

Research Article:

ChatGPT in Teaching-Learning and Research: A Systematic Review

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ABSTRACT

Based on the most recent available data, ChatGPT has amassed a substantial user base of approximately 180.5 million since its public release in November 2022. This widespread adoption has prompted concerns among educators regarding its seamless integration into teaching and learning processes. The capacity of ChatGPT to rapidly generate highly pertinent content has generated significant interest and discussions in the educational sphere especially at a higher level. Although a substantial body of research exists in this field, there is a notable gap in the literature regarding comprehensive review articles focusing on specific subtopics, such as the application of ChatGPT and its impact on higher-level teaching, learning and research. To date, no thorough examination has been conducted to synthesise and critically analyse the existing studies in this particular domain. To address this, we conducted a systematic review of research articles following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, utilising databases such as Scopus, IEEE Xplore and ScienceDirect. Among the 106 initially identified studies, only 25 articles met our inclusion criteria. The results presented shed light on how ChatGPT can prove effective in teaching, learning and research. The review also brought to light a lot of issues, such as plagiarism, manipulation, cheating and ChatGPT's trustworthiness. Our findings also underscore the limitations in the use of ChatGPT and emphasise the ethical considerations involved. Furthermore, this review illuminates potential avenues for future studies and also presents a critical assessment, paving the way for improvements in the field.

Keywords: ChatGPT in teaching-learning, Artificial Intelligence, AI, ChatGPT, ChatGPT in research, systematic review

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INTRODUCTION

The 21st century has experienced a rapid transformation in educational methodologies, primarily propelled by technological advancements, particularly in artificial intelligence (AI) (Petersen, 2021). A more innovative and sophisticated method of creating digital content has given birth to advancements in machine learning, including generative AI, in recent times (Hu, 2022). The Generative Pre-Trained Transformer (GPT) and Generative Adversarial Network (GAN) are two of the most significant generative AI systems (GPT) (Hu, 2022; Jovanovic & Campbell, 2022; Abukmeil et al., 2021; Brown et al., 2020). The GPT uses models of natural language to devour and generate text in a variety of dialects. These models serve as creative writers who can write anything from a paragraph to a full research study on almost any topic. GPT models can even interact with participants just like conversations, like chatbots used for video games or customer service characters (Aydin & Karaarslan, 2022; Korngiebel & Mooney, 2021; Jovanovic & Campbell, 2022; Pavlik, 2023). In our exploration of ChatGPT, we initiated the process by providing prompts to the ChatGPT 3.5 model (<https://chat.openai.com/>). The ensuing responses are detailed as follows for a comprehensive understanding.

We commenced by inquiring about ChatGPT's self-description. The initial prompt posed was, "What is ChatGPT?" The following response was generated by ChatGPT.

"ChatGPT is a language model developed by Open AI, specifically part of the GPT (Generative Pre-trained Transformer) family. It is designed for natural language understanding and generation, making it well-suited for various conversational applications. GPT models are pre-trained on large datasets containing parts of the Internet to learn the patterns and structures of language. The "Chat" in ChatGPT indicates its focus on generating coherent and contextually relevant responses in a conversational style. It can be used for a wide range of tasks, including answering questions, engaging in dialogue, providing information, and more. GPT-3.5, the architecture upon which ChatGPT is based, has 175 billion parameters, making it one of the most powerful language models as of my last knowledge update in January 2022. The large number of parameters allows it to capture complex language patterns and generate diverse and contextually appropriate responses. Users can interact with ChatGPT through an API provided by Open AI or through various platforms and applications that integrate the model for conversational purposes".

(OpenAI, 2024)

Subsequently, we posed the question "How does it work?" as a follow-up, deliberately opting for a more conversational tone by using this phrasing instead of "How ChatGPT works." The ensuing response is presented as follows:

ChatGPT works based on the transformer architecture, which is a

type of neural network architecture designed to process sequential data efficiently. The key aspects of how ChatGPT works can be summarised as follows:

1. **Pre-training:** ChatGPT is pre-trained on a massive dataset containing parts of the Internet. During this pre-training phase, the model learns to predict the next word in a sentence, given the context of the preceding words. It develops an understanding of grammar, facts, reasoning abilities, and contextual relationships by learning from diverse and vast linguistic data.
2. **Attention Mechanism:** The transformer architecture, which underlies ChatGPT, uses attention mechanisms to process input data in parallel rather than sequentially. Attention mechanisms allow the model to focus on different parts of the input sequence when generating an output, enabling it to capture long-range dependencies in the data.
3. **Fine-tuning:** After pre-training, ChatGPT can be fine-tuned on specific tasks or datasets to make it more specialised. Fine-tuning helps adapt the model to particular use cases and improves its performance on specific tasks.
4. **Tokenisation:** Input and output data are tokenised, which involves breaking down text into smaller units called tokens. Tokens can be as short as one character or as long as one word. Tokenisation helps the model process and understand the input text more effectively.
5. **Generative Nature:** ChatGPT is a generative model, meaning it can generate coherent and contextually relevant responses. When given a prompt or input, it uses its learned knowledge to generate a sequence of tokens that forms a response. The generation is based on the patterns and information it has learned during the pre-training phase.
6. **Prompt Engineering:** Users interact with ChatGPT by providing prompts or input sentences. The way prompts are formulated can influence the quality and relevance of the model's responses. Crafting clear and specific prompts often leads to better outcomes.

