

An Artificial Intelligence Application in Science Education: ChatGPT

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Introduction

The rapidly changing field of educational technology is fundamental to changing the confront of teaching and learning (Farrokhnia, Banihashem, Noroozi, & Wals, 2023). Artificial Intelligence is one of the foremost revolutionary technological advancements that has affected education. According to Mhlana (2023), intelligence (AI). AI in education (AIEd) has drawn a part of consideration over the past forty years owing to its potential to significantly improve learning, teaching strategies, and administrative duties in educational environments (Chiu et al., 2023). Large language models (LLMs), a particular kind of AI calculation that uses artificial neural networks (ANNs) and hugely expansive information sets to comprehend, summarize, produce, and foresee modern substance that's about inconceivable to recognize from human manifestations (Zhai, 2022), have created new opportunities for improving a variety of educational aspects, including personalized instruction and content creation (Valtonen & Mäkinen, 2022). By interacting with students, providing prompt assistance, and encouraging interactive learning situations, chatbots that take utilize of LLMs' capacity to comprehend and create human-like reactions have moreover appeared promise in improving student learning and educational results (Bozic & Poola, 2023). The uncommon and nonstop mechanical advancements in chatbots have expanded their potential for sending over different spaces and made their utilize more helpful, characteristic, and easy (Baidoo-Anu & Ansah, 2023). A later well-known AI-powered innovation that has affected the education part is ChatGPT. The aim of this research is to provide information about what the ChatGPT artificial intelligence model is, its positive, negative aspects and limitations, and methods to overcome the negative and limitations.

Artificial Intelligence

Educational technology, which has created quickly in later a long time, plays an awfully vital part in improving the instructing and learning environment (Valtonen & Mäkinen, 2022). One of the foremost imperative advancements in instructive innovation is Artificial Intelligence (Mhlana, 2023). Artificial Intelligence was created by John McCarthy in 1955 and is characterized as the capacity of a machine to effectively perform errands that are considered brilliantly (McCarthy, Minsky, Rochester, & Shannon, 1955). Kurzweil (1990) characterizes artificial intelligence as the craftsmanship of creating machines that can perform errands that require human insights (Adıgüzel, Kaya, & Cansu, 2023). Artificial intelligence may be a field of consideration that points

to deliver computers and machines with human-like insights (Coppin, 2004) and the coming about developments and advancements (Chen, Xie, Zou, & Hwang, 2020). Artificial intelligence is additionally characterized as a subfield of computer science that focuses on examining the basic nature of intelligence by employing a set of algorithmic strategies to make artifacts that take after human insights (Dwivedia, et al., 2021). In other words, artificial intelligence points to mimic the mental aptitudes of the human brain such as issue understanding, choice making, expectation and induction (Aktay, Gök, & Uzunoğlu, 2023). Artificial intelligence is accomplished by understanding how the human brain works, as well as how people learn, choose and work when attempting to solve issues, and after that leveraging the comes about of this inquire about to form cleverly program and frameworks (Bozic & Poola, 2023). To provide a more comprehensive definition; any hypothesis, strategy or strategy that encourages examination, recreation, utilization and investigation of human considering forms and behaviors by machines, particularly computers, can be considered artificial intelligence (Lu, 2019).

The main purpose of artificial intelligence is to form a framework that learn, show, explain, advise, comprehend, think and act like humans. In addition, performing tasks such as voice recognition, learning, planning and problem solving are also among its objectives (Bozic & Poola, 2023). Thanks to the fast advancement of artificial intelligence, instruction and learning innovations, its utility in instruction includes a critical effect on the way we learn (Chen, Xie, Zou, & Hwang, 2020).

Artificial Intelligence in Education

Since the 1980s, artificial intelligence in education (AIEd) has been built up as a coherent field of academic study (Williamson & Eynon, 2020). In AIEd, two approaches are received: the advancement of AI-based devices for classrooms and the knowledge and evaluation of learning (Holmes, Bialik, & Fadel, 2019). Ouyang and Jiao (2021) categorized artificial intelligence in education (AIEd) into three paradigms: AI-driven, where the student is seen as a collector, and AI-supported, where the student is seen as a collaborator and pioneer. To begin with worldview, AI is utilized to speak to and direct cognitive learning, whereas students are the recipients of AI administrations. Within the moment worldview, which has cognitive and social constructivist hypothetical establishments, students collaborate with AI whereas AI underpins learning. Within the third worldview based on connectionism, AI enables learning whereas students intervene in their own learning, supporting the solid collaboration between students, teachers, data and innovation within the framework. In this regard, artificial intelligence within the field of instruction is recognized as a effective device that empowers modern ideal models in directions plan, mechanical headway and instructive inquire about that cannot be accomplished with conventional instructive strategies. This property is thought to be related to the integration of social, cultural, financial and educational measurements (Lu,2019).

