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A DANCE BETWEEN ORDER AND CHAOS: AN INTEGRATIVE REVIEW ON THE CONVERSATIONS AND CASES OF GENAI'S DUAL ROLE IN EDUCATION

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ABSTRACT

ChatGPT and its allied technologies have introduced a state of "educational chaos," igniting widespread discussions about the dual potential of artificial intelligence (AI) in education; both beneficial (order) and detrimental (chaos). Although ChatGPT has recently celebrated its second anniversary, conversations surrounding its educational applications show no signs of waning. Significant developments have emerged across three main dimensions involving teacher instructional strategies and student learning, institutional policies, and research practices. However, there are limited studies that present useful cases capturing these three areas within a single study. Using an integrative review approach, the study first identifies key dialogues on the contentious role of advanced AI technologies in education and secondly reports actual interesting cases of its use in education across the three domains. A total of 21 articles sourced from Web of Science (WoS) and Google Scholar published between 2023 and 2024 were critically analysed. The chaos theory by Edward Lorenz served as a useful framework for understanding the complexities surrounding GenAI's impact on education and how human ingenuity has leveraged technology for various tasks. The findings reveal that while ChatGPT enhances personalised learning,

supports instructional design, and streamlines research, it also presents challenges such as academic integrity, over-reliance on AI-generated content, and the risk of misinformation. Institutional responses range from outright bans to adaptive policies integrating AI literacy and ethical guidelines. It is recommended that a safe and cautious approach be employed in integrating GenAI into education to maximise its full benefits and subsequently reduce its potential harmful effects.

Keywords: *artificial intelligence, chatbot, ChatGPT, chaos theory, technologies*

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Introduction

Artificial intelligence (AI) has been integrated into our world the past few years. Yet, its impact on the educational landscape has been both transformative and “chaotic”, resulting in both beneficial (order) and detrimental (chaos) outcomes. As Biswas et al. (2018) note, while chaos is difficult to define, it is easily recognised when it occurs. Similarly, AI has undeniably introduced a chaotic transformation to education. The chaos theory provides an appropriate conceptual lens for this review because it captures the non-linear, unpredictable, and emergent dynamics that AI technologies introduce into the educational system. As such, by framing the discussion through chaos theory, the study can systematically explore how seemingly disorderly disruptions can generate both instability and new forms of order in instructional practices, policy and research. AI has propelled educational progress in ways that mirror its disorderly essence, presenting both benefits, referred to as order, and challenges, described as chaos in this context. This has propelled researchers and practitioners to refuse to take the back seat but delve into it so as to understand and adopt the appropriate strategies to enjoy the benefits as institutions overcome the challenges. Similar to the rapid changes in society due to COVID-19, the pressing challenge for researchers today is to discern between the order and chaos that AI technologies like ChatGPT pose to the educational system.

By way of explanation, ChatGPT is a large language model (LLM), equipped with natural language processing (NLP) abilities, which enable individuals to use queries and prompts to get tailored responses and ideas to their questions. By using a conversational style, ChatGPT is recognised to stand out among other LLMs because it realistically engages users through a dialogue style. This provides users with responses that are viewed to be more unique and tailored toward the needs of the individuals (Rahman & Watanobe, 2023; Yu, 2023). The use of ChatGPT has been massive across the globe, with the global south not being an exception because of the high performance in its application domains, as emphasised by researchers like Kasneci et al. (2023). The use of such an application within the educational setup has challenged the traditional way of teaching, learning and assessment. It has also forced educators and practitioners to either embrace its potential or question its use, with some calling for a total ban within educational settings (Reuters, 2023; Yadava, 2023; Zhou et al., 2023).

While Michel-Villarreal et al. (2023) argue that empirical studies are needed to evaluate the effectiveness of ChatGPT in developing course outlines and content, other researchers have noted that the application is useful in such activities for educators (Rahman & Watanobe, 2023). Through the preparation of lesson plans, putting together learning activities, carrying out assessments and giving feedback and guidance (Kasneci et al., 2023; Kooli, 2023; Rahman & Watanobe, 2023; Zhuo et al., 2023), ChatGPT has been noted to be a valuable tool to educators. Playing such roles by ChatGPT has helped educators to reduce their workload and diminish the stressful processes they go through playing such essential roles. In terms of the research role of educators, ChatGPT supports educators from aiding in idea generation to drafting final papers for publication.