(OpenAI, 2024)

REVIEW OF RELATED LITERATURE

Within this section, we scrutinised studies about AI's influence on education, emphasising the implications of the ChatGPT model in advanced teaching, learning as well as research at higher levels. The framework is delineated as follows:

Open AI developed the open-source tool ChatGPT (Kirmani, 2022) which can answer an array of text-based demands, such as writing letters of gratitude and supporting those having challenging conversations about efficiency issues. ChatGPT has the potential of constructing answers which are similar to normal human conversation (Dale, 2021). The

capacity of the ChatGPT model to improve student's learning outcomes by giving prompt, personalised responses, addressing individuality concerns, providing instant feedback, and assisting in the comprehension of difficult concepts has generated considerable interest in its application in education (Garcia Sanchez, 2023). It is mandatory to understand that AI offers notable obstacles and ethical dilemmas in education. Concerns like maintaining student privacy, offering equitable access to education, and figuring out how these developments affect the role of educators should receive special attention. To guarantee that AI is applied in an appropriate manner that is advantageous and fair for all students, these issues must be handled responsibly (Incio Flores et al., 2021). Recent developments in AI have had a significant effect on education, as demonstrated by the increase in educational process efficiency, the advancement of worldwide learning, the individualisation of learning, the production of quality content, and the improvement of educational administration for maximum effectiveness and efficiency (Jara et al., 2020). A key component in streamlining the teaching-learning process is ChatGPT. Education is a learning process that transcends the mere acquisition of knowledge rather than being confined to a single product (Garcia-Pena et al., 2020). ChatGPT is an effective tool for encouraging students' writing skill development. Students can enhance their communication and attain excellence in their written skills by engaging with the system and receiving detailed feedback, recommendations for enhancement, and grammatical corrections on their writing (Osorio, 2023). Numerous investigations have attempted to investigate the possible effects of AI, especially with the ChatGPT educational tool. Numerous AI-related educational applications, including chatbots, adaptive testing, personalised learning experiences and predictive analytics, were examined. Consequently, it exhibits remarkable promise for enhancing learning effectiveness and offering tailored educational assistance to educators and learners alike. But it is important to consider the risks and constraints brought about by these technologies, including those about data privacy, cultural differences, language competency, and related ethical considerations (Wang et al., 2023). Language models especially ChatGPT, have a considerable impact on actual teaching-learning processes. This could involve the potential to enhance more adaptive and personalised learning and more effectively arrange the processes of assessment and evaluation (Baidoo-Anu & Owusu Ansah, 2023; Zhang, 2023; Rudolph, 2023).

Several studies have caught our attention, specifically those concentrating on higher education (King, 2023; Dempere et al., 2023). Additionally, noteworthy studies have highlighted the application of ChatGPT in research contexts (Ray, 2023; King, 2023). However, despite these valuable individual contributions, there exists a conspicuous gap; a lack of a comprehensive review study investigating the ChatGPT's effects on higher-level teaching, learning and research. This void has motivated our initiation of this systematic research review. The primary research questions that this review seeks to address include:

- RQ1: To review the status of ChatGPT in higher education, especially in teaching-learning and research.
- RQ2: To determine the possible benefits and limitations of ChatGPT and to have a research-based discussion around the applications of ChatGPT in education, especially in teaching, learning and research.

This study looks at the ChatGPT from several angles, such as its current state in teaching and learning, and its use in research. It also includes in-depth descriptions and references on the subject. It provides a thorough understanding of ChatGPT in education by methodically examining the range of studies, their objectives, and the methodological components used in the inquiry.

METHODOLOGY

We adhered to the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), (Moher et al., 2009) while carrying out our search. To improve the reliability of systematic reviews and meta-analyses, the PRISMA approach places a strong emphasis on thorough and transparent reporting. For these kinds of investigations, researchers can use it as a useful tool to assess and comprehend the procedures and conclusions. Crafting articles through the PRISMA approach encompasses four key phases: identification, screening, eligibility and inclusion (Mengist et al., 2020). The PRISMA flowchart for this systematic review and the corresponding sections are described in Figure 1.

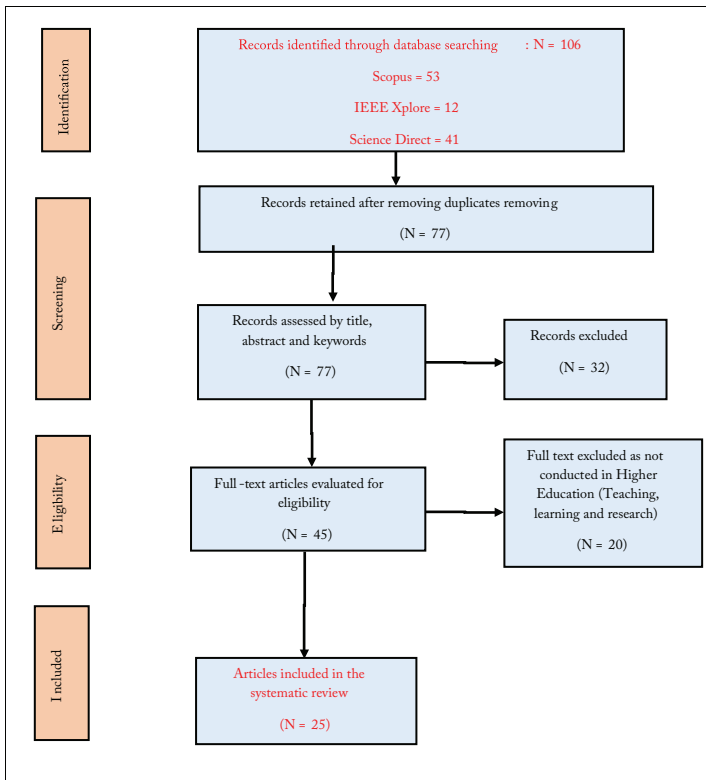


Figure 1: The PRISMA systematic review

Identification

The Identification approach, which is outlined in the PRISMA guidelines, is the first step in every systematic review. Databases including Scopus (<https://www.scopus.com/>); IEEE (<https://ieeexplore.ieee.org/search/advanced>); and ScienceDirect (<https://www.sciencedirect.com/>) were accessed for this study. The review’s primary phrases were meticulously chosen to accurately convey the concepts under investigation. Several keywords about ChatGPT in education were referenced. Table 1 shows the search queries that were utilised for this investigation.

Table 1. Search string employed in the study

Term #1		Term #2		Term #3		Term #4		Term #5
“ChatGPT”		“Education”		“Student”				
“ChatGPT”		“Teaching and Learning”		“Process”		in		
“Higher”	AND	“Education”	AND	“ChatGPT”	AND		AND	Education
“Teaching and Learning”		“Artificial Intelligence”		“Education”		and		“Analysis”
“AI”		in		“Research”		“Education”		
“AI”		in		“Higher”				

Following the identification of 106 studies from the above-mentioned databases, the titles were scrutinised to assess their relevance to the topic of “ChatGPT in Teaching-Learning and Research”. In the first place, 29 publications were excluded as found duplicates. After removing duplicates, 77 publications were screened again resulting in the exclusion of 32 articles as these publications were deemed unrelated to the study’s objectives as shown in the PRISMA flow diagram. In the second phase, the remaining 45 publications underwent another round of screening, resulting in the exclusion of 20 more articles which were not related to higher education. Ultimately, 25 research articles were included for review, and the findings were presented following a comprehensive examination of these selected research articles. Table 2 shows the inclusion and exclusion criteria of the finding.

Table 2. Inclusion and exclusion criteria

Criterion	Inclusion criteria	Exclusion criteria
Timeline	Research carried out in May 2022 to October 2023	Research carried out before May 2022
Literature Type	Journal articles, qualitative and quantitative studies, reviews, meta-analyses and bibliometric studies	Books, chapters in books, articles from conferences and thesis
Language	English-language articles	Non-English-language articles
Subject Area	Pertaining to ChatGPT in Teaching-Learning and Research	Not about ChatGPT in Teaching-Learning and Research

Table 3. Included research studies

No.	Author and year	Aim	Methodology	Database	Outcome
1	Nemorin et al. (2023)	An overview of the conversation about AI development and education (AIED)	Text mining and thematic analysis	Scopus	There is a dearth of thorough and consistent evidence to back up the useful effects of implementing AI in education. There is no consistent research that looks into the overall impact that AI holds for education, let alone its potential to help achieve high-quality education for all.
2	Shidiq (2022)	Innovative writing abilities in the application of AI -based ChatGPT and its issues for the areas of learning	Qualitative method	Scopus	The ChatGPT mechanism is an autonomous (AI) chatbot that may create text in various formats, like inventive, casual, and formal writing. ChatGPT makes processing information from text input so simple that work tends to be less innovative or as original.
3	Tlili et al. (2023)	What would happen if the devil acts as a protecting angel? ChatGPT operates as an example of the application of chatbots in education	Instrumental case study using qualitative methods	Science Direct	A study shows that people are excited about using ChatGPT in learning environments and public discourse surrounding it is positive. The findings of the study unveiled that the ChatGPT can transform learning in several ways.
4	Cotton et al. (2024)	Keeping academic integrity in the ChatGPT era	Qualitative	Science Direct	Higher education could gain from ChatGPT in many ways, including better accessibility, interaction, and participation by learners. Asynchronous interaction is made quicker, rapid feedback is given, and distant learning is facilitated by ChatGPT. Additionally, ChatGPT brings up several issues with academic integrity and plagiarism.
5	Cooper (2023)	Evaluation of learning science with ChatGPT: A pilot investigation of generative AI	Exploratory qualitative research	Science Direct	Educators should responsibly use ChatGPT, and prioritise critical thinking. Educators should critically evaluate any AI-generated content in their specific teaching contexts.