Whereas the effect of AI on education is still dubious (Holmes, Bialik, & Fadel, 2019), it has noteworthy potential to move forward learning, instructing, academic developments, evaluation, and educational organization (Chen, Xie, Zou, & Hwang, 2020)In expansion to its potential to

revolutionize education, it requires more than the utilize of progressed AI computing innovations to attain positive educational results (Castañeda & Selwyn, 2018). The utility of innovation ought to be closely connected to speculations of educating and learning to direct guidelines plan and innovative progression, particularly in AI (Bower, 2019). As for the conceptual system of AI-assisted learning, Zheng et al. (2021) contend that the utilization of AI innovations, learning substance and educational approaches are regularly interconnected and ought to be thoroughly coordinated into learning situations to guarantee learning proficiency and effectiveness. When planning learning exercises bolstered by AI, teachers and professionals ought to consider six vital components to attain the anticipated learning objectives: learners, themes, assignments, academic approaches, interaction strategies, and application of AI innovations (Zheng, Jiayu, Zhong, & Gyasi, 2021).

Artificial intelligence provides instructors with time and flexibility as well as efficiency, personalization and simplified activities (Bozic & Poola, 2023). In the future, as AI solutions advance to a higher level, they will help identify gaps in teaching and learning and increase educational competence (Adigüzel, Kaya, & Cansu, 2023). It is imperative to utilize to contribute to the method of making social and financial esteem in science, which is the field specifically influenced by current improvements in science and innovation (Bayram & Çelik, 2023). Within this regard, when we look over the literature, over numerous considers on the utilize of AI in science education. The impact of AI on pre-service science teachers' opinions on socioscientific issues (Bayram & Çelik, 2023) and the impact of AI on issue understanding and imaginative composing aptitudes of primary school students (Bor & Küçükaydın, 2021), raising awareness of pre-service science teachers (Çam, Çelik, Güntepe, & Durukan, 2021), the utilize of AI by science teachers within the remove instruction prepare (Erkoç, 2023), the impact of AI on the science handle abilities of 8th review talented understudies on seasons, DNA and pressure (Sarioğlu, 2023), the discernments of pre-service physics teachers about AI (Erdoğan & Bozkurt, 2023), the impact of AI on the GPA of pre-service science teachers (Erdoğan & Bozkurt, 2023), the impact of AI on the science handle aptitudes of 8th grade talented students (Sarioğlu, 2023, physics teacher candidates' perceptions about AI (Erdoğan & Bozkurt, 2023), the utilize of Artificial Neural Networks (ANN) within the classification of science educator candidates' review point averages (Yorgancı & Işık, 2019).

When we see at the utilization zones of AI innovations in education prepare incorporates numerous sorts counting shrewdly instruction frameworks, chatbots, robots, learning analytics control boards, versatile learning frameworks, and programmed evaluation (Chen, Xie, Zou, & Hwang, 2020). In later a long time, chatbots, which have gotten to be far reaching particularly within the field of education, contribute to the person improvement of students (Arruda, Marinho, Souza, & Wanderley, 2019) (Topal, Eren, & Geçer, 2021) (Nghị, Phuc, & Thang, 2019).

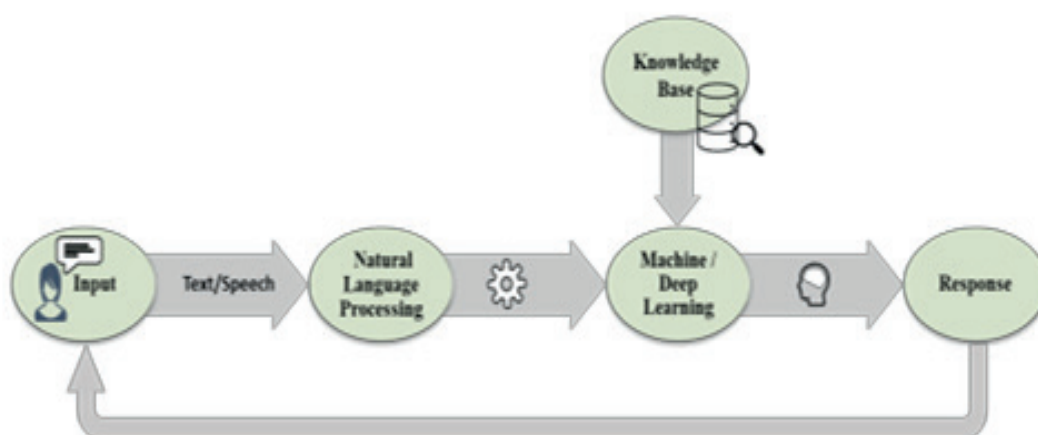
Chatbots

Chatbots are artificial intelligence agents that can interact with the user by providing an appropriate response to a series of questions (Clarizia, Colace, Lombardi, Pascale, & Santaniello, 2018). Therefore, chatbots permit people to connected as on the off chance that they were talking

to a genuine individual amid a discussion by to begin with understanding the substance of the discourse, distinguishing the social and passionate needs of clients, and mirroring and deciphering human communication (Chechanowski, Przegalinska, Magnuski, & Gloor, 2018).