Students, on the other hand, are not left out of the enormous benefits of utilising ChatGPT in their educational endeavours. However, the controversial debate for the ban of ChatGPT in education stems from the concerns raised by some academics who believe that the extent of over-reliance of students to complete their assignments and other school-related projects through the use of such software is likely to affect their critical thinking skills (Deshpande & Szefer, 2023; McGee, 2023; Yu, 2023). By using ChatGPT, students are provided with more coherent feedback prompted by the meaning and intent of their questions, and the feedback could also be modified to meet their needs (Deng & Lin, 2023). This convenience could encourage students to engage in academic dishonesty through plagiarism and the presentation of incorrect information and sometimes biased data without proper academic scrutiny (Chan & Hu, 2023; Lim et al., 2023; Lo, 2023; Lund & Ting, 2023). Such practices risk the potential of producing half-baked graduates who may lack judgement abilities for the job market, as well as lead to academic crises on the reputations of academic institutions. These have led to urgent calls for educators to provide guidance and training to help students understand and properly use these tools to enhance academic activities and foster the development of ethically responsible graduates. Equally, others are also calling for clear guidelines in the form of policies to regulate the incorporation of AI and its allied technologies into education to enhance academic integrity and prepare students to meet the workplace demand for digital and AI skills.

Amid the order and chaos brought about by the unpredictable pace of AI advancement, three primary dimensions have emerged in the rapid integration of ChatGPT in education; teacher instructional strategies and student learning, instructional policies, and research practices. Though the transformation may look chaotic, there seems to be hope that order may ultimately emerge and be restored if the necessary steps are taken. To properly draw conclusions and clearly implement any meaningful strategies, further studies are required. As such, given the limited studies, this research utilises an integrative review approach to capture and analyse useful cases that will address the three dimensions. Specifically, the study explores key discussions on the role ChatGPT is playing in education and provides evidence of interesting cases demonstrating its usefulness within the educational sphere through the use of Edward Lorenz's (1963) chaos theory. This approach provides a detailed perspective of how ChatGPT is changing traditional education practices and sheds light on both the possible benefits and challenges of such technologies. Accordingly, this integrative review is guided by the following research questions: (1) How is ChatGPT shaping instructional strategies, policies, and research practices in education? (2) What benefits ("order") and challenges ("chaos") emerge from its integration into educational settings? Given the qualitative and exploratory nature of this integrative review, no formal hypotheses are proposed.

Construing the Complexities of AI Adoption through the Chaos Theory

Chaos theory, pioneered by Edward Lorenz (1963), was first applied in physics and mathematics to explain how small, seemingly insignificant events can generate large, unpredictable impacts on complex systems. Lorenz showed that minor variations, though initially unnoticed, can accumulate and interact to produce outcomes that defy precise predication. As Galatzer-Levy (2009) notes, chaotic systems are impossible to determine precisely within a system at a specific time in the future because they follow differential equations that will result in an unpredictable outcome. However, Feigenbaum (1983) holds that, while these chaotic systems may appear unpredictable, they are bounded, and the patterns they create can result in mathematical constants, offering a measure of structure within the chaos.

Lorenz illustrated this with the “butterfly effect”, where the flap of a butterfly’s wings could, over time, trigger a distant tornado. This metaphor captures how small, unconnected events may generate far-reaching and disruptive consequences. Because these changes are inherently unpredictable, chaos theory calls for new approaches that recognise and manage uncertainty rather than attempting to ignore or eliminate it (Akmansoy & Kartel, 2014). A core implication of the butterfly effect is that institutions will experience diverse outcomes based on their unique contexts (McMillan, 2008). A strategy that succeeds in one setting may fail in another, even under similar conditions. Institutions must, therefore, carefully evaluate which AI tools best fit their needs if they are to emerge from the “chaos” through resilience.

Since its development, chaos theory has been applied across various fields, and this study extends its use to AI in education. Chaos theory was chosen over alternative complexity frameworks because it uniquely emphasises sensitivity to small changes and the emergence of unpredictable but patterned outcomes. These properties map directly onto the disruptive and fast-evolving dynamics of AI adoption in education, where minor shifts in policy, practice, or student use can cascade into major systemic consequences. These reflect how ChatGPT and its allied technologies have introduced a state of “educational chaos”, igniting discussions about the dual potential of AI in education, both order and chaos. In this context, chaos theory provides a valuable framework for understanding AI’s unpredictability and for challenging conventional practices that seek to preserve the status quo.