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Table 3. (Continued)

No.	Author and year	Aim	Methodology	Database	Outcome
6	King & ChatGPT (2023)	A discussion about chatbots, AI, and copied content in higher learning	Qualitative	Science Direct	Since chatbots and AI are not fundamentally favourable or detrimental, their susceptibility to exploitation in higher learning demands more research. A ChatGPT model compels us to rethink how we define originality and attribution in the digital age.
7	Sallam (2023)	Analysis of opinions and questions about the use of ChatGPT in medical education, investigations and daily life	Mixed method (Meta-analysis)	Scopus	ChatGPT has great potential to pick up the pace of innovation in healthcare and support diversity and equity in research by bridging language barriers.
8	Memarian & Doleck (2023)	ChatGPT in the educational settings: Approaches, Opportunities, and Restrictions	Qualitative method (Grounded theory)	Science Direct	Regarding ChatGPT's application in education, there are hopes and worries, but protecting student learning and integrity in academics must come first. Inspections, asynchronous intervention, inspection-based learning, individualised and sophisticated instruction, observations, investigation reliability, assignment delegation, and psychological shift are just a few of ChatGPT's potential applications.
9	Ray (2023)	ChatGPT: An extensive evaluation of the history, uses, major difficulties, prejudice, morality, constraints, and potential	Qualitative method (Systematic review)	Scopus	This paper investigates how ChatGPT has transformed scientific research in several areas, including processing data, hypothesis development, collaboration, and public education. The study looks at the possible drawbacks and a moral dilemma related to using ChatGPT in research and highlights the significance of finding stability between human knowledge and AI-assisted innovation.

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Table 3. (Continued)

No.	Author and year	Aim	Methodology	Database	Outcome
10	Strzelecki (2023)	Higher education students' adoption of ChatGPT: A comprehensive unified theory of technology	Unified theory of acceptance and the use of technology (UTAUT2) theoretical model	Science Direct	The capacity of ChatGPT to provide personalised assessments, interactive learning environments, and material may be emphasised, demonstrating its revolutionary potential for education and providing a more customised learning route.
11	Habibi et al. (2023)	Use and adoption of ChatGPT in higher education learning	Survey method (Unified theory of acceptance and the use of technology model-2 (UTAUT2))	Science Direct	Educators should emphasize AI in students' daily education. They can improve outcomes for student learning by developing AI systems that are more efficient and intuitive to use.
12	Ansari et al. (2023)	A systematic review that maps the global evidence concerning the use of ChatGPT in educational institutions	Qualitative Research	Science Direct	Students use ChatGPT as an on-demand tutor for a variety of learning objectives, Educators applies it for developing materials and personal and professional learning. On the other hand, concerns with precision, dependability, academic honesty, and possible harm to cognitive growth shall be considered.
13	Rawas (2024)	The digital era of higher education with Chat GPT	Qualitative research	Science Direct	Higher education institutions have a big chance to enhance the calibre and availability of learning through ChatGPT, but putting it into practice will require careful thought and a clear grasp of the chances and challenges that it presents.
14	Halaweh (2023)	ChatGPT in education: Responsible implementation techniques	Mixed method (Systematic Review)	Scopus	Additional analytical abilities will be required by students in their assessment of the material, as well as the development and presentation of original ideas. Additionally, effective learning and work safety are two more things that require presentation skills and are critical for success in the real-life setting of work.

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Table 3. (Continued)

No.	Author and year	Aim	Methodology	Database	Outcome
15	Pradana et al. (2023)	Examining ChatGPT in the classroom: A bibliometric inquiry and review of literature	Mixed method (Bibliometric analysis)	Scopus	A potent AI tool with the potential to revolutionise the education field is ChatGPT. Its capacity to carry out intellectually stimulating and knowledge-based tasks, like assigning grades and providing guidance to students, could completely transform the way that education is delivered.
16	Su & Yang (2023)	Assessing ChatGPT's potential: A structure for using generative AI in education	A theoretical framework called "IDEE"	Scopus	The use of ChatGPT and other forms of "educative AI," or generative AI in education, can provide students with highly personalised and interesting learning opportunities. However, its incorporation into educational procedures must be done so responsibly, ethically, and with the backing of a solid theoretical framework.
17	Karakose & Tulubaş (2023)	Facilitations of education via ChatGPT: Applications for further research	Argumentative systematic review	Scopus	There are numerous opportunities provided by ChatGPT to change the objectives, subject matter, procedures, and methods of instruction to meet the needs, desires and requirements of the students as future members of society.
18	Lo (2023)	What effect does ChatGPT have on education? A brief overview of the literature	Rapid Review Approach	Scopus	According to the review's findings, ChatGPT's performance ranged from excellent to subpar depending on the subject domain. Although ChatGPT can function as both a simulated tutor for students and an assistant to teachers. Because of the difficulties in using it, schools and universities should immediately update their institutional policies and assessment procedures.