The creation of a chatbot includes the utilization of Natural Language Processing (NLP). NLP may be a innovation that empowers a machine to get it, analyze and decipher characteristics of human dialects. Also, the execution of a chatbot depends on the size and exactness of its databases, which suggests that bigger database estimate will lead to superior execution. Figure 1 appears how a chatbot works (Aleedy, Atwell, & Meshoul, 2021).

Figure 1. *General Chatbot Workflow , Explanation note: Aleedy, Atwell, & Meshoul, 2021*



Given an incite or setting, the demonstration forms the input and gives a reaction. When preparing the input, it draws on a huge database, such as books and articles, and produces content comparable to the content on which it was prepared. The reaction is prepared reliably, each time based on the input and the words it has created so remotely. They demonstrate employments attentional components to center on the foremost pertinent parts of the input and to create a coherent reaction suitable to the given setting. It can produce content in numerous dialects by fine-tuning the multilingual figure or by giving the dialect code to the figure (Baidoo-Anu & Ansah, 2023).

Progressing and exceptional mechanical propels in chatbots have made them utilize more comfortable, progressively common and easy, and are extending their potential for sending in different areas (Schöbel, et al., 2024). In especially, the capabilities of a chatbot can shift depending on innovations such as common dialect handling, machine learning, profound learning, and counterfeit neural systems (Nirala, Singh, & Purani, 2022). Chatbots play a significant part in supporting students' learning (Kooli, 2023), improving learning encounters, and encouraging different learning approaches such as personalized learning, collaborative learning, emotional learning, and learning by doing (Kuhai, Alturki, Alramlawi, & Alhejori, 2023). Chatbots such as Alex, ELIZA, megaHAL, PARRY, ANTswers, A.L.I.C.E., Bard, Bing, Ernie, and ChatGPT have been enhanced (Kane, 2016) (Osetskyi, Vitrenko, Tatomyr, Bilan, & Hirnyk, 2020). One of the unmistakable cases of chatbot applications is the Chat Generative Pre-Trained Transformer, known as ChatGPT, which was presented on November 30, 2022 by OpenAI, one of the driving manufactured insights inquire

about research facilities (Albadarin, Tukiainen, Saqr, & Pope, 2023).

ChatGPT

ChatGPT portrays itself as “a effective machine learning computer program that employments the Generative Pre-trained Transformer (GPT) Generative Pre-trained Transformer (GPT) calculation to produce human-like reactions to text-based inputs” (Albadarin, Tukiainen, Saqr, & Pope, 2023). Generative Pre-Trained Transformers (GPTs) are prepared on a huge database, counting articles, websites, books, and composed discourse, to progress their yield (Aktay, Gök, & Uzunoğlu, 2023). This gives it the capacity to reply to prompts in a conversational way, permitting engineers to customize the dialect demonstrate for their utilize cases and make profoundly complex reactions (Halaweh, 2023). By foreseeing the following word in a sentence based on the setting of past words, and by identifying patterns and regularities within the information, it effortlessly creates human-like content, fitting expressions and pictures in reaction to the user’s inquiry (Bozic & Poola, 2023). Besides, the transformer structure, based on the component of individual consideration, permits the long short-term memory (LSTM) to get a handle on the setting of the content being handled and to store data from past inputs. This permits it to analyze parts of the input, with a specific center on repetitive neural systems (RNNs), creating more characteristic and steady yield. Hence, by utilizing profound neural systems to prepare huge sums of content information and learn designs in dialect, it permits it to make coherent and syntactically rectify sentences (Lund, et al., 2023).

One of the foremost critical highlights that recognizes ChatGPT from other AI-based chatbots is that it is more effective in exercises that require imagination (Ali, Shamsan, Hezam, & Mohammed, 2023). A wide assortment of errands can be performed, counting dialect interpretation, summarizing or completing content, replying to questions, making imaginative substance (such as sonnets, articles, stories, blogs, fiction), and reacting to questions (AlAfnan, Dishari, Jovic, & Lomidze, 2023). It can give clues in discourse, clarify complex themes, concepts or topics, rectify mistakes in existing code and produce unique modern codes (Squeeze, 2023). Additionally, it not as it were distinguishing the issue but moreover gives adjust arrangements (Albadarin, Tukiainen, Saqr, & Pope, 2023).

ChatGPT’s capacity to get it normal dialect inquiries and create human-like reactions has made it a well-known apparatus for getting fast answers to a wide extent of questions, from common to complex points (Lo, 2023). For this reason, the most recent adaptation of ChatGPT (ChatGPT-4), prepared on a bigger and more different dataset and claimed to be able to perform more effective and complex capacities, was created and discharged on Walk 14, 2023 (Ratnam, Sharma, & Tomer, 2023). The expanded measure of the demonstration permits for more progressed characteristic dialect preparing capabilities, much obliged to its capacity to reason and get it headings in different spaces, and to end up more versatile and finish challenging errands (Roumeliotis & Tselikas, 2023). For case, in the event that a client sends a picture and demands a depiction, it depicts the picture in detail inside a number of seconds (OpenAI, 2023). Google search results, which are popular and easy to access, are based on websites that the Google algorithm identifies as relevant to your

search query, while ChatGPT provides direct answers from a large and comprehensive database, as they are programmed with a specific set of knowledge and rules to generate answers (Singh, Kumar, & Mehra, 2023). Figures 2 and 3 show the answers given by both Google search engine and ChatGPT to the question ‘What is artificial intelligence?’