Analysing AI implementation through the lens of chaos theory highlights that it is not a linear process; rather, it encompasses fluctuating states and interrelated activities (Styhre, 2002). Undisputably, the advent of chatbots in the education ecosystem, especially in developing economies, has brought compelling challenges regarding ethics, affordability, higher levels of digital literacy and the like. Meanwhile, these innovations ought to be embraced if education in these economies can match up with their counterparts elsewhere (Adarkwah et al., 2023). It is in this context that Nonaka (1988) argues that nurturing internal chaos can align organisations more closely with their external environments.

Importantly, engaging chaos theory does not exclude traditional educational perspectives. For instance, constructivism emphasises learners’ active role in knowledge creation, while connectivism highlights the role of digital networks in shaping learning. AI both disrupts and enriches these traditions: it enhances constructivist opportunities for personalised learning

and expands connectivist networks but also risks encouraging over-reliance and diminishing critical thinking. Chaos theory complements these perspectives by adding a systems-level lens that captures how local disruptions ripple outward, producing emergent, unpredictable transformations across education.

Judging from the preceding and our search, the chaos theory has rarely been applied to the field of education. As far as our search could go, there is yet a study that applies this theory in the application of AI to the field of education. We take cognisance of the fact that in as much as the introduction of AI has introduced 'chaos', it holds the potential of revolutionising education for all educational institutions that embrace it. We, therefore, agree with MacMillan (2008) in her viewing institutions as chaotic systems within the context of AI, enabling the institutions to develop flexible strategies and decision-making frameworks to navigate complexity. We fully appreciate that long-term forecasting remains challenging under the circumstances presented by AI and its rapid evolution; chaos theory offers insights into underlying patterns that can aid short-term predictions and bolster institutional resilience.

Research Design

An integrative literature review was used to provide a broad understanding of the themes identified in the topic (Whittemore et al., 2014). An integrative literature review mainly addresses mature or emerging research topics that sometimes have contradictory evidence in the literature and will benefit from a comprehensive conceptualisation and synthesis (Torraco, 2005). The integrative literature review is best suited for dynamic topics that experience rapid growth in literature but have yet to be comprehensively reviewed or updated over a period of time (Torraco, 2016). First, studies on generative artificial intelligence (GenAI) use in education are relatively new, gaining significant attention following the launch of ChatGPT in November 2022. Additionally, research on GenAI has rapidly increased, but there is a paucity of studies that consolidate the teaching and learning, research, and institutional policy aspects in a single study. Using the integrative literature review approach allowed for the study's results to be synthesised using narrative analysis (Whittemore et al., 2014).

The five-stage criteria developed by Whittemore and Knafl (2005) were followed to guide the analysis; 1) problem identification (what are the key conversations on GenAI use in education and actual use cases in teaching and learning, research, and policy?) (2) literature search (described in the method section); (3) data evaluation (only highly-cited studies were included); (4) data analysis (a narrative analysis was used to present the results) and (5) presentation (narrative discussion).

Search Database

The Web of Science (WoS) database was consulted to retrieve influential articles on GenAI use in education. To ensure that significant studies not captured in WoS were included, a complementary manual search was conducted via Google Scholar. This manual search was carried out in three ways: by tracing backwards and forward citations of influential works, by performing author-based searches of leading scholars in GenAI and education, and by scanning keyword-based results across grey sources such as conference proceedings and book chapters that met the study's inclusion criteria. The initial search on WoS yielded 9,244 studies, and 15,100 studies

on Google Scholar were also retrieved. In total, 24,344 articles were obtained from both searches.

Search Strategy

To provide a comprehensive analysis of the literature on the topic, specific search terms based on the extant literature review were developed. To fully capture all pertinent literature, a broad range of search terms was developed involving "Generative AI", "conversational agents", "chatbots", "large language models", "ChatGPT", and "education". The search terms were used on both the WoS and Google Scholar databases. Specifically, the following search string was searched to solicit literature from WoS: "generative AI" OR "conversational agents" OR "chatbots" OR "large language models" OR "ChatGPT" AND "education". ChatGPT was used as part of the keywords as opposed to other GenAI technologies because it is the pioneer of advanced conversational agents that sparked the current debate/discussions on GenAI use in education. Additionally, among all the GenAI tools, it is the most researched. To confine our studies to include only relevant studies, clear inclusion/exclusion criteria were developed. We limited the search to the field of education at all levels and only articles published from 2023 and beyond, which is the peak year for studies on GenAI. The study followed the principles of the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement (Moher et al., 2009). Importantly, a citation threshold of 200 was applied to ensure inclusion of highly influential work shaping the field. While this inevitably excluded some emerging but less-cited studies, the threshold was intended to focus the review on works with demonstrated academic and practical impact. No country restrictions were set for articles to allow for diverse perspectives on GenAI use in education (see Figure 1). Details about the eligibility criteria are presented in Table 1.