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Table 3. (Continued)

No.	Author and year	Aim	Methodology	Database	Outcome
19	Grassini (2023)	Changing the nature of education: Examining the benefits and drawbacks of ChatGPT and AI in learning environments	Systematic review	Scopus	ChatGPT has the potential beyond helping teachers create tests, quizzes, and course content. Creating comprehensive lesson plans, engrossing presentation displays and other teaching resources is another useful use for it. With this additional support, teachers may improve and modify these material resources in more interesting and dynamic ways to gather and meet a variety of learning requirements.
20	Chaudhry et al. (2023)	Time to assess the current method for examining the ability of learners performance in higher learning in the new ChatGPT era: Through a case study	Quasi-experimental design	Scopus	Based on the findings, higher education institutions should review their academic credibility policies and performance-based assessment systems for tracking students' growth and learning. To ensure that students maintain academic integrity, instructors must also reconsider the methods they currently use for assessment and devise fresh approaches
21	Shoufan (2023)	Examining how students view ChatGPT: A thematic analysis and follow-up survey	Thematic Analysis	IEEE	ChatGPT serves a valuable purpose in educational settings, offering learning opportunities. Yet, students must recognise its limitations. Educators are encouraged to incorporate ChatGPT into learning experiences and provide guidance on effective prompting strategies and methods for evaluating generated responses. Developers play a key role in enhancing model accuracy for responses. This study sheds light on ChatGPT's capabilities and constraints in education, contributing various insights that can direct future research and development efforts.

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Table 3. (Continued)

No.	Author and year	Aim	Methodology	Database	Outcome
22	AlAtinan et al. (2023)	Chat GPT as an instructional tool: Possibilities, difficulties, and suggestions for courses in composition, business writing, and communication	Qualitative study	Scopus	The paraphrased responses produced by ChatGPT were not taken up by the similarity-detecting tools. Similarity detection software suppliers require upgrading their products to maintain their effectiveness in averting these kinds of situations.
23	Farrokhnia et al. (2024)	ChatGPT's SWOT analysis: Implications for research and practice in education	Qualitative study	Scopus	ChatGPT's capacity to provide realistic replies is outstanding. It can also improve itself by offering individualised, real-time responses and chances for information accessibility, which supports complicated, individualised learning while lightening the workload of teachers. Possess shortcomings such as a lack of higher-order thinking abilities, a danger of prejudice and discrimination, a hard time assessing the quality of responses, and a lack of profound comprehension. It results in risks to plagiarism and academic integrity.
24	Rueda et al. (2023)	A systematic review of the effects of ChatGPT implementation in education	Systematic Review	Scopus	Although the introduction of ChatGPT into the classroom improves student learning, the findings also emphasise how crucial it is that educators receive adequate training in using the application. Teachers must be familiar with ChatGPT's functionality for its execution to be successful, even though it is capable of enhancing learning.
25	Chiu (2023)	A case study of ChatGPT and mid-journey demonstrates the influence of generative AI (Gen AI) on practices, policies, and research direction in education	Qualitative Study	Scopus	The study findings provide a trio of suggestions for practices: multidisciplinary instruction, new knowledge required, and a know-it-all perspective. Three policy implications are also provided: new assessment, AI education, and professional standards.

Included

The topic of this review of the literature was ChatGPT in Teaching-learning and Research. 15 publications from Scopus, 1 from IEEE and 9 from ScienceDirect were selected. The choice of the educational materials in the databases was based on their exceptional quality. Each investigation concentrated on a distinct ChatGPT research and teaching-learning feature. The majority of the research was carried out in educational settings. A comprehensive compilation of the research studies that have been thoroughly examined is provided in Table 3. This includes essential information such as the author's names, titles of the studies, the methodology employed, databases from which data were extracted, and the resultant outcomes.

FINDINGS

This section responds to the research questions formulated to guide this review. The findings of this review are categorised into three main sections: (A) ChatGPT in teaching and learning, (B) ChatGPT in research, and (C) Limitations of ChatGPT in teaching, learning and research.

Section A: Chat GPT in Teaching and Learning

The initial inquiry we aimed to address was encapsulated in the question, “RQ1: To review the status of ChatGPT in higher education, especially in teaching-learning and research.” Following our comprehensive review, we arrived at the following answer.

The utilisation of the ChatGPT in teaching-learning processes within higher education showcases numerous advantages, such as heightened student engagement, enhanced collaboration, and improved accessibility. The potential of ChatGPT to comprehend human codes enables the effortless generation of various literary forms, from poetry and fairy tales to novels, rivalling human creative labour (Shidiq, 2023). Jalil et al.'s (2023) investigation into ChatGPT's responsiveness to practice quizzes within a well-established program evaluation curriculum highlighted its effectiveness. Additionally, employing ChatGPT in novel contexts yields consistently reliable justifications (Firat, 2023). The adaptability and practicality of the ChatGPT make it an effective and attractive tool for flexible and open educational institutions, offering increased autonomy for self-directed students. This model can instil confidence in self-taught learners through personalised support, guidance and feedback. According to Sok (2023), ChatGPT provides five primary advantages, encompassing the creation of learning assessments, enhancement of pedagogical practices, virtual one-on-one tutoring, outline creation, and idea brainstorming. Despite its swift and efficient information processing, ChatGPT does not sacrifice creativity, debunking the misconception that it tends to be uncreative. The investigators found that the below-mentioned constructs have been used by researchers to enlighten the adoption and the use of ChatGPT in teaching and learning.

Personalised tutoring

Students can receive individualised tutoring and feedback from ChatGPT as per their individualistic learning requirements and development. According to Chen et al.'s (2020) study findings, an agent that speaks based on a generative model (ChatGPT) might offer students individualised math tutoring, leading to enhanced educational results. The investigation revealed that the conversational intermediary was able to modify its justifications for learner misunderstandings and modify up to an optimal level of comprehension.

Essay grading software

ChatGPT can evaluate essays, thereby opening up the time for teachers to concentrate on different elements. Chat GPT was created using an array of articles assessed by real humans that was competent to precisely grade high school students' writings, with an association with human grades of 0.86, as stated by Kim et al. (2019). Research has indicated that ChatGPT was able to recognise prime components of effective articles as well as offer feedback analogous to that provided by human graders.

Interactive learning

ChatGPT enables learners to participate in conversations with an online tutor to develop dynamic educational materials. According to the research by Peng et al. (2019), speaking intermediary models efficiently assist learners who are taking English as a language course, leading to increased mastery of the language.

Adaptive to learning

ChatGPT is capable of helping develop systems that are adaptive to learning and modify their methods of instruction according to a student's growth and accomplishments. According to Chang et al. (2021) research, a personalised educational system built around a generative model (ChatGPT) will empower learners to acquire programming skills efficiently, moving to improved efficiency in programming evaluations.

Section B: ChatGPT in Research

Turning our attention to the second query, "RQ2: To determine the possible benefits and limitations of ChatGPT and to engage in a research-based discussion regarding its applications in education, particularly in teaching-learning and research." The review yielded the following comprehensive insights.

An advanced model of language ChatGPT possesses the ability to produce humanlike writings. This technology is crucial to many industries, including marketing, customer service, teaching-learning area as well as research. Although AI and chatbots are inherently neither beneficial nor detrimental, there is still room for improvement given the potential for abuse, especially in higher education. Researchers can now more easily and quickly

gather data for research purposes. However, various ethical concerns must be addressed when using ChatGPT in research (Su & Yang, 2023). Data privacy is one of the most crucial ethical challenges while using ChatGPT in research. Participants' data must be protected from unauthorised access and kept secret by researchers. To do this, you must protect chatbot technology, encrypt data, and put security measures in place to protect data from hackers. Sallam (2023) investigated ChatGPT in medical education, research, or practice. The study indicated healthcare practice, research, and education could undergo a paradigm shift as a result of the anticipated ChatGPT applications. However, deploying this AI chatbot should be done very cautiously due to its potential risks. Ray (2023) investigates how ChatGPT has transformed scientific research in several areas, including processing data, hypothesis development, collaboration, and public education. The study looks at the possible drawbacks and moral dilemmas related to using ChatGPT in research and it highlights the significance of finding a sense of balance between human knowledge and AI-assisted innovation. The righteous ramifications of modern technologies must be applied effectively in educational publishing as well as research (Nie et al., 2023).

According to Cooper (2023), the main ethical issues with AI relate to its potential impact on the environment, difficulties with content regulation, and the potential for copyright infringement. ChatGPT has the capability of producing scholarly works, including research papers that are on par with works written by people (Else, 2023). Research findings indicate that ChatGPT demonstrates a commendable ability to produce research studies suitable for publication (Dowling & Lucey, 2023) and often reviewers fail to detect the scientific abstracts with fictitious data generated by ChatGPT (Gao et al., 2022). However, according to Bleumink and Shikhule (2023), it is possible to recognise texts created by GPT models with a high degree of accuracy and a low rate of false positives. The impact of AI on education cannot be overstated if there is no way to detect improper or unreported use whether conducting research, writing essays, or conducting exams.