Figure 2. Answer provided by Google Search Engine

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What Is Artificial Intelligence (AI)?

16 Ağu 2024 — AI is technology that enables computers and machines to simulate human learning, comprehension, problem solving, decision making, creativity and autonomy.

[Machine learning](#) · [What is Generative AI?](#) · [What Is Deep Learning?](#)

Figure 3. Answer provided by ChatGPT

what is artificial intelligence



Artificial intelligence (AI) refers to the simulation of human intelligence in machines that are designed to think and act like humans. This can include capabilities such as learning, reasoning, problem-solving, perception, and language understanding. AI systems can be categorized into two main types: narrow AI, which is designed for specific tasks (like virtual assistants or recommendation systems), and general AI, which aims to understand and perform any intellectual task that a human can do. AI technologies are used in various applications, from everyday tasks to complex decision-making processes.



Moreover, the wide and comprehensive capacity of ChatGPT can lead to changes in learning goals, learning activities and assessment practices. Its impact in these areas is thought to be very large (Farrokhnia, Banihashem, Noroozi, & Wals, 2023) (Zhai, 2022). In this context, it is important to emphasize the positive, negative and limiting aspects of ChatGPT.

Positive Aspects of ChatGPT

There are numerous positive perspectives of utilizing ChatGPT in education for students (Albadarin, Tukiainen, Saqr, & Pope, 2023).

- **Personalized Learning:** ChatGPT can supply personalized learning encounters based on the learner's level of understanding by fitting substance and clarifications to the individual's needs and pace, giving challenging questions when essential, and disentangling concepts (Oranga, 2023). It can analyze student designs and inclinations and suggest learning assets such as articles, recordings, and reading material that fit their needs (Bozic & Poola, 2023). A ponder by Chen et al. (2020) appeared that ChatGPT can give students with personalized arithmetic lessons, give fitting clarifications for students' misguided judgments, and adjust to their level of understanding, which can lead to superior learning results. A think about by Chiang and Lee (2024) appeared that ChatGPT can give more successful back to students learning programming and progress execution on programming evaluations. The consider moreover demonstrated that the show can get it students' information and alter the trouble of the issues in like manner (Albadarin, Tukiainen, Saqr, & Pope, 2023), (Firat, 2023), (Rahman & Watanobe, 2023), (Zhu, Sun, Luo, Li, & Wang, 2023).
- **Creating adaptive tests:** It can be utilized to make versatile tests that alter to each student's level of trouble, permitting for more precise and successful evaluation of information and aptitudes (Bozic & Poola, 2023).
- **Alternative assessment methods:** Alternative assessment methods such as intelligent recreation and diversions can be utilized to make more locks in and bona fide evaluation involvement for students (Bozic & Poola, 2023) (Oranga, 2023).
- **Self-directed learning:** It permits students to require duty for their claim learning and create the abilities and approaches essential for their victory (Fuchs, 2023). It moreover changes them into advocates of their possession learning through increased motivation and victory within the learning prepare (Crawford, Cowling, & Allen, 2023)
- **24/7 Availability:** ChatGPT allows students to access information and help whenever and wherever they need it (Khan, Ahmad, Jabeur, & Mahdi, 2021, Oranga, 2023).
- **Accessible Learning:** It makes learning more accessible for individuals with visual or hearing impairments through different and specialized text-based interactions (Farrokhnia, Banihashem, Noroozi, & Wals, 2023).
- **Instant Feedback:** ChatGPT gives moment input on assignments, tests, and questions, making a difference understudies get their mistakes and adjust them quickly (Kuhai, Alturki, Alramlawi, & Alhejori, 2023).
- **Extensive Knowledge Base:** Prepared on a wide run of sources and able to supply clarifications, definitions and cases on different subjects (İşler & Kılıç, 2021).

- **Providing Accurate and Clear Information:** It can answer user questions accurately by processing information in an accurate, efficient, systematic and informative manner (Zhang, Lu, Zhu, & Zhang, 2023). Within the study carried out by Topal et al. (2021), within the “States of Matter” unit of the 5th grade Science course, students were able to inquire all sorts of questions to ChatGPT and the chatbot replied all the questions of them. After this consideration, the ones expressed that they seem to get data around the courses and other areas from ChatGPT. According to Brandtzaeg and Følstad (2017), one of the foremost common reasons why individuals (aged 16-55) incline toward chatbots is to get data. In brief, ChatGPT is for the most part utilized to supply data to clients and reply to their questions rapidly (Rasul, et al., 2023).
- **Language Learning:** It makes a difference dialect learning by reenacting real-life discussions and giving students with corrections on language structure (Brandtzaeg & Følstad, 2017), enhancing language abilities and giving moment input on vocabulary (Lin & Chang, 2020). A study by Kim (2021) searched the utilize of ChatGPT in language learning and found that it is successful in enhancing students’ English language skills and is profoundly evaluated by students.
- **Language Translation:** It can be utilized to decipher instructive materials into distinctive dialects and make them more open to a more extensive group of audience (Beam, 2023). A research by Jeon and Lee (2023) appeared that ChatGPT can get it the meaning of sentences in a dialect and precisely interpret between dialects by accomplishing state-of-the-art comes about in different interpretation criteria.
- **Study Help:** Making a difference students with inquire about by summarizing articles, making citations, or proposing extra readings and sources (Jeon & Lee, 2023).
- **Writing assistance:** It can give feedback on linguistic use, accentuation, and spelling mistakes by analyzing students’ composing style and proposing advancements (Pokrivcakova, 2019). Lin and Chang (2020) found that the prompts created by ChatGPT to reinforce students’ composing abilities made a difference in students create more different and complex thoughts for their composing assignments.
- **Conceptual Reinforcement:** By helping students gain a deeper understanding, it helps them understand difficult concepts more easily through discussion and practical problems and strengthens their understanding (Liu, Subbareddy, & Raghavendra, 2022).
- **Conversational Learning:** By engaging students in conversational interactions, it also encourages active learning and critical thinking and is particularly useful in developing communication skills (Kim, 2021).
- **Collaborative Learning:** It encourages collaborative learning by making a difference students work together on group tasks or problem-solving duties (Grudin & Jacques, 2019).

- **Interactive Learning:** It can be utilized to make intelligently learning encounters where students can connect with a virtual mentor through chat (Albadarin, Tukiainen, Saqr, & Pope, 2023). A study by Peng et al. (2023) appeared that ChatGPT can give compelling back to learners of English as a second language, where the operator can detect the students' questions, give suitable and sensible reactions, and as a result, language capability can improve (Peng, et al., 2023).
- **Exposure to Different Perspectives:** It encourages open-mindedness and critical thinking by providing students with different viewpoints and perspectives on various topics (Oranga, 2023).
- **Flexibility:** Adapts to diverse learning styles and choices, whether students prefer reading, listening or conversational arguments (De Castro, 2023)
- **Affordability:** Using ChatGPT is cost-effective as it eliminates the need to hire additional human trainers or instructors, providing accessibility to information without having the resources (Su & Yang, 2023).
- **Scalability:** It can be scaled to get a huge number of learners at the same time for both person and gather learning situations (Oranga, 2023).
- **Automatic grading:** It can be utilized to consequently review essays and other written tasks. This spares teachers a part of time and gives students prompt input on their work (Albadarin, Tukiainen, Saqr, & Pope, 2023). It can give precise, steady and objective task (Bozic & Poola, 2023). A study by Khan et al. (2021) appeared that ChatGPT can precisely review papers composed by tall school students with a relationship of 0.86 with human grades. The think about appeared that the demonstration was able to distinguish key highlights of well-written papers and give input comparable to that given by human raters (Khan, Ahmad, Jabeur, & Mahdi, 2021).
- **Facilitated lesson planning:** It can be utilized to create educational program and make lesson plans and educating materials based on particular learning gains (Bozic & Poola, 2023).
- **Text analysis:** By identifying patterns and trends in the language used, it assists researchers in analyzing and comprehending vast amounts of text data, such as news articles or posts on social media. (Peng, et al., 2023).
- **Learning by having fun:** It is seen as engaging and exciting for students and they claimed that they learn by having fun (Kolchenko, 2018).
- **Offering different learning approaches:** Creating, supporting and presenting new learning approaches to improve the learning process and outcomes (Vartiainen & Tedre, 2023) and facilitating their implementation (Deng & Yu, 2023). It can also demonstrate how teachers can embrace or create fresh, successful teaching and learning methods that

might emerge. (Sonderegger & Seufert, 2022).

- **Improving thinking abilities:** It greatly enhances students' capacity for original and creative thought as well as their retention, reasoning, and analysis skills. (Liu, Subbareddy, & Raghavendra, 2022).

Negative Aspects of ChatGPT

Although ChatGPT has a lot of promise in a number of areas, including education, it also has a number of drawbacks and difficulties. Because of its negative aspects, the extensive use of ChatGPT in education has sparked some worries. (Oranga, 2023). To mention the negative aspects:

- **Lack of Critical Thinking:** ChatGPT only generates answers based on patterns in the data it has been trained on because it lacks the ability to truly comprehend and think critically. As a result, these answers might not always be correct or logical. (AlAfnan, Dishari, Jovic, & Lomidze, 2023).
- **Data Dependency:** The quantity and quality of the data in the database that ChatGPT uses is crucial because it is trained on a lot of data. The model might not function as well if the data is insufficient or irrelevant (De Castro, 2023). It was highlighted in a study by Peng and colleagues (2023) that when the training data is unrelated to the task at hand, a ChatGPT-based question answering system does not function as well as intended.
- **Limited Context Awareness:** ChatGPT lacks an in-depth understanding of the wider context and can sometimes produce inappropriate or meaningless responses that are irrelevant (Oranga, 2023). Its capacity to comprehend and produce contextually relevant responses in a conversation is limited, according to a study by Ali et al. (2023) (Ali, Shamsan, Hezam, & Mohammed, 2023).
- **Vulnerability to Bias:** Biased or discriminatory responses could result from the model inadvertently reinforcing preexisting biases in educational data (Mhlanga, 2023). For instance, a model may not accurately grade essays written by students from other demographic groups if it is trained on a dataset that primarily consists of essays written by students from that group (De Castro, 2023). According to a study by Alafnan et al. (2023), ChatGPT displays gender bias in its language production.
- **Failure to Verify Information:** Although ChatGPT offers information, it is unable to confirm that this information is accurate. As a result, users ought to assess the information offered critically (Zhu, Sun, Luo, Li, & Wang, 2023).
- **Limited Subject Knowledge:** Despite having access to a wealth of information, they might not be knowledgeable about certain crucial subjects and their understanding may be out of date (Gilson et al., 2022).

- **Risk of Misinformation:** Using ChatGPT exclusively to obtain information can result in the unintentional spread of inappropriate and erroneous information, particularly when it comes to contentious or quickly changing subjects. Despite having a sizable database, it cannot take the place of books in this situation (Alkaissi & McFarlane, 2023). In one study, Oadir (2023) asked ChatGPT to write an article, and a book based on an article he was working on. ChatGPT included an article that didn't exist and even gave him the article's bibliographic information with a non-functional URL (Qadir, 2023).
- **Privacy Concerns:** Conversations with ChatGPT can be recorded and stored, potentially leading to privacy concerns if sensitive or personal information or data is shared (Ray, 2023).
- **Lack of Emotional Intelligence:** When ChatGPT lacks emotional intelligence and empathy, it is unsuitable for offering counseling or emotional support (Jeon & Lee, 2023). Students who engaged with a virtual tutor who exhibited human-like emotional behavior outperformed those who engaged with a virtual tutor who did not, according to a study by Chechanowski et al. (2018) (Chechanowski, Przegalinska, Magnuski, & Gloor, 2018).
- **Over Reliance on Technology:** Overuse of artificial intelligence such as ChatGPT can lead to overreliance and overdependence on technology (Arruda, Marinho, Souza, & Wanderley, 2019). In addition to extended radiation exposure, this results in deficiencies in critical thinking abilities and learning independence (Aktay, Gök, & Uzunoğlu, 2023).
- **Unpredictable Responses:** Unpredictable or inappropriate responses that may cause problems in educational or professional settings, and may also produce responses that are inappropriate for the age of the student (Kolchenko, 2018)
- **Lack of Real World Experience:** Since there is no real-world experience, it cannot provide practical advice based on personal experiences (Kolchenko, 2018).
- **Failure to Meet Individual Needs:** ChatGPT cannot truly comprehend the concepts they teach students because it is based on statistical patterns in the data it is trained on (Aleedy, Atwell, & Meshoul, 2021). As a result, it finds it difficult to offer clarifications or feedback that are specific to the needs and misconceptions of each learner. Additionally, because it is unable to follow one-on-one interactions and needs, it is unable to satisfy the unique requirements of the user (Baidoo-Anu & Ansah, 2023). According to a study by Clarizia et al. (2018), ChatGPT was unable to offer explanations that were specific to the misconceptions of the students (Clarizia, Colace, Lombardi, Pascale, & Santaniello, 2018).
- **Language Limitations:** It may not be equally proficient in all languages and its performance may vary depending on the language with which it interacts (Chiang & Lee, 2024).
- **Security Risks:** It can be utilized to produce damaging or immoral content, including spam, scams, and fake news (Farrokhnia, Banihashem, Noroozi, & Wals, 2023).

- **Lack of Social Interaction:** Despite ChatGPT's ability to mimic conversations, it cannot take the place of in-person social and emotional interactions and may result in a decline in empathy as well as a lack of communication and social skills (Ray, 2023).
- **Plagiarism:** Plagiarism and academic dishonesty may result from students using ChatGPT to produce written work without giving due credit or obtaining permission to use it (Day, 2023). According to data presented by Hisan and Amri (2023), students who used ChatGPT in their writing assignments were more likely than those who did not to engage in plagiarism. Furthermore, a number of studies have demonstrated that ChatGPT-generated text is imperceptible by plagiarism detection software like Turnitin, despite the fact that features like the absence of errors, consistent style and tone, and the use of sophisticated vocabulary and sentence structures may raise suspicions (AlAfnan, Dishari, Jovic, & Lomidze, 2023).
- **Difficulty in Objective Assessment:** Due to the difficulties in plagiarism and plagiarism detection, there are difficulties in accurately assessing papers and student performance (Rudolph, Tan, & Tan, 2023).
- **Lack of Creativity and Originality:** ChatGPT can limit the creativity and originality of responses and diminish higher-order thinking skills because it can only produce responses based on patterns in the data it observes during training (Su & Yang, 2023). The ability of ChatGPT to generate unique and varied melodies in a music composition system is limited, according to a study by Rasul et al. (2023).
- **Technical Requirements:** Some users may find it difficult to use ChatGPT because it requires technical hardware and background knowledge, such as high-speed internet, access to computer resources, and specialized software. (Oranga, 2023).

When choosing whether and how to use ChatGPT in education, it's critical to take these negative aspects and limitations into account (Aktay, Gök, & Uzunoğlu, 2023). These limitations can be lessened and the potential advantages of ChatGPT in education can be maximized with the support of proper training, observation, and assessment (Adıgüzel, Kaya, & Cansu, 2023).

Methods to Overcome the Negative Aspects and Limitations of ChatGPT

It is crucial to approach the use of GPT technology in the classroom responsibly and thoughtfully, considering both the possible advantages and difficulties and working to get past any limitations that might appear (Aleedy, Atwell, & Meshoul, 2021). All students' educational experiences can be improved and made more enriching by doing this with GPT technology (Halaweh, 2023). Ways to overcome these challenges and limitations are;

- **Diversifying training data:** By gathering data from multiple sources and making sure that the data is devoid of bias and inaccuracy, diverse and representative training data can be used to address bias and inaccuracy issues (Bozic & Poola, 2023).

- **Providing contextual and critical thinking skills:** Giving students the context and critical thinking abilities they require to decipher and evaluate the language generated by ChatGPT is essential to overcoming their lack of contextual understanding (Halaweh, 2023).
- **Encouraging higher-order thinking skills:** Critical thinking and problem-solving abilities should be promoted in addition to the use of the generated content to lessen the possibility that students will grow unduly reliant on ChatGPT technology (Bozic & Poola, 2023).
- **Including alternative assessments:** Alternative assessments such as projects, essays, and presentations should be included alongside ChatGPT to prevent cheating (Aleedy, Atwell, & Meshoul, 2021). Moreover, to leverage the power of ChatGPT and build professional capacity, teachers should support students in high-quality assessment practices that enhance student learning (Aktay, Gök, & Uzunoğlu, 2023).
- **Providing technical support and training:** Access to specialized software and computer resources, as well as technical support and training, are necessary to guarantee that educators and learners can utilize ChatGPT technology in the classroom (Castañeda & Selwyn, 2018). Furthermore, institutions and organizations should carefully plan ChatGPT implementations, provide clear guidelines for its use, invest in ongoing monitoring and maintenance, and offer alternatives to users who need more complex or personal assistance (Holmes, Bialik, & Fadel, 2019). Furthermore, managing expectations and guaranteeing a satisfying user experience can be achieved by informing users about ChatGPT's features and limitations (Clarizia, Colace, Lombardi, Pascale, & Santaniello, 2018). According to a study by Ali et al. (2023), people who lacked the requisite ChatGPT skills discovered that it did not enhance their work and might even be detrimental. (Ali, Mohammed, Shamsan, and Hezam, 2023) This worry may result in unequal access to ChatGPT's advantages; specifically, individuals lacking the requisite skills might not be able to fully utilize it, which could lead to disparities in educational opportunities and outcomes (Vartiainen & Tedre, 2023). Thus, professional development programs that give educators and pre-service educators a foundational understanding of AI should be made available to them (Valtonen & Mäkinen, 2022).
- **Using plagiarism detection software:** Utilize plagiarism detection software, which finds similarities between student work and other sources to help spot instances of cheating (Day, 2023).
- **Referencing and verifying information in constructed responses:** By carrying out more research and referencing reliable sources, the data produced by ChatGPT should be confirmed (Day, 2023). Additionally, when citing content produced by ChatGPT, it should be made explicit that the information was produced by an AI language model, along with the date and the platform name, such as "Chat GPT" or "OpenAI's language model" (Kooli, 2023).

- **Monitor student behavior during exams:** Using remote proctoring software that can identify and flag questionable behavior, such as a student accessing outside resources or copying information from other students, teachers can keep an eye on how their students behave during exams (Khan, Ahmad, Jabeur, & Mahdi, 2021).
- **Clear expectations and consequences:** Clear expectations regarding academic integrity and cheating should be established, along with specific penalties for infractions, to discourage cheating (Day, 2023).
- **Inform students about ethical behavior:** It is important to educate students about academic integrity and moral conduct (Kooli, 2023). It is also important to emphasize that cheating is not only immoral but also detrimental to the learning process and, eventually, the cheater's academic success (Crawford, Cowling, & Allen, 2023).
- **Addressing ethical concerns:** Strong data privacy and security procedures should be put in place, and ethical issues should be given top priority, to address ethical concerns (Crawford, Cowling, & Allen, 2023). In addition, data protection and privacy laws, as well as legal and regulatory compliance, must be complied with when using AI chatbots that process user data (Ray, 2023).
- **Attention to Ethical Use:** Users should use ChatGPT ethically, avoiding harmful or unethical uses, such as spreading fake news or engaging in malicious activities (Crawford, Cowling, & Allen, 2023).