Table 1: Inclusion/Exclusion Criteria Table

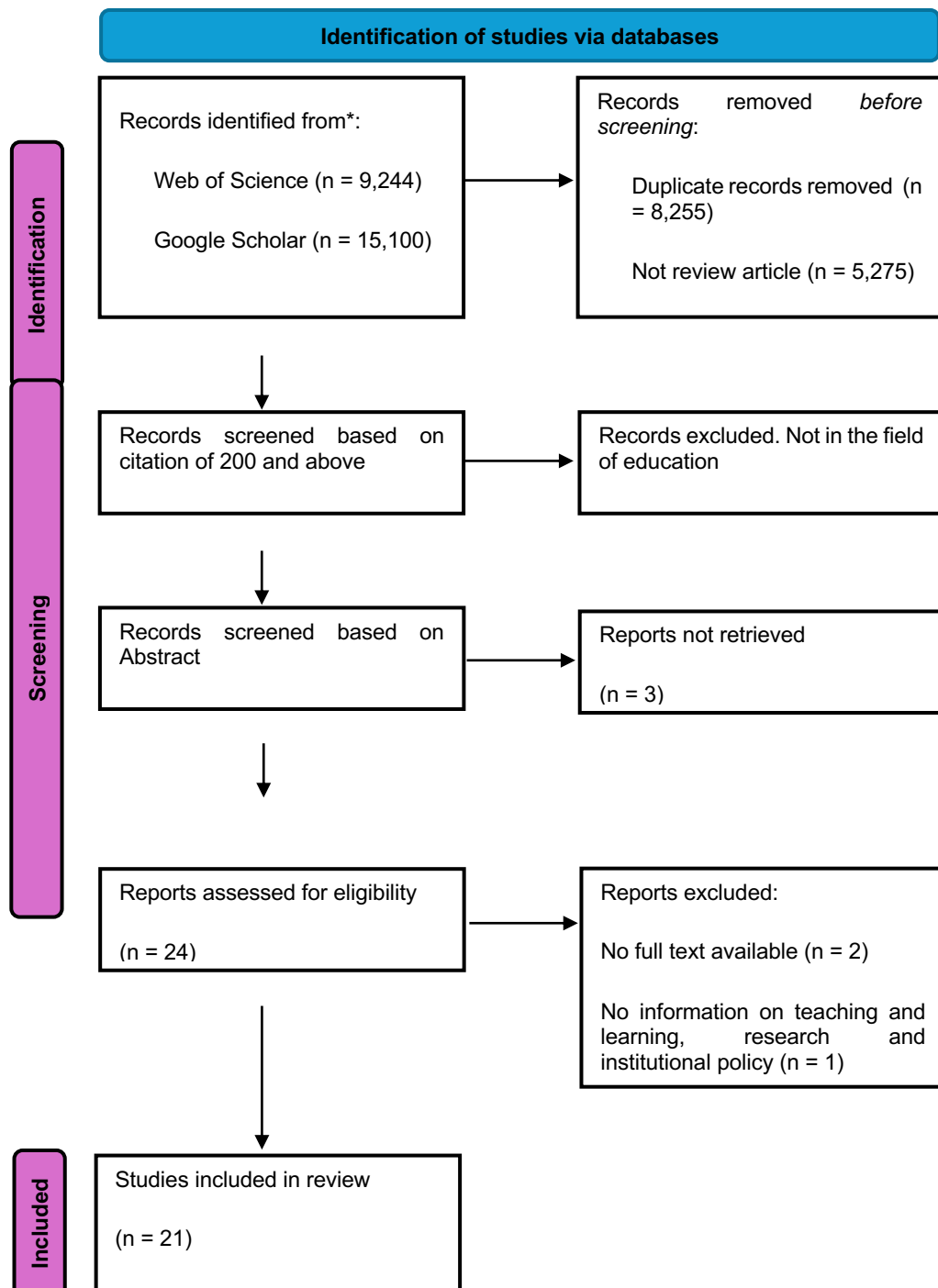
Criteria	Inclusion	Exclusion
Type of Document	Full research articles, reviews, opinion pieces, conference papers, and book chapters	Non-full-text research documents or preprints
Publication Year	Published in 2023 or later	Published before 2023
Field	Focused on Education	Outside the field of Education
Language	Articles in English	Articles in any language other than English
Citations	Highly cited articles (200 citations or more)	Articles with fewer than 200 citations
Focus	Articles focused on generative AI in an educational context	Articles not primarily about generative AI
Peer Review Status	Peer-reviewed articles	Non-peer-reviewed articles