Section C: Limitations in the Applications of ChatGPT in Teaching-learning and Research

Research indicated that ChatGPT should be used sparingly in educational contexts. This brought to light a lot of issues, such as manipulation, cheating, and ChatGPT's honesty and trustworthiness. There are risks related to the concerns with academic honesty, unfair learning evaluations, inaccurate data, and an over-reliance on AI. According to a recent survey (Westfall, 2023), 48% of students admitted to utilising the site for a quiz or at-home test, and 89% of students said they had used it to help with homework. While doing so, a startling 52% of students have utilised it to create an essay. Since GPT designs do not have the potential to fully understand both the context and the significance of the text they create, they cannot deal satisfactorily with assignments that require prudent thought that aren't encompassed by the training data (Strubell et al., 2019). As per research by DeMello et al. (2014), learners had better learning outcomes when they engaged with a virtual instructor who resembled human-like affective behaviour than when they came in contact with a guide who did not exhibit this behaviour. Based on generative models, a teaching system

was unable to provide explanations that were particular to students' presumptions Wang et al. (2023). The ability of generative model frameworks to produce specific melodies was found to be limited by Ziegler et al. (2019). If the instructional information was irrelevant to the assignment at hand, a productive model-based answering questions system performed poorly, according to a study by Baidoo-Anu and Owusu Ansah (2023). The possible ethical problems with ChatGPT have become a matter of concern. It is advised to establish ethical guidelines and increase transparency in AI to resolve such problems (Ahmad et al., 2023).

The downside of the ChatGPT alongside additional Generative AI techniques for educational purposes which was reflected by different research investigations can be categorised as:

1. **Lack of human interaction:** Technology cannot replicate the sort of human connection that an actual educator or coach can provide. This dearth of the human element might be averse to learners who would draw more advantages from having close contact with a guide. According to DeMello et al. (2014), when learners communicated with an online guide who imitated human-like impacting behaviour, they had more effective Learning outcomes than when they interacted with a tutor who failed to demonstrate this behaviour.
2. **Restricted understanding:** The concepts that generative models are supposed to aid students in understanding are not understood by them because they are specialised in specific statistical trends in data. This might be a drawback if you want to provide explanations or feedback specific to a student's requirements and misunderstandings. Weng et al. (2020) in their research also revealed that tuition systems based on generative models failed to provide explanations tailored to the misunderstandings of learners.
3. **Inadequacy in crafting personalised guidance:** Models of AI as well as ChatGPT might offer advice and broad knowledge; however, they may not address the individual requirements of every pupil (Ribeiro et al., 2020). ChatGPT along with productive AI designs have the potential to supply knowledge as well as support, but cannot customize guidance and provide lessons that can satisfy the specific requirements of each learner (Ribeiro et al., 2020).
4. **Insufficiency in creative expression:** The responses' originality and creativeness may be inhibited by the constraint that models are generative and only come up with answers which rely on the design observed during training. According to the research by Ziegler et al. (2019), generative model-based musical composition systems have trouble generating unique and varied melodies.

DISCUSSION

The foremost objective of this in-depth and systematic review was to explore the use and adoption of ChatGPT applications at the higher education level with a focus on teaching, learning, and research. The findings reveal that ChatGPT can enhance student learning by providing personalised feedback, interactive learning environments, and creative content

generation. Our findings indicate that the ChatGPT has enough potential to transform the higher education system by contributing creative, innovative and flexible learning opportunities for students and educators. However, the outcomes further indicate that ChatGPT cannot replace in-person communication and critical thinking, and its use should be guided by ethical principles and best practices (Tlili et al., 2023; Memarian & Doleck, 2023; Su & Yang, 2023). ChatGPT has the great potential to accelerate innovation in education and promote diversity and equity in research by bridging language barriers. It can be used to generate essays, summarise texts, answer a wider range of queries, translate languages and correct grammar mistakes (Memarian & Doleck, 2023). According to Shidiq (2023), ChatGPT can also help learners develop their creative writing skills, as it can produce text in various genres and styles, such as inventive, casual, and formal writing. Moreover, ChatGPT can enhance the accessibility, interaction, and participation of learners in online learning environments, as it can facilitate asynchronous communication, provide rapid feedback, and enable distant learning (Cotton et al., 2024).

However, the studies we reviewed also highlighted some challenges and limitations of ChatGPT in the field of education. Among the main challenges, the issue of academic integrity and plagiarism is of great concern, as ChatGPT can easily generate text that is similar or identical to existing sources, without proper attribution or citation (Cotton et al., 2024). This poses a threat to the quality and originality of academic work, as well as the ethical standards and values of education. Another challenge is the reliability and validity of ChatGPT-generated content, as it may contain errors, inaccuracies, biases, or inappropriate language, depending on the input and the model parameters (Cooper, 2023). Therefore, educators and learners should critically evaluate and verify any AI-generated content before employing it in their teaching and learning contexts.

The examined studies have also highlighted the opportunities that ChatGPT has presented for students and educators at the higher level. Among these opportunities is the potential to leverage ChatGPT as a tool for enhancing critical thinking and meta-cognition. It can prompt learners to reflect on their learning processes and outcomes, facilitating comparisons and contrasts between various sources and perspectives (Cooper, 2023). Additionally, another avenue lies in utilising ChatGPT as a catalyst for fostering dialogue and collaboration. It can enhance communication and interaction among learners, educators, and other stakeholders, stimulating the generation of new ideas and questions for further exploration (King & ChatGPT, 2023). Moreover, ChatGPT might be a useful tool for a valuable resource for personalisation along with differentiation, adapting to each learner's own needs and requirements, preferences, and goals. It also provides assistance and feedback across varying levels of difficulty and complexity (Tlili et al., 2023).

