping students stay motivated and on track (Kaushal & Yadav, 2023). AI chatbots have a transformative potential in education. By personalizing the

educational experience, flipping classrooms, enhancing language learning, and acting as a constant companion, AI chatbots are revolutionizing the way students learn and teachers teach. As technology continues to develop, it is likely that AI chatbots will become an integral part of the educational landscape, revolutionizing the way we approach education in the digital age.

The study (Dwivedi et al., 2023) revealed that the utilization of ChatGPT and other AI bots carries several risks, including the utilization of black-box algorithms, discrimination and biases, the propensity for vulgarity, the risk of copyright infringement, plagiarism, and the dissemination of fake media. Organizations must comprehend these risks and take necessary measures to manage and mitigate them effectively. Periodic risk assessments should be coupled with ethical reviews and bias screenings as AI algorithms are constantly developing and evolving. Context is a crucial aspect in identifying, assessing, prioritizing, and mitigating risks linked to ChatGPT adoption across different business sectors (Garcia-Penalvo, 2023). The risk arises from the quality, authenticity, and reliability of the data used to train the model and how the model is corrected by human designers and developers.

Once risks are identified, ethical models can be used to navigate a path forward. Utilitarianism, a widely accepted approach to ethical decision-making, emphasizes causing the least amount of harm or promoting the greatest good for individuals, society, and the environment. This theory provides a conflict resolution framework that uses a flexible, results-oriented approach to formulate and test policies at each stage of the AI risk management cycle. Contextual considerations enable AI developers, organizations deploying AI, and policy makers to make pragmatic and workable moral decisions that consider both the opportunities and negative implications. Therefore, it is crucial to integrate AI risk management frameworks and ethical theory perspectives to make socially responsible judgments that ensure the cautious, reasoned, and ethical use of generative AI models like ChatGPT (Graham, 2023). According to utilitarianism, optimal decisions and actions related to ChatGPT's design, development, adoption, deployment, maintenance, and evolution should prioritize providing the most benefits or causing the least harm to society. This necessitates the development of responsible AI toolkits and frameworks that embed ethical perspectives to promote a well-balanced view of what is ethical and what is not.

The utilization of ChatGPT in education has been the subject of controversy, with a preponderance of positive sentiment among users. ChatGPT, a type of language model AI technology, has been widely used in various fields. In education, ChatGPT can help students learn more efficiently and effectively, providing them with more convenient and flexible learning methods (Ouh et al., 2023). For example, ChatGPT can help students quickly search for information, provide online language translation, answer complex questions, and create original content (Ansari et al., 2023). These functions can help students save time and effort in learning, while also improving their learning efficiency and results. ChatGPT can also help teachers improve teaching quality and efficiency. For example, ChatGPT can help teachers generate courseware content more efficiently, answer student questions in real time, customize teaching materials to suit the needs of each student, and assess students' learning performance. These functions can help teachers save time and effort in teaching, while also enabling them to provide better quality teaching and personalize learning.

Despite the above advantages, ChatGPT has also been criticized for its shortcomings in education. ChatGPT may produce erroneous answers due to its lack of human-like reasoning ability. ChatGPT's language model AI technology may not be able to fully replace human teachers in terms of communication and interaction with students. ChatGPT's commercial operation mode may limit its availability to many users. The application of ChatGPT in education has both positive and negative aspects (Dalalah & Dalalah, 2023). While ChatGPT has greatly improved teaching efficiency and effectiveness, it still cannot replace human teachers completely. Therefore, it is recommended that schools use ChatGPT as a tool to enhance teaching quality and efficiency rather than replace human teachers. At the same time, schools should also pay attention to the potential risks of ChatGPT's application in education and take corresponding measures to protect students' privacy and security (Barrot, 2023).

Ethical Issues in the Use of ChatGPT in Education

Ethical Concerns of the Use of ChatGPT in Education

The use of ChatGPT in education raises several ethical concerns. One of the primary concerns is the issue of plagiarism. ChatGPT is a powerful language model that can generate fluent and coherent text. It is, therefore, easy for students to use the tool to generate reports, assignments, or even essays without proper attribution or understanding of the material. This practice can lead to widespread plagiarism, which is unethical and goes against the principles of academic integrity (Jarrah et al., 2023). Another ethical concern is the potential for information overload. ChatGPT has an extensive knowledge base, but it may not always provide the most accurate or relevant information. When students rely on ChatGPT for answers, they may not develop the ability to discriminate between reliable and unreliable information. This can result in the student gathering a large amount of irrelevant or incorrect information, which can be overwhelming and counterproductive.

Since ChatGPT generates text based on user input, students can easily use it to produce written assignments without proper attribution. This practice can lead to academic dishonesty and undermine the purpose of education (Abdulai & Hung, 2023). Therefore, educators need to be vigilant in monitoring students' use of ChatGPT and provide appropriate guidance on academic integrity. The use of ChatGPT may also raise concerns about privacy and data protection. As ChatGPT becomes more widely used in educational settings, concerns have been raised about the collection and storage of student data. It is essential to ensure that appropriate privacy measures are implemented to protect student information while using ChatGPT as a teaching aid.

The use of ChatGPT may also lead to a dependence on the tool and a failure to develop important cognitive and analytical skills. When students rely on ChatGPT for answers, they may not exercise their own judgment and critical thinking skills. This can result in a decline in their ability to reason, analyze, and evaluate information independently. While ChatGPT has the potential to be a valuable educational tool, its use raises several ethical concerns. To ensure ethical use of ChatGPT in education, it is important to promote academic integrity, provide guidance on information evaluation, and encourage independent thinking skills (Rusandi et al., 2023b). Teachers and educators should also be aware of these ethical concerns and take necessary measures to address them effectively.

Clinical Ethics in the Use of ChatGPT in Education

Clinical ethics is a crucial aspect of healthcare education, particularly when it comes to the use of ChatGPT in education. The ethical concerns regarding the use of ChatGPT in clinical education are diverse and multifaceted (Temsah et al., 2023). ChatGPT's ability to generate text that mimics human speech and writing can be seen as a double-edged sword. While it can simulate conversation and writing in a clinical setting, ChatGPT's language generation may not always be accurate or appropriate. This can result in students receiving incorrect or misleading information, potentially leading to poor decision-making in real-world clinical situations. There is an ethical concern regarding the use of ChatGPT in patient care. Even if ChatGPT can generate accurate and appropriate responses, its use may not always be suitable for patient care. The lack of human-patient interaction and communication skills in a clinical setting can result in patient dissatisfaction and a breakdown in the doctor-patient relationship. ChatGPT's ability to access and store vast amounts of data raises concerns about patient privacy and confidentiality. The potential for data breaches and the misuse of patient information for commercial or other non-medical purposes is a real concern. This issue is further compounded by the lack of transparency and accountability in ChatGPT's data handling practices.

The issue of accountability and liability is a key ethical concern regarding the use of ChatGPT in clinical education. In the event that ChatGPT provides incorrect or harmful advice that leads to negative patient outcomes, who would be held responsible (Ahmed, 2023)? Would it be the educator, the student, or the technology provider? The lack of clarity on accountability and liability issues can lead to legal uncertainties and moral conflicts. Therefore, clinical ethics plays a crucial role in the

use of ChatGPT in education, particularly in clinical settings. To ensure ethical use of ChatGPT, it is imperative to consider issues such as accuracy and appropriateness of information generation, patient care and communication skills, patient privacy and confidentiality, accountability and liability. Furthermore, educators and healthcare institutions should develop clear guidelines and policies on the use of ChatGPT in clinical education to ensure ethical and responsible practices.

Ethical Guidelines in the Use of ChatGPT in Education

The use of ChatGPT in education raises several ethical concerns that must be addressed to ensure responsible and ethical practices. In this context, ethical guidelines are necessary to provide a framework for the appropriate use of ChatGPT in education (J. K. Kim et al., 2023). It is important to ensure the accuracy and authenticity of the information generated by ChatGPT. The technology should not be used to disseminate incorrect or misleading information. Instead, ChatGPT should be employed to provide accurate and reliable information that is based on scientific evidence and reliable sources. ChatGPT should not be used to replace human-to-human interactions in the clinical setting. While the technology can simulate conversation and writing, it cannot replicate the human touch and empathy essential in patient care. Therefore, ChatGPT should be used as a supplementary tool to enhance clinical education and not as a replacement for human interaction in patient care. Stringent measures should be implemented to protect patient privacy and confidentiality when using ChatGPT in clinical education. The technology provider should ensure the security of stored data and adopt robust encryption methods to prevent data breaches.

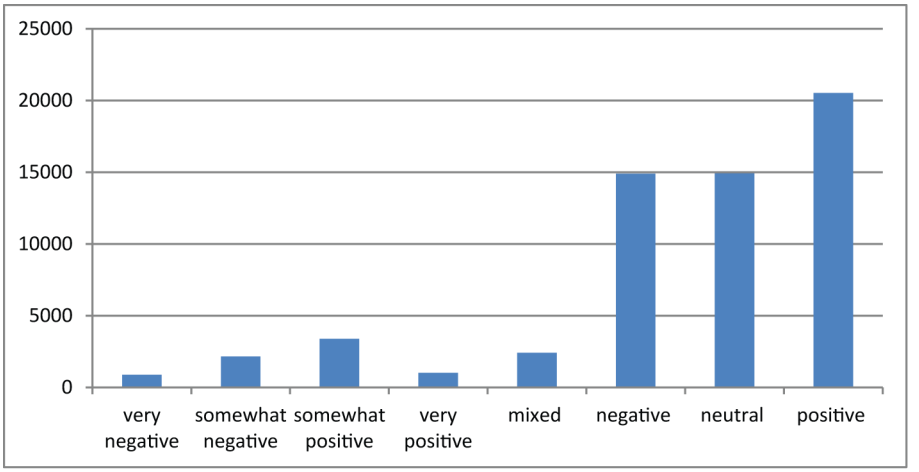
There should be clear guidelines on the use of patient information for educational purposes, ensuring that the privacy rights of patients are upheld. It is crucial to establish clear accountability and liability frameworks in case of any negative outcomes resulting from the use of ChatGPT. The involved parties – educators, students, and technology providers – should be made aware of their respective responsibilities and liabilities. This would enable informed decision-making and ensure that all parties are accountable for their actions. Ethical guidelines should encourage transparency and openness in the use of ChatGPT (Schou-Juul et al., 2023). All parties involved should be aware of how the technology works, what data is collected, and how it is used. This would promote trust and ensure that all parties have a clear understanding of the processes involved. Ethical guidelines are essential to ensure the responsible and ethical use of ChatGPT in education, particularly in clinical settings. Guidelines should address accuracy and authenticity of information, human-to-human interactions in patient care, patient privacy and confidentiality, accountability and liability, and transparency and openness. By formulating clear ethical guidelines, we can ensure that ChatGPT is used in a manner that enhances clinical education while maintaining professional ethics and patient privacy rights.

Sentimental Analysis

To conduct sentimental analysis through NVivo Plus 12, we followed a series of steps. First, we collected and imported the text data into NVivo Plus 12. Then we used the sentimental analysis feature to analyze the sentiment of the text data, including positive, negative and neutral emotions. In addition, we conducted a cross-sectional analysis of sentiment by comparing different groups of data, and conducted a trend analysis of sentiment by comparing data at different time points. Finally, we presented the results of sentimental analysis in tables, charts and narratives to help readers better understand the emotional tendencies of the text data.

The sentimental analysis provides information on the process of identifying and analyzing the sentiments in ChatGPT-based education. The data was coded through the use of NVivo Plus 12, a software tool that facilitates qualitative data analysis (Feng & Behar-Horenstein, 2019). The auto coding function of this software was employed to assign codes to different sentiment expressions. The various sentimental codes were then classified into different categories. These categories include very negative (n = 884), somewhat negative (n = 2158), somewhat positive (n = 3383), and very positive (n = 1015). There was also a mixed sentiment category (n = 2408) that encompassed a combination

Figure 3. Sentimental analyses of ChatGPT-based education



of both positive and negative sentiments. On the other hand, the negative sentiment category (n = 14897) was composed of predominantly negative expressions, while the neutral sentiment category (n = 14918) included a range of sentiment expressions that were neither positive nor negative. Finally, the positive sentiment category (n = 20523) was populated by predominantly positive sentiments, followed by neutral and negative sentiments (Figure 3).

DISCUSSION

In the use of ChatGPT in education, term frequency analysis plays a crucial role in determining the importance and relevance of specific terms within a given text or corpus (Durian, 2002). This review presents an overview of the program's capabilities, discusses its system requirements, and presents suggested applications for the use of the program in corpus-based text analysis, something which has been previously unexplored in the text analysis software review literature. Examples of the types of analyses NVivo can perform are discussed, and a brief overview of key features of the program is provided. By analyzing the frequency of words or phrases, term frequency analysis can identify key concepts, topics, or themes that are most frequently mentioned within the text. This analysis can be used to inform the development of ChatGPT models, enabling them to prioritize and respond to the most relevant questions or requests from students.

