**ANALYSIS OF CHATGPT IN EDUCATION, ITS POTENTIAL BENEFITS, LIMITATIONS AND POSSIBLE APPLICATIONS**

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**ABSTRACTS**

AI has revolutionized the way we learn and teach, and one of its most innovative applications is ChatGPT. This language model is trained on extensive data and can generate human-like responses to a wide range of questions, making it a powerful tool in education. This paper examines the potential benefits, limitations, and applications of ChatGPT in education, including its use as a tutor, learning assistant, and tool for generating educational content. Additionally, the paper explores the ethical and privacy concerns that come with using AI in education. Ultimately, ChatGPT's ability to provide personalized and engaging learning experiences holds great promise for transforming education, but careful consideration must be given to ethical and privacy concerns.

**KEY WORDS**

# **1.INTRODUCTION**

By developing and analyzing smart software and hardware, referred to as intelligent agents, that are capable of carrying out a variety of tasks, artificial intelligence (AI) has had an impact on how we go about our daily lives. According to Bansal and Khan (2018), a chatbot is a human-computer interaction (HCI) model and artificial intelligence application. A chatbot is defined as "A computer program designed to simulate conversation with human users, especially over the Internet" by the dictionary.

## **1.1 HISTORY OF CHATBOTS**

In 1950, Alan Turing proposed the Turing Test, which helped make chatbots more well-known. Eliza was the first chatbot, and it used pattern matching and a response system based on templates. ALICE received the Loebner Prize in 1995, and PARRY was created in 1972. Virtual personal assistants like Apple Siri, Microsoft Cortana, Amazon Alexa, Google Assistant, and IBM Watson, as well as chatbots like SmarterChild, were developed (Suhaili, Salim et al. 2021).

As shown in Fig.1 according to Scopus, interest in chatbots increased quickly, especially after 2016. While a large number of less well-known chatbots are relevant to research and their applications, many chatbots were created for industrial solutions.

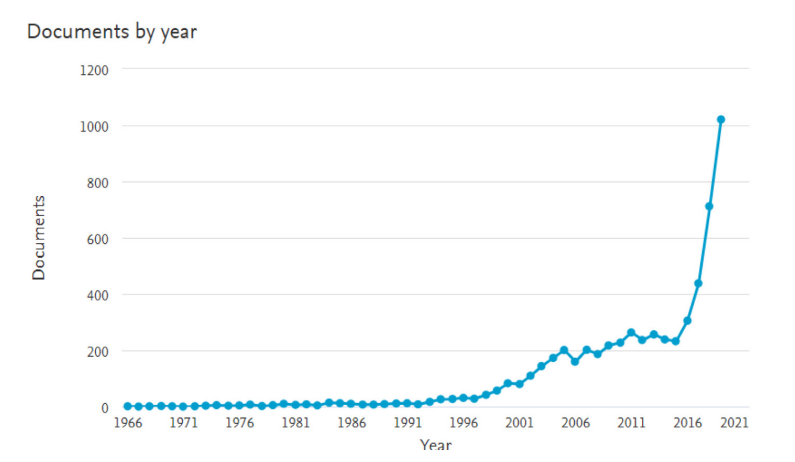


Fig 1. Search Results in Scopus (Scopus preview—Scopus—Welcome to Scopus, 2020), from 1966 to 2019 for the keywords ‘‘chatbot’’ or ‘‘conversation agent’’ or ‘‘conversational interface’’

## **1.2 SIGNIFICANCE OF CHATBOTS**

Chatbots are computer programs designed to simulate conversation with human users through text or voice interactions. (Adamopoulou and Moussiades 2020)They have the potential to streamline customer support, improve customer experience, and provide businesses with valuable insights into customer behavior. They can handle multiple customer queries at once, provide 24/7 availability, reduce staffing costs, personalize responses, enhance customer experience, and collect and analyze data on customer interactions. These benefits make chatbots an increasingly important tool for businesses looking to improve their customer service and stay competitive in today's digital landscape.

## **1.3 CATEGORIES OF CHATBOTS**

Chatbots have become increasingly dynamic with the arrival of new technologies, so a precise classification has become subjective to the scope of their use. (Hussain, Ameri Sianaki et al. 2019) Chatbots can be classified into various categories based on criteria such as mode of interaction, knowledge domain, usage and design techniques. The broad classification can be done based on the following criteria: mode of interaction, knowledge domain, usage and design techniques.

1. Interaction Mode (Text based, or voice/speech based)
2. Chatbot Application (Task-Oriented or Non-Task-Oriented)
3. Rule-based or AI (Machine learning, Deep learning etc.)
4. Domain-Specific or Open-Domain

But in general, Chatbots are divided into two categories based on their goals.

1. Task-oriented chatbots
2. Non-task-oriented chatbots

Non-task-oriented chatbots can mimic a conversation with a human in open domains, whereas task-oriented chatbots are made to conduct brief discussions in closed domains.

## **1.4 CHATGPT HISTORY**

Innovating models like GPT-2, GPT-3, and ChatGPT are developed by OpenAI, a company dedicated to creating AGI for the benefit of humanity. When compared to GPT-3, ChatGPT performs better at contextual understanding, answer production, and overall coherence.GPT-4-based ChatGPT was developed by OpenAI as a result of its research and development efforts, which built on the success of GPT-3.

GPT models are designed to generate natural language writing that is coherent and consistent with human language. They may pre-train on a lot of text material and then concentrate on particular downstream tasks. Pre-training includes unsupervised model training using a large corpus of text data. By giving the model a smaller labeled dataset after pre-training, it can be improved on a particular downstream task.

(Ray 2023) The GPT language's initial release in 2018 is GPT-1. It has a Transformer architectural foundation and had been pre-trained using a large amount of text data. After pre-training, GPT-1 could be further fine-tuned to perform certain downstream tasks like sentiment analysis, language translation, or text categorization. In comparison to later versions of the GPT model, GPT-1 featured a tiny number of parameters—117 million. Despite being relatively modest, GPT-1 excelled at a variety of tasks involving natural language processing and proved how pre-training on a lot of text data for improving language understanding.

A large language model called GPT-2 with 1.5 billion parameters that had been pre-trained on a sizable corpus of text data was able to produce state-of-the-art on tasks including text categorization, sentiment analysis, and question-answering. Additionally, it was able to produce writing that was convincing and difficult to differentiate from human-written content, raising questions about potential misuse.

GPT-3, which has 175 billion parameters, is one of the largest and most powerful language models ever made. It has extensive natural language processing capabilities and was trained on a large corpus of text data. Additionally, it incorporates innovative features like multi-task learning and few-shot learning that make it extremely flexible and adaptable. It has attracted interest from the artificial intelligence sector and has been used in a variety of real-world applications.

OpenAI developed a new language model called InstructGPT that uses human feedback and reinforcement learning to increase its reliability. It serves as the foundation for the ChatGPT conversational agent and provides a method for gathering human feedback during the fine-tuning stage. In OpenAI's technology, this procedure has developed into a standard, enabling InstructGPT to outperform GPT-3.

A language model called ProtGPT2 can be used to create and develop new proteins. It is constructed using the GPT2 Transformer design, has 36 layers, and 1280 dimensions. Using a causal modeling objective, it was pre-trained on the UniRef50 database to predict the following token or oligomer in the sequence. ProtGPT2 is a promising tool for protein engineering and design.

For processing biomedical text data, BioGPT is a domain-specific, generative, pre-trained Transformer model that was developed using 15 million PubMed abstracts.

ChatGPT is capable of generating coherent and realistic responses since it has been pre-trained on a large amount of text data to learn the patterns and relationships between words and phrases in natural language.

GPT-4, a multimodal language model that can receive both image and text inputs and produce text outputs, has been made available by OpenAI. It has proven to perform at human levels on a variety of academic and professional standards, such as the top 10% of test takers on a simulated bar exam. GPT-4 was developed over the course of six months by iterative alignment, which led to the best-ever results in terms of factuality, steerability, and staying within given boundaries (Ray 2023).

Table 1. Comparison of GPTs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Version | Uses | Architecture | Parameter count | Year |
| GPT-1 | General | 12-level, 12-headed Transformer decoder (no encoder), followed by linear-softmax with Book Corpus: 4.5 GB of text | 117 million | 2018 |
| GPT-2 | General | GPT-1, but with modified normalization with Web Text: 40 GB of text | 1.5 billion | 2019 |
| GPT-3 | General | GPT-2, but with modification to allow larger scaling with570 GB plaintext | 175 billion | 2020 |
| InstructGPT | Conversation | GPT-3 fine-tuned to follow instructions using human feedback model | 175 billion | 2022 |
| ProtGPT2 | Protein Sequences | As GPT-2 large (36 layers) with Protein sequences from UniRef50 of total 44.88 million | 738 million | 2022 |
| BioGPT | Biomedical Content | As GPT-2 medium (24 layers, 16 heads) with non-empty items from PubMed total 1.5 million | 347 million | 2022 |
| ChatGPT | Dialogue | Uses GPT-3.5, and fine-tuned with both supervised learning and reinforcement learning from human feedback (RLHF) | 175 billion | 2022 |
| GPT-4 | General | Trained with both text prediction and RLHF and accepts both text and images as input, third party data | 100 trillion | 2023 |

## How Does it work?

A strong and effective method for modeling natural language sequences is the Transformer architecture. In order to create a sequence of hidden representations that can be decoded into an output sequence, it first encodes the input sequence using self-attention. For GPT-3.5, the model makes use of a stack of 13 Transformer blocks, each of which has 12 attention heads and 768 hidden units. A series of tokens that are embedded using an embedding layer into a continuous vector space serve as the model's input. The remaining 12 Transformer blocks, which individually apply self-attention and feedforward layers to the hidden representations, are then passed through.

(Panda and Kaur 2023) A series of hidden representations that are produced by the final Transformer block are decoded into an output sequence using a linear projection layer and a softmax activation function. The GPT-3.5 architecture has shown state-of-the-art performance on a variety of language problems and is a strong and effective technique to model natural language sequences.

The working of chatgpt is carried away in three steps as follows.

1. Collect demonstration data and train a supervised policy

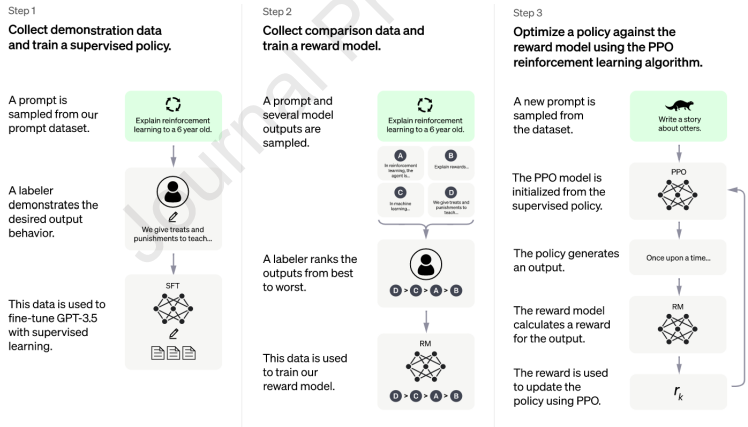
A prompt is first sampled from the prompt dataset. The desired output behavior is displayed via a labeler. Using supervised learning, this data is used to improve GPT3.

1. Collect a comparison data and train a reward model

Second, samples from a prompt and several model outputs are taken. The outputs are ranked by a labeler from best to worst. The reward model is trained using this data.

1. Optimize a policy against the reward model using reinforcement learning

The dataset is then sampled for a fresh prompt. The policy generates an output. A reward is determined by the reward model for the output. With the help of the proximal policy optimization (PPO) algorithm, the reward is used to update the policy.



GPT3.5 Model Workflow

**2.LITERATURE REVIEW**

The Open AI in Education literature study focuses on the ethical appropriate application of ChatGPT, an advanced language model created by OpenAI. It has the potential to change the way learners gain knowledge and access information and can provide numerous benefits for both students and teachers, but it also has the potential to reinforce stereotypes and forms of discrimination, resulting in uneven and unjust learning experiences. Furthermore, it can make kids less capable of critical thinking (Mhlanga 2023).

(Lo 2023) Had done research on “How Can ChatGPT Be Used to Enhance Teaching and Learning?” The findings of this review suggested that chatGPT can serve as an assistant for both instructors and students, providing suggestions for teaching preparation and assessment tasks. It can also provide recommendations related to special education, which are beneficial for students with special learning needs. Similarly, (Rudolph, Tan et al. 2023) had done research on “ChatGPT in the context of existing artificial intelligence in education” Baker and Smith (2019) distinguish educational settings as student-facing, teacher-facing, and system-facing, all of which have the capacity to dramatically impact educational practices. This approach has been proven to give significant clarifications on the usage of artificial intelligence in education.