CONCLUSIONS

This systematic review encompassed 30 studies, incorporating qualitative, quantitative, and review publication types. The identification process involved searching Scopus, IEEE Xplore and Science Direct databases. After an in-depth and systematic analysis of these

publications, it became apparent that the introduction of AI-powered large language models, such as ChatGPT, provides various benefits. These advantages include the development of learning assessments, enhancement of pedagogical practices, virtual one-on-one tutoring, and the creation of educational outlines (Sok, 2023). Beyond aiding in test and syllabus creation, ChatGPT proves to be a versatile tool for crafting detailed lesson plans, captivating slide shows, and other teaching materials. This additional support empowers educators to modify and enhance these resources in more engaging and dynamic ways to cater to diverse learning needs (Grassini, 2023). Based on the insight we gained while conducting this review we believe that implementing a personalised educational system based on a generative model like ChatGPT will enable learners to efficiently acquire programming skills, leading to enhanced effectiveness in programming assessments.

IMPLICATIONS

While ChatGPT plays a crucial role in educational settings, providing distinctive learning opportunities, students need to recognise its limitations. Educators are encouraged to seamlessly incorporate ChatGPT into learning experiences, guiding effective prompting strategies and methodologies for evaluating generated responses. However, it presents formidable challenges, such as the absence of a human element, a potential threat to academic integrity, limitations in customising guidance, and the inability to provide explanations tailored to students' assumptions. Additionally, concerns regarding precision, reliability and potential implications for cognitive development must be carefully considered.

ChatGPT's introduction into the educational field has various applications for learners as well as for educators. AI has the power to fundamentally alter the way we instruct and acquire knowledge in the classroom. An example of an AI innovation that could completely transform higher education is the Open AI language model ChatGPT. It has the potential to have a beneficial influence on the field of education and learning because of its capacity to deliver results based on the user's entered keywords. It is important to acknowledge that not all of these resources have a positive influence on student's ability to develop a variety of learning skills, including creative writing abilities. Therefore, educators must devise a plan that goes beyond the use of online learning, which students may abuse for assignment completion. In this article, we have explored the advantages and challenges associated with integrating ChatGPT into higher education, concerning teaching, learning and research. It has been observed that ChatGPT can enhance student learning and wisdom by promoting collaboration, individualising recommendations, and easing communication. However there are challenges to be addressed, like issues with implementation and moral dilemmas. To fully realise ChatGPT's potential in higher education, institutions must ensure transparency, privacy, and data security, address ethical concerns, and make research and development investments. By doing this, they can make the classroom more conducive to learning and friendly for both instructors and students.

To summarise we believe the implications of this study are twofold. First, it provides evidence on the current status and prospects of ChatGPT in higher education, which

can inform policymakers, educators, and researchers, who are interested in adopting or developing ChatGPT applications. Second, it raises awareness of the ethical and social issues that ChatGPT entails, which can stimulate debate and dialogue among stakeholders and foster conscientious and ethical exercise of ChatGPT in the educational sector.

LIMITATIONS

This systematic review searched only three databases, namely Scopus, IEEE and ScienceDirect. It is important to note that our findings do not encompass all researchers who have explored the subject. We advocate for additional investigations utilising alternative databases such as Web of Science, Elsevier, PubMed, Dimensions, ERIC, Academic Search Ultimate, Education Research Complete, ACM Digital Library and Google Scholar to offer a more comprehensive insight into the application of AI, like ChatGPT, in the field of education (teaching, learning and research). Additionally, our study is confined to higher education teaching-learning and therefore, it does not assert the efficiency or limitations of ChatGPT in other educational stages. Finally, we posit that the utilisation of ChatGPT has significantly influenced research, leading to the emergence of novel challenges. Subsequent studies conducted post this review may identify and address these fresh challenges, warranting further scrutiny and exploration.

SUGGESTIONS FOR FURTHER RESEARCH

We acknowledge the presence of limitations in our systematic review. The analysis focused on research published between May 2022 and October 2023, utilising three databases: Scopus, IEEE Xplore and ScienceDirect. Future research endeavours should expand the timeframe to include studies conducted after October 2023 and encompass a broader array of databases. While our review concentrated on ChatGPT studies in higher education, there is a potential for further exploration of its applications in lower or secondary education. Additional research in the realm of ChatGPT in higher learning exist, for instance, it is essential to investigate ChatGPT's efficacy across various academic disciplines. Delving into its potential impacts on students' motivation and engagement is another critical area requiring in-depth exploration. Furthermore, we recommend conducting reviews that specifically focus on research conducted in professional education.

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