Study Selection

The eligibility criteria guided the study selection. The selection process involved title and abstract screening against the inclusion criteria, removal of duplicates, and resolution of discrepancies through consensus among authors. Studies were

prioritised if they addressed contested or “chaotic” debates about GenAI in education and/or provided concrete use cases of policy guidance. The systematic approach followed helped in the inclusion of only relevant studies for the analysis. Figure 1 presents the processes of arriving at the papers selected and analysed for this study.

Figure 1: A PRISMA flowchart of the literature search process



Data Synthesis

The final records (n=21) involving 14 documents from WoS and seven from Google Scholar were analysed to identify key themes that align with the three main categories (teaching and learning, research, and institutional policy) of the study. Specifically, the studies were checked for discussions on either the GenAI in teaching and learning practices or for research or the development of institutional policies to guide a safe and responsible adoption. The three categories or themes underlined the diverse applications of GenAI in education. To enhance clarity and avoid repetition, the findings are summarised in a condensed thematic Table 2 (chaotic debates) and Table 3 (practical use cases), with the details presented in the appendix.

Table 2: Discussions of GenAI in Education (Themes from 12 studies)

Theme	Opportunities (Order)	Challenges (Chaos)
Teaching & Learning	- Personalised learning support - Reduced teacher workload - Inclusive learning opportunities - Feedback and scaffolding	- Plagiarism & academic dishonesty - Shallow learning & stifled creativity - Biased/inaccurate outputs - Threats to professional expertise
Research	- Drafting, editing, summarising - Language support for non-native speakers - Assistance with data analysis	- Fabricated references - Lack of peer-reviewed grounding - Intellectual outsourcing concerns
Institutional Policy	- Calls for authentic assessment - AI literacy and ethics training - Opportunities for flexible curriculum	- Institutional bans (schools, journals, conferences) - Fragmented or unclear regulations - Risk of widening digital divide

Table 3: Documented Use Cases of GenAI in Education (Themes from 9 studies)

Theme	Opportunities (Order)	Challenges (Chaos)
Teaching & Learning	- Support for exam prep and complex concepts (e.g. USMLE) - Customised lesson plans and activities - Continuous feedback & tutoring support	- Dependence leading to reduced critical thinking - Inaccurate/incomplete knowledge - Data privacy & authorship issues
Research	- Scientific writing support - Hypothesis generation - Pattern detection in large datasets	- Risk of bias and fabricated references - Lack of transparency in AI decision-making - Threats to research integrity
Institutional Policy	- Calls for ethical guidelines - Redesign of assessment methods - Integration into teacher training	- Bans in school & journals - Unequal access (digital divide) - Potential misuse in academic publishing

Box 1: Discussions of GenAI in Education

- **Academic integrity risk** were the most cited issue (14 of 21 studies), highlighting plagiarism, dishonest use, and assessment validity challenges.
- **Fabricated or unreliable references** appeared in 9 studies, raising concerns about credibility in research outputs.
- **Bias, misinformation, and shallow reasoning** were recurring limitations, with GenAI struggling on context-sensitive or higher-order tasks.
- **Institutional bans and prohibitions** were noted in 8 studies, though often paired with calls for regulation, guidance, and integration.
- The literature illustrates the “chaos” side of AI adoption: unpredictable consequences, destabilised norms, and contested governance.

Box 2: Actual Use Cases of GenAI in Education

- **Personalised learning benefits** were highlighted in 13 studies, including feedback, tutoring, scaffolding and customised assessments.
- **Teacher workload reduction** was cited in 11 studies, with GenAI supporting lesson planning, grading, and curriculum design.
- **Research support** appeared across multiple studies, from drafting and summarising to data analysis and language editing.
- **Collaboration and inclusivity:** 7 studies emphasised that GenAI can democratise access and support diverse learners, though risks of digital divide remain.
- These findings demonstrate the “order” side of chaos theory: patterns of innovation, efficiency, and expanded learning opportunities emerging from disruption.

Findings and Discussion

GenAI Order and Chaