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The Application of Generative Artificial Intelligence (ChatGPT) in Educational Support

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Abstract: Integrating ChatGPT into education enhances learning methods through personalized teaching approaches and tools that support educators. This study employs multiple methodologies to ensure objective insights, relying on an inductive and descriptive-analytical approach. The theoretical analysis of artificial intelligence (AI) based on available data explores the relationships within the phenomenon under study. ChatGPT facilitates virtual tutoring, automated grading, content generation, and personalized learning experiences. Additionally, it improves accessibility for students with disabilities and supports multilingual communication. While AI integration in education offers significant advantages, concerns arise regarding student plagiarism, misinformation, and overreliance on AI-driven learning methods. Implementing ChatGPT in education necessitates ethical measures to uphold academic integrity and minimize bias. The study emphasizes the importance of teacher supervision and standardized guidelines to regulate AI applications effectively. To maximize the benefits of ChatGPT, the study recommends enhancing AI literacy in educational programs, equipping teachers with AI-related skills, and establishing ethical regulations. AI should function as a supplementary tool rather than replace educators' mentorship roles. A well-balanced approach, combining proper monitoring protocols, educational best practices, and regulatory frameworks, will ensure responsible and effective AI-driven learning experiences.
Keywords: Generative artificial intelligence, educational support, chatGPT, educational process, teaching process.

1. Introduction

The 21st century is characterized by an unprecedented acceleration of technological advancements, impacting every facet of human existence. This relentless progress compels societies to adapt and evolve, particularly in the realm of education. Education, as the cornerstone of human capital development, plays a pivotal role in shaping future generations. To cultivate a generation equipped to navigate the complexities of a rapidly changing world, educational systems must embrace and integrate cutting-edge technologies. As Kamble et al. [1] emphasizes in his work on the Fourth Industrial Revolution, these technologies are not merely tools but catalysts for profound societal transformation.

Artificial intelligence (AI), with its diverse applications, stands at the forefront of this technological revolution. Recognizing its transformative potential, nations worldwide are exploring strategies to harness AI's capabilities to enhance educational practices. This research delves into the application of generative AI, specifically ChatGPT, a large language model developed by OpenAI, within the educational domain. Alsaadat [2] highlight the potential of such AI models to personalize learning, automate tasks, and provide valuable insights into student performance. This study investigates how ChatGPT can be leveraged to support and augment traditional teaching and learning processes.

This research uses the framework image to develop a complete study of ChatGPT's impact on educational processes. The investigative phase starts by introducing the research problem which includes main questions along with its meaning and stated goals and methodological methods. Next the research details a comprehensive theoretical foundation by adopting essential publications from AI and educational research fields. This framework encompasses two core areas: the broader landscape of artificial intelligence and its applications, with a particular focus on the capabilities and implications of ChatGPT.

The research adopts an inductive method that examines all available literature about AI in education as demonstrated by Zawacki-Richter et al. [3]. Current empirical evidence and theoretical analysis enables this work to detect vital transformational patterns and obstacles in educational AI tool integration especially regarding ChatGPT technologies. The study argues that educational modernization depends on AI solutions yet teachers need to retain control of student instruction.

The research explores how generative AI particularly through ChatGPT functions in educational assistance which expands existing knowledge about technology implementation in education. The study demonstrates practical strategies to utilize AI through ChatGPT for educators who need to deliver effective instructional support while public policy creators and researchers explore the potential of AI technology in education for modern learning outcomes (see Jafari [4]).

The research evaluates how ChatGPT transforms educational methods by answering "What capabilities does the ChatGPT application hold to enhance educational processes?" This investigation provides clear answers to multiple questions

regarding this objective.

1-The study conducts a breakdown of essential aspects within artificial intelligence frameworks to establish a basic theoretical base.

2-The research investigates AI tools which exceed ChatGPT while identifying methods to efficiently implement them for educational environments to broaden AI applications in education.

3- The research evaluates various ways ChatGPT supports educational processes directly by understanding its value for both personalized educational content and interactive instructional methods as well as automated content generation.

4- The study will develop concrete recommendations with guidelines to optimally use ChatGPT in educational environments after generating its findings. These recommendations will address potential issues and ethical questions.

This research establishes new theoretical insights into both educational applications of artificial intelligence while specifically examining the educational effects of large language models namely ChatGPT. Through this practical initiative educators will receive beneficial information for enabling them to use ChatGPT effectively as well as improving educational outcomes and developing new educational methods. The study examines both the ethical aspects of AI education usage and covers bias concerns and accessibility standards and data security issues to establish responsible ChatGPT implementation practices.

2. Theoretical Frameworks:

2.1. Artificial Intelligence Frameworks:

The concept of artificial intelligence (AI) has many definitions, such as:

2.1.1. The capability of a digital computer or robot to carry out functions that are characteristically of a human brain, such as reasoning, comprehending, learning, and solving problems is known as artificial intelligence (Ref. Ding et al. [5]).

2.1.2 A system or device that is capable of imitating human intelligence to perform some functions and progressively advance based on the data collected over time. AI is the science that makes machines to think as people do by duplicating behaviors and cognitive processes, or simply put, a computer with a mind (Yamato et al. [6]).

2.1.3. An array of traits in software programs that have been designed to think and learn, respond in ways that were not previously anticipated, and exhibit reasoning skills, and other human-like faculties (Yim and Su [7]).

2.1.4. An area of information technology that specializes in machines performing processes and reasoning in a human fashion, although highly simplified, is referred to as AI (Gao and Wang [8]).

2.2. How artificial intelligence is developing (Gangwal et al. [9]):

The roots of AI can be traced back to the middle of a century where researchers began studying the possibility of making computers 'learn.' Alan Turing (Copeland [9]), the well-known British mathematician and computer scientists, made great contributions to the field. In 1950, he presented the 'Turing test' which evaluated whether a machine could perform tasks that would be assumed to require human intelligence. In the following decades, the advancement in algorithms and techniques led to the development of computers that could perform increasingly sophisticated tasks like translation and recognition of patterns. Milestones (Zhang [10]) were reached with the construction of the first expert system in 1970s that could provide suggestions and make decisions based on a set of rules. Neural networks and machines developed independently from 1980 to 1990, which allowed computer systems to self-learn from data and as a result, added roll recognition and classifying images into its range of accomplishment. AI technologies were steered by deep learning and reinforcement learning in the 21st century, permitting computers to control complicated activities like driving self-driving vehicles and playing strategy games. The introduction of AI has led to a shift in many industries such as transportation, entertainment finances, healthcare, and many more.

2.3. Elements of Artificial Intelligence (Yadav et al. [10]):

There are three basic parts that can explain in some detail what AI consists of:

2.3.1. Knowledge Base: An information storage system comprising of pertinent documents such as helpful articles, how-to manuals and troubleshooting documents that allows the system to conduct certain activities and provide appropriate answers to user queries.

2.3.2 Programmed Procedures: Techniques such as deduction, induction, and inference that emulate human reasoning to perform specific operations.

2.4. Categories of Artificial Intelligence (Goertzel [11]):

AI is generally separated into two categories:

2.4.1. Narrow (Weak) AI: Built to perform one or a set of limited defined activities.

2.4.2. General (Strong) AI: Expected to accomplish all tasks that any human can. This is still a theoretical aspiration.

2.5. Defining Features of Artificial Intelligence (Dahlke [12]):

AI incorporates the following key features:

2.5.1. The capacity to think and comprehend.

2.5.2. Learn and utilize information.

2.5.3. Ability to use prior experiences to new problems.

2.5.4. Investigating to extract findings through adaptive experimentation.

2.5.5. Ability to react promptly to complex or difficult situations.

2.5.6. Manage situations that lack clear information.

3. Artificial Intelligence branches and their role in the global markets (Karagkouni and Sotiropoulou [13]):

AI has applications in different fields such as (See Fig. 1):

3.1. Natural Language Processing (NLP) includes: linguistics, voice and speech recognition, acoustic modeling, machine translation and philosophy of language.