Chat GPT can be used to provide personalized suggestions for learning materials and resources based on a learner's specific needs and goals. It may also be used as a tutor or mentor, providing feedback and help, guidance and support, and as a tool for self-evaluation and reflection. This practice can assist students in taking responsibility for their own learning and development, as well as developing the skills and strategies required for success as self-directed learners (Firat 2023).

ChatGPT can help students improve academic performance and engagement by providing personalized recommendations for learning resources and activities, teacher support, test preparation, online tutoring, and language learning. It can also help teachers improve their instructional methods by providing individualized recommendations based on data on teaching best practices and student learning results. Additionally, it can help students enhance their academic performance and engagement by personalizing tutoring sessions to individuals' learning preferences (Ray 2023).

AI technologies have been shown to increase motivation and engagement, facilitate interactive learning environments, and improve academic performance. It has the potential to improve reading comprehension, foster learning outcomes, and reduce anxiety among middle school students. Teachers can use AI technologies to improve teaching skills and competence, introduce adaptive teaching strategies, provide professional development, and present assessments of students. AI-based learning management systems can provide numerous benefits for both students and teachers(Adiguzel, Kaya et al. 2023).

NLP Application: ChatGPT is a natural language processing tool that is able to understand natural language text better than previous language models. It provides high-quality responses to natural language questions due to its extensive training and ability to generate human-like responses. It is able to automate natural language processing activities such as translation, text summarization, and sentiment analysis, saving time and minimizing the need for human work. It can be trained on data from a variety of languages and dialects, and can learn and adapt to the language, writing style, and context of individual users, resulting in customized replies that are tailored to their needs. It is able to quickly and efficiently analyze large volumes of natural language data, making it suitable for large-scale language processing tasks.

It can also help those with diverse degrees of linguistic skill, such as non-native speakers and persons with impairments, improve communication and accessibility. ChatGPT applications in natural language processing include language translation, text summarization, and sentiment analysis.

Traditional chatbots rely on established rules and replies to create answers to user inquiries, which may be time-consuming and need specialized knowledge. They are constrained to a set of prepared replies and may struggle to develop natural language responses. They require constant maintenance to ensure that the questions and answers they supply are up to date and relevant, and they may provide robotic, stiff responses that are less appealing for users. They can require tremendous time and money to build, train, and maintain.

However, ChatGPT is a machine learning system that generates answers based on a vast corpus of text data. Because it does not rely on established rules and replies, it can handle a broader range of inquiries and deliver more natural language responses. It is pre-trained on a vast corpus of text data and may be fine-tuned to perform better on certain tasks or topics. It is intended to provide natural language replies that closely resemble human conversation, making it more engaging and user-friendly. It may be trained on current data and fine-tuned for specific activities, thereby lowering development and maintenance costs over time (Panda and Kaur 2023).

The above-mentioned differences in characteristics make it abundantly evident that ChatGPT is a significant advancement over traditional knowledge base-based chatbots, allowing for more flexible and natural language conversation.

Despite its strengths, ChatGPT has limitations and weaknesses. It lacks a deep understanding of the meaning of words it processes, leading to responses that are sometimes lacking depth and insight. It is less competent when it comes to content that requires higher-order thinking skills, such as critical and analytical thinking. This is due to the high dependency of AI tools on data that are trained without a deep understanding of context, common sense, and emotions.

The lack of a deep understanding of the context and true meaning behind words can pose various risks, especially within the realm of education. For example, ChatGPT used for personalised learning may not have a deep understanding of the curriculum, learning style, and cultural context in which the student lives, resulting in content recommendations that are either too difficult or too easy for students. Additionally, ChatGPT has been shown to generate human-like text, which could pose a potential risk to the integrity of online exams. Additionally, ChatGPT has the potential to respond sufficiently to exam questions in the fields of medical and law. Over-dependence on ChatGPT can have negative consequences both for students and teachers. For students, it can lead to a decline in their higher-order cognitive skills such as creativity, critical thinking, reasoning, and problem-solving, while for teachers, it can reduce the quality of their interactions with students and exacerbate existing inequalities (Farrokhnia, Banihashem et al. 2023).

**3.ANALYSIS**

ChatGPT has shown to be a helpful tool in education domain, it is critical to acknowledge and address the obstacles and ethical considerations related with its usage (Ray 2023). This section looks into these challenges and considers ChatGPT's future potential in the education sphere.

ChatGPT and other AI models can raise ethical concerns such as privacy violations and job displacement. These include biases, privacy, accountability, and transparency. Biases can lead to unfair or discriminatory outcomes, privacy can be revealed, accountability can be difficult, and transparency can make it difficult to identify and correct biases. Researchers, developers, and users of ChatGPT should prioritize ethical considerations throughout the model's development and use, such as fairness, privacy, accountability, transparency, and responsible use. These considerations open several avenues for research, such as algorithms for calculating similarity scores and cheating detection(Fraiwan and Khasawneh 2023).

AI technologies are highly recommended, but their limitations need to be considered. (Mhlanga 2023)They raise ethical and privacy concerns, and have been banned in countries such as Russia, China, Venezuela, Belarus, and Iran. Research on AIEd reveals a weak link to pedagogical perspectives and instructional approaches, and overlooks the challenges and risks involved in learning and teaching with AI. It is essential to ensure that AI-based educational tools are designed with user privacy and data security in mind, and that they do not reinforce biases or perpetuate inequalities. Microsoft 365 Copilot was added to Office apps, and further research is needed to ascertain the potential benefits of these emerging technologies for education.

It is critical to be transparent and honest about the use of ChatGPT in educational settings, as well as to provide frequent venues for students and instructors to debate the moral and responsible use of AI. Transparency is essential because it ensures that students, instructors, and educational institutions understand how the technology works and what it can achieve. It is the job of educators to aid students in developing well-informed and critical perspectives on AI, as well as to use AI technology in a way that supports, rather than replaces, their teaching(Mhlanga 2023).

Users and regulators need trust and openness in AI systems to understand how they make decisions and predictions. By promoting transparency, fostering public trust, and paving the way for more equitable and beneficial AI applications, developers can demonstrate their commitment to ethical development and responsible deployment (Ferrara 2023).

Transparency may assist in the creation of public confidence in AI systems by demonstrating a commitment to ethical development and responsible deployment. Users and regulators may be more willing to trust and use these technologies if they perceive developers take measures to promote justice and equity (Larsson and Heintz 2020).

(Khowaja, Khuwaja et al. 2023) Future developments in intellectual property law are affected by the controversy over intellectual property rights in relation to massive language models. Who owns the models themselves and the data used to train them?

(Mhlanga 2023) The data that ChatGPT was trained on determines its objectivity, and this is true of any AI-powered application. The answers of the model may reflect biases that are present in the training data if the training data itself has some biases. This could lead to the dissemination of false information or damaging stereotypes, particularly when pupils cannot critically analyze the information that they are receiving. Additionally, if the model is taught to use prejudiced language, it may produce answers that contribute to the perpetuation of negative preconceptions or prejudices. This could lead to chatbots in the education sector that deliver biased information or perpetuate harmful prejudices, which would have a negative influence on student learning and development.

An AI language model called ChatGPT is developed to respond to user inputs based on patterns and probabilities discovered via extensive data analysis. (Khowaja, Khuwaja et al. 2023) Researchers have attempted to test chatGPT's moral bounds, for example, by asking it if a person should be tortured and included certain nations that chatGPT believed it was OK to torture. As it is programmed to produce responses to user inputs based on patterns and probabilities learned from vast amounts of data, it has also been linked to racial profiling. Making ensuring that big language models are created and utilized in morally and responsibly is crucial.

**CONCLUSION**

ChatGPT is a strong artificial intelligence technology that has the potential to benefit students, educators, and researchers. However, the risks of academic integrity, biased evaluation, factual inaccuracies, and over-reliance on AI must be addressed. To guarantee that ChatGPT is used in an inclusive, equitable, transparent, and ethical manner, educational policymakers, educational leaders, and instructors should collaborate to improve assessment criteria to prevent unfair learning evaluation. It is also critical to have students create academic reports that include citations. Educational institutions should create training materials and distribute them to both instructors and students so that they can utilize ChatGPT effectively.

Action research should be carried out to investigate the usefulness and efficiency of using this AI technology into education. To guarantee accuracy, students should be alert and review, evaluate, and amend replies provided by ChatGPT. Researchers should begin using ChatGPT to better grasp its benefits and drawbacks for academic purposes. Otherwise, ChatGPT could be a curse rather than a blessing.

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