Coding is essential in organizing and managing the vast amount of data generated by ChatGPT in education. Coding involves assigning unique identifiers or symbols to different data elements, such as words, phrases, or semantic relationships, to facilitate information retrieval and analysis (Unahalekhaka & Bers, 2021). By employing coding techniques, ChatGPT models can be optimized for performance and scalability, enabling them to handle large-scale educational datasets (Ouh et al., 2023). ChatGPT models can generate personalized feedback and recommendations based on individual learning styles and needs (Temsah et al., 2023). This personalization approach enables ChatGPT models to provide more relevant and engaging content to users, thereby enhancing their learning experiences. Coding enables efficient information retrieval and analysis while supporting scalability and personalization in educational settings.

The role of AI chatbots in education is to provide an interactive and personalized learning experience for students (Adeshola & Adepoju, 2023b). These chatbots can engage students in asynchronous or synchronous learning environments, simulating human-to-human interactions

and providing individualized feedback and guidance. AI chatbots can be designed to assess students' knowledge, identify areas where they need improvement, and suggest appropriate learning resources or strategies. By employing AI chatbots, education systems can enhance student engagement, improve learning outcomes, and streamline communication between learners and educators (Jangjarat et al., 2023).

However, the use of ChatGPT in education raises ethical concerns. One major issue is the potential for AI chatbots to automate or replace human-to-human interactions in the classroom, leading to a loss of human connection and social skills. ChatGPT-based education systems may not provide students with an opportunity to develop their critical thinking skills as the chatbot may provide ready-made answers instead of challenging students to think for themselves. ChatGPT's algorithm may be biased or limited by its training data (Watters & Lemanski, 2023), leading to unintentional discrimination or exclusion of certain groups of students. Therefore, it is essential to consider ethical issues when implementing ChatGPT in educational settings (Crawford et al., 2023).

Sentimental analysis plays a crucial role in assessing students' emotional states and monitoring their progress in ChatGPT-based educational systems (Sudheesh et al., 2023). This analysis involves analyzing textual data to determine the sentiment or emotional tone of the text. By employing sentimental analysis techniques, ChatGPT models can detect patterns or trends in sentiment across large datasets and provide insights into how individuals or groups are feeling or reacting to particular events or topics (Praveen & Lohia, 2023). Sentimental analysis can be used to assess students' emotional states, identify areas where they may need additional support or resources, and monitor their progress throughout the learning process.

CONCLUSION

Major Findings

AI chatbots, e.g. ChatGPT, have revolutionized education, but their use raises ethical concerns. They can enhance language learning, but may lead to plagiarism and information overload. Students may not develop discrimination skills and may rely on ChatGPT, leading to concerns about academic dishonesty and a failure to develop cognitive and analytical skills. The use of ChatGPT in clinical education also raises accountability and liability concerns regarding the use of patient information for educational purposes. Guidelines should be established to ensure privacy rights are upheld. Finally, the positive sentiment category was populated by predominantly positive sentiments, followed by neutral and negative sentiments.

Limitations

The study may have methodological limitations, such as the use of a qualitative approach to analyze the sentiment of ChatGPT's answers. While NVivo 12 Plus can help analyze text data, it cannot fully understand and process natural language. This may result in a subjective interpretation of the data and potentially limit the validity and generalizability of the findings. Sentimental analysis using NVivo 12 Plus may be limited by subjectivity. While the software can help analyze text data, it cannot fully understand the context and intention of the words used. A human analyst may interpret the sentiment differently based on their own biases and prejudices, which can influence the validity of the analysis.

Future Research Directions

Future research on ChatGPT in education should focus on two key areas: its application effectiveness in various educational settings and ethical considerations (Jeyaraman et al., 2023). Firstly, researchers should investigate optimal integration methods of ChatGPT into different educational settings, including language learning, writing assistance, and subject-specific tutoring. Controlled experiments should compare ChatGPT's performance against traditional educational methods and assess its impact

on student learning outcomes. Secondly, given ethical concerns regarding ChatGPT's potential to promote plagiarism and information overload, researchers should explore methods to mitigate these risks. Additionally, sentiment analysis of ChatGPT's use in education is a newly rising aspect worth exploration in order to examine the effect of students' sentimental trend on learning experiences and effectiveness. Finally, as ChatGPT becomes more prevalent in education, it is essential to consider its broader social and cultural impacts by examining how it shapes learners' attitudes towards knowledge production, collaboration, and agency in learning. Such research will provide valuable insights into the potential long-term consequences of ChatGPT integration into education.

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CONFLICT OF INTEREST

We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

AUTHOR CONTRIBUTIONS

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