3.2. Computer Vision: Development of systems for identification from images (fingerprints) and the simulation of

vision systems for civilians and military applications and for the physiology.

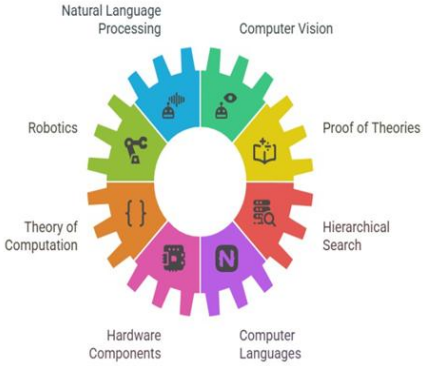

Fig. 1 AI branches and global market

3.3. Robotics: It is the fusion of mechanical engineering with industrial automation, control, electronics, all functions of economy and science.

3.4. Proof of Theories: Development of mathematics, logic, and part of philosophy.

3.5. Theory of Computation and Automatic Programming: Development of computer science.

3.6. Hierarchical Search: Search systems, their types, development of expert systems and their identification.

3.7. Hardware Components: Development in electronic hardware and computing sciences.

3.8. Computer Languages and systems: Development of new languages and frameworks for computer science.

3.9. Knowledge Engineering (Expert Systems): Transformation in chemistry, medicine, management, operations research, civil engineering, petroleum industry, etc. for large savings.

4. How Artificial Intelligence Enhances the Educational Process (Chen et al. [14]):

In the last few years, artificial intelligence has grown remarkably, serving as a technology that changes how we live. It has extended its impact to various fields as one of the most important being education. AI serves as a bridge between distinct learning domains, categorizing, refining, and clarifying knowledge by employing neural networks. AI in education is distinguished by its simplicity, affordability, speed of accomplishing tasks, and capacity to collect and store immense amounts of data. These tools rely on machine learning or deep learning—described as "the development of algorithms that allow machines to learn independently by mimicking human neural cells and processing vast datasets.

5. Important Aspects of AI in Education:

Artificial intelligence plays a role to improve education in a myriad of ways (Hu [15]):

5.1. Reservation and provision of learning experiences.

5.2. Creating opportunities for all people for a variety of learning through life.

5.3. Evaluation of teaching and learning accomplishments.

5.4. Assisting educators and improving learning and teaching practices.

6. Prominent Uses of AI in the Classroom (Batz et al. [16]):

The following are some of the primary tools that are changing education for the better (see Fig. 2):

6.1. Tutor AI: A search engine that enables users to look for valuable information, educational content, and courses. It facilitates self-learning by providing resources in a way that helps students utilize their time and effort.

6.2. Elicit: A research tool that enables out-of-class students to access an unlimited number of PDF articles. Elucidates requested papers and captures important information for research work as he or she goes.

6.3. Scholarly: A platform that automates the process of making notes from scientific articles by translating high-level texts with complex mathematics and tables into a language that everyone can easily digest.

6.4. Typeset: This platform assists very young children by explaining scientific subjects like biology in an elementary level, so even five-year-olds can understand it.

6.5. Elif: Provides visual maps and figurative graphs to help the user comprehend better.

6.6. Visual Sitemaps: Gives detailed graphs for visual location maps and encourages internal Important Aspects of AI in Education.

7. Chat GPT application:

In this research, we will present the Chat GPT application in some detail (Roumeliotis and Tselikas [17]).

7.1. Background of ChatGPT (Dimeli and Kostas [18]):

Particular attention within this paper is given to ChatGPT, an abbreviation for Chat Generative Pre-Trained Transformer. It is an artificial intelligence conversational agent designed by OpenAI, a company stationed in San Francisco led by Sam Altman and sponsored by Microsoft and Elon Musk. ChatGPT is capable of conversing with users and providing answers to questions; even recalling and following up on previous parts of a dialogue. The interaction imitates normal conversation between people. The users are free to provide him with feedback where he dutifully accepts apologies for getting things wrong. As the name suggests, ChatGPT gets his name from the dataset of texts of all kinds (the internet, public information, informal speech and even conversations) a human grant him access to. He uses complex set of calculations to look through the information of the internet that he has access to and builds sentences with the

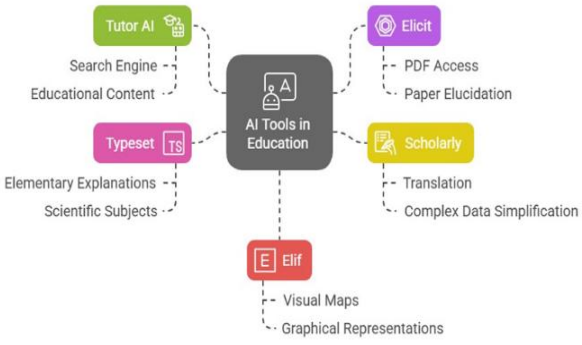

Fig.2 AI Tools Transforming Education

closest resemblance to people's speech, mimicking as brain acts.

7.2. Defining ChatGPT:

Scholars and experts have provided many definitions, including the following:

7.2.1. "A language machine that writes articles or summarizes information using statistical reasoning, reinforcement learning, and word phrase and sentence indexing." Compared with earlier chatbots (e.g., Siri, Alexa), ChatGPT outshines them all. (Alagha and Helbing [19]).

7.2.2. The OpenAI product: a large linguistic robot which uses specified inputs to produce human-like written text such as casual dialogue and translation (Adesso [20]).

7.2.3. "A fully generative chat transformer" which answers questions posed to it in ordinary language and was introduced to the world by OpenAI on November 30 2022. Everybody is astonished about the uncanny capabilities of these technologies and their capabilities to constantly shape new essays, articles, and other journals that professionals used to write (Hasnain [21]).

8. The most important terms of Chat GPT

8.1. Deep learning: It is a machine learning method that enables computers to learn and improve on their own. It relies on artificial neural networks designed to mimic the way humans think and learn (Herath [22]).

8.2. Chatbot: An online robot that engages users in chat for entertainment purposes (Suryanto [23]).

8.3. Generative Pre-trained Transformer (GPT-3): The biggest and the best AI language model which has 175 billion parameters and consists of its best abilities in text structures generation (Floridi and Chiriatti [24]).

8.4. NLP: The aspect of AI concerned with the interactions between human language and computers that makes it possible for the computer to understand natural language (Khurana et al. [25].

9. Applications of ChatGPT

As is evident, ChatGPT has unlimited applications (see Fig. 3); below are some examples: (Feng et al. [26], Shadi et al. [27] and Chang et al. [28]).

9.1. CV Assistance: ChatGPT can assist its users in creating or reconstructing a CV and can also aid in editing.

9.2. Content Development: ChatGPT can be used by content creators to enhance or improve their texts, writing style, or in script and creative piece development.

9.3. Text to Image: Partnered with DALL-E 2 (sister program of Open AI), the AI is able to create images from mere words.

9.4. Clarification: ChatGPT is able to simplify or clarify complex matters.

9.5. Mathematics: It works out equations including all steps and provides a clear explanation of it.

9.6. Social Issues: The AI is able to provide advice to do with relationships and other aspects of life.

9.7. Multilingual: ChatGPT has the capability of creating content unlike Google translate which is single layered, thus benefiting marketers who seek diverse audiences.

9.8. Rich Articles: It writes detailed articles on nearly any subject.

9.9. Research Summaries: It condenses papers or scientific studies efficiently.

9.10. Educational Tutoring: ChatGPT provides personalized tutoring by explaining concepts, answering questions, and offering interactive learning experiences for students across various subjects.

9.11. Research Assistance: It helps students and researchers summarize academic papers, generate literature reviews, and suggest relevant sources for study.

9.12. Assignment & Essay Assistance: ChatGPT aids in structuring essays, generating ideas, and improving writing style while maintaining academic integrity.

9.13. Language Learning Support: It offers grammar corrections, translations, vocabulary building, and conversational practice in multiple languages.

9.14. STEM Education Aid: ChatGPT assists students in solving mathematical problems, explaining scientific concepts, and providing coding support with step-by-step explanations.

9.15. Exam Preparation & Practice: It generates practice questions, quizzes, and flashcards, helping students prepare for exams more effectively.

9.16. Academic Writing & Citation Help: The AI suggests citations, formats references in various styles (APA, MLA, etc.), and refines academic writing.

9.17. Educational Accessibility: ChatGPT supports students with disabilities by providing text-to-speech assistance, summarizing content, and adapting materials for diverse learning needs.

9.18. Teacher Support & Lesson Planning: Educators can use ChatGPT to develop lesson plans, create educational materials, and design interactive classroom activities.

9.19. Ethical AI Education & Awareness: It helps students and teachers understand the ethical implications of AI in education and promotes responsible usage.

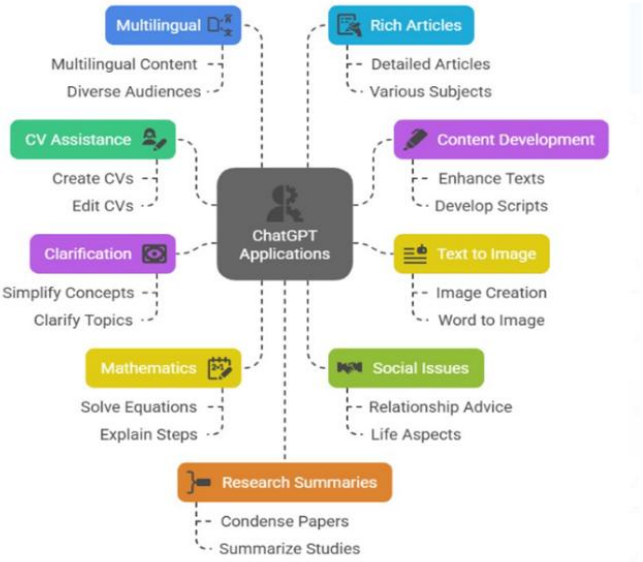

Fig. 3 Applications of ChatGPT

These applications demonstrate how ChatGPT enhances learning experiences, improves accessibility, and supports both students and educators in an academic setting.

10. The Implementation of ChatGPT in Education

ChatGPT is a powerful language model that has the ability to change education because of its ability to comprehend and respond to natural language. It assists both students and teachers in these ways (Zhang et al. [29]] Al-Mamary, and Abubakar, [30]):

1. Automated Teaching: As a virtual tutor, ChatGPT can provide immediate feedback and respond to questions about specific subjects (like math or history) in a comprehensive manner. It is a lifesaver for learners who need more assistance or are trying to learn on their own.

2. Personalized Feedback: Teachers can utilize it to assess learners' work, provide feedback, and make recommendations that help improve the learning process.

3. Interactive Tests: It generates dynamic quizzes, poses questions, answers them, and offers additional context for deeper understanding, making the entire learning process enjoyable.

4. Virtual Class Assistance: In a virtual environment, it helps students during a live lecture by responding to their questions asked via chat, providing materials needed, and assisting students who are lost in the lecture.

11. Students Benefits of using ChatGPT in Education (Salih et al. [31], Park and Ahn [32] and Hartley et al. [33]):

11.1. Responses to inquiries are immediate and accurate.

11.2. Practical guidance in diffing strategy enhances time management and study skill.

11.3. Improvement of both motivation and active involvement with the provided guidance.

11.4. Training resources such as materials and videos can be made available without restriction.

11.5. Individual learning style based customized response helps learners achieve academic excellence.

11.7. Support for learning difficulties, helping students' complete tasks like summaries or articles efficiently.

11.8. Virtual tutoring with real-time, personalized guidance, solving math problems or teaching new languages with translations, exercises, and grammar checks.