With more sophisticated generative AI, like ChatGTP-5, anticipated to arrive soon, these different approaches might be effective for a while but might not hold up over time (Lu, 2019). Rather, we must begin to acknowledge the quickly evolving landscape of educational practices and adapt them to our existing methods (Aktay, Gök, & Uzunoğlu, 2023). In order to optimize ChatGPT's advantages and minimize its disadvantages, it is crucial to use it as a tool rather than a final information source, supplementing its use with human supervision and direction, particularly in urgent circumstances (Vartiainen & Tedre, 2023).

Conclusion

The advantages and disadvantages of GPT should be considered when determining whether and how to use ChatGPT in the classroom (Adıgüzel, Kaya, & Cansu, 2023). It is important for researchers, educators, students, and other professionals to exercise caution when using ChatGPT (AlAfnan, Dishari, Jovic, & Lomidze, 2023). No matter how strong the tool is, it is crucial to keep in mind that ChatGPT cannot take the place of human instructors and trainers; rather, it should be used in conjunction with human assistance and training (Kolchenko, 2018). Accordingly, incorporating ChatGPT into the classroom and instructing students on its safe and productive use can equip them for success in an artificial intelligence-dominated workplace (Albadarin, Tukiainen, Saqr, & Pope, 2023). In this regard, there are a few issues that need to be addressed when instructing Chat GPT (Baidoo-Anu & Ansah, 2023);

- How can ChatGPT be used to enhance students' learning?
- Is it required that educators and learners receive instruction on ChatGPT?
- How should the ChatGPT model be integrated into teacher education programs?
- How do students evaluate ChatGPT?

Policymakers, researchers, educators, and technologists should collaborate to address these issues and start conversations about how technology can be used in a safe and beneficial way to enhance student learning (Mhlanga, 2023). Furthermore, having these conversations is a crucial step in maximizing advantages and guaranteeing academic integrity for teachers and students alike (Ali, Shamsan, Hezam, & Mohammed, 2023). The effectiveness of ChatGPT's integration into the educational process and its ability to improve student learning and achievement will determine its use in the classroom (Aktay, Gök, & Uzunoğlu, 2023). Therefore, ChatGPT's potential to revolutionize education and empower the next generation of learners should be unlocked by taking a careful and balanced approach to its use (Adigüzel, Kaya, & Cansu, 2023). Through organized training and the provision of sufficient background information, this involves teaching educators and learners how to use it sensibly and recognize its limitations (Bozic & Poola, 2023).

To develop innovative, well-organized, and captivating teaching methods, educators must become highly proficient in integrating ChatGPT into their classrooms (Rasul et al., 2023). To guarantee that they can use ChatGPT in an equitable and efficient manner, educators should be provided with training, assistance, and competency development (Fuchs, 2023). Learners should receive the required training, which includes background knowledge on how to use the information effectively, how this model operates, the data used in their training and how to understand its limitations, challenges, and issues, as well as the ability to evaluate the information it produces, since the inputs determine the accuracy and quality of the information provided (Williamson & Eynon, 2020). Additionally, there should be a focus on reconsidering, refining, and redesigning creative evaluation techniques that give top priority to evaluating students' capacity to apply knowledge to challenging situations and exhibit comprehension (Crawford, Cowling, & Allen, 2023). The creation of precise rules, regulations, and instructional guidelines is an essential remedy in this situation (Jeon & Lee, 2023). Therefore, in order for students to understand the limitations of ChatGPT and the significance of higher-order thinking skills that machines cannot replicate; educational research should offer suggestions for classroom practice (Castañeda & Selwyn, 2018). To fully comprehend ChatGPT and assess its possible advantages, disadvantages, and educational limitations, more research is required. A thorough literature review will offer important new information on the subject. (Vartiainen & Tedre, 2023).

In the literature review, ChatGPT has been used in medical education (Eggmann, Weiger, Zitzmann, & Blatz, 2023), language teaching (Lin & Chang, 2020), mathematics teaching (Kabiljagić, Wachtler, Ebner, & Ebner, 2022), social studies teaching (Son, 2020), and education in general (Lo, 2023). In science education, according to the 5E learning model, both middle school students

(Ergun, 2023) and pre-service teachers (Okul & Muslu, 2024) were used in lesson plan design and in learning the views of middle school students on recycling (Aktay, Gök, & Uzunoğlu, 2023), (Çelik, 2023), motivation to learn chemistry (Korsakova, et al., 2021), and measuring the capacity to answer, explain and solve chemistry-related questions and problems (Clark, 2023). These studies have demonstrated the potential for additional advancement in this emerging field and the necessity for more thorough investigation into the various educational applications of ChatGPT.

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