12. Uses of CHAT GPT in training:

ChatGPT also enhances virtual training (Holmes et al. [34] and Luckin [35]).

12. 1. It responds to learners questions, provides instant feedback, and offers personalized content, which boosts self-study engagement and learning.

12.2. It tracks learner completion rates and provides progress evaluation.

12.3. It assists educators in generating content rapidly, and has the ability to conduct mass training for thousands of trainees simultaneously.

12.4. It encourages learners to develop their abilities to resolve problems without merely following set step-by-step processes.

13. Concerns about using ChatGPT:

There are important concerns associated with its increasing use (Xu and Ouyang [36] and Chatterjee and Meuschke [37]):

13.1. Plagiarism: It allows copying since students might hand in work done by AI as authentic work.

13.2. Professional Conduct: Without citing the original content, AI aggregates information from multiple authors which poses ethical issues.

13.3. Prejudice and Fallacy: ChatGPT is capable of producing misleading or prejudiced answers due to was taught with defective data.

14. Opinions on the concerns of using ChatGPT:

In light of these concerns, (Roose [38]) wrote an article in The New York Times in which he met with a group of K-12 teachers and public-school administrators in New York City and discussed how schools would need to adapt to prepare students for a future filled with all kinds of artificial intelligence. However, he found that most of them focused on just one tool: ChatGPT, specifically the chatbot application, which can write persuasive essays and solve science and math problems, among other tasks. However, it has caused panic and anxiety among many teachers, as students have used it to write assignments, essays, solve problem sets, and even do homework, thus encouraging students to cheat. Furthermore, the bot sometimes provides incorrect or misleading answers, which is why some schools have taken strict measures regarding the use of artificial intelligence applications. These include the following:

14.1. New York City public schools have banned access to ChatGPT on school computers and networks, citing concerns about the negative impact on student learning.

14.2. Concerns about the safety and accuracy of the content. But, (Roose [38]) commented that after speaking with dozens of teachers, he concluded that banning ChatGPT from the classroom is a mistake. Instead, he suggested that schools should consider adopting ChatGPT as an educational tool for the following reasons:

a. Students' creativity can be unleashed, private lessons can be provided, and they can be better prepared to work alongside artificial intelligence.

b. Especially since blocking ChatGPT will not work with students, as they have their own phones and computers. Therefore, the application is easily accessible outside of school.

c. Schools can also treat this application the same way they treat calculators, allowing it to perform some tasks but not others.

d. They can also modify lesson plans and replace homework tests with in-class tests or group discussions.

In general, the researchers in this work believe that the Chat GPT application should be the best friend of teachers and students, as it can help them perform many tasks, including: preparing lessons, providing feedback to students, improving students' writing and language skills, and providing multiple educational resources without wasting time and effort. It is known that every new technology has its pros and cons, and it was created primarily to serve people, not to harm them. Therefore, this technology should be used and benefited from, but according to the warnings mentioned. It should also be noted that this technology is used to increase skills and performance better than currently, and not to replace the people who perform these tasks (Özçelik and Ekşi [39]).

15. Research Methodology:

To answer the main research problem and its causes, it was necessary to use multiple methods to discover the cognitive truth, and to come up with answers that I believe were closer to objectivity. Accordingly, the inductive approach was relied upon using the descriptive analytical method; through the theoretical analysis of artificial intelligence based on the data available in the same research topic to deal with the phenomenon under study to determine its relationships.

16. Outcomes of the Research:

The research study analyzes the effects of artificial intelligence in educational environments, in particular the impact of ChatGPT, and mentions how it can optimize education in the following ways:

16.1. Artificial intelligence and its applications, especially CHAT GPT, can revolutionize the educational process by saving time and effort for both teachers and learners, and providing a vast array of diverse learning resources.

16.2. Artificial intelligence applications have achieved a record in taking into account individual differences among students, as well as achieving the principle of learning and self-development compared to other learning methods.

16.3. Field studies have shown that smart learning systems are highly effective in achieving the goals of the educational process.

17. Recommendations:

Based on the results of the current research, we present the following set of important recommendations (See Fig. 4):

17.1. Designing modern teaching methods and strategies that work with artificial intelligence technologies.

17.2. Integrating the CHATGPT application as the main teaching and learning tool in the educational program.

17.3. Employ ChatGPT to assist learners that have disabilities or face challenges in learning.

17.4. The necessity of holding training courses for both the teacher and the learner and all those involved in the educational process to learn how to use artificial intelligence applications.

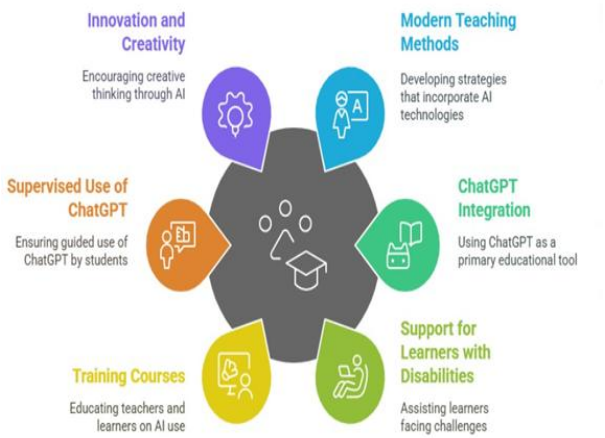

Fig. 4 Recommendations for Enhanced Education

17.5. When using the ChatGPT app, care must be taken not to use it at all, but rather under the supervision of a teacher, who will guide, advise, and monitor the student's use.

17.6. Consider helping students develop innovation and creativity by leveraging the unlimited resources provided by the ChatGPT app.- Make the process of learning more interesting and less difficult for learners.

17.7. Education should be made easier and more attractive to learners.

17.8. Efforts must be made to integrate educational and social aspects into AI applications to suit the nature of each community.

18. Conclusion

The research investigated how ChatGPT functions within educational institutions by showing its capacity to boost learning activities and improve teaching efficiency as well as accommodate different student requirements. Research shows that artificial intelligence including generative AI delivers three main advantages by making education specific to students while helping educators work efficiently and encouraging innovative thinking. Educators should implement ChatGPT in educational settings yet should exercise caution to protect ethical standards and defend student learning guidance from teachers. ChatGPT as well as other AI-based tools should work with conventional educational practices rather than functioning as their replacement. Supervision plays a vital role in controlling AI systems because they can instantly analyze learning while creating educational materials yet help students with different needs yet their proper management requires clear guidelines. School supervisors need to actively monitor AI technologies in education to achieve both optimal tool utilization and preserve school standards. The study proves that accepting AI technology in education creates more than an artificial intelligence advancement because it drives essential progress toward the modernization of educational spaces. ChatGPT provides value to educational outcomes through proper policy development alongside training practices and ethical protocols while supporting students for a technology-driven academic environment.

CRediT authorship contribution statement:

Both authors made significant contributions to the research and preparation of this manuscript. Aboelnour N. Abdalla developed the research framework, coordinated the study design, and guided the analysis and interpretation of results. He also provided key insights into the educational use of generative AI via ChatGPT. Ahmed Khalifa focused on the theoretical foundation, examining the educational impact of AI-based tools and evaluating ChatGPT's performance in this context. He also contributed to the research content and final conclusions. Together, the authors co-wrote, revised, and refined each draft, incorporating feedback to ensure clarity and technical accuracy.

Data availability statement

The data used to support the findings of this study are available from the corresponding author upon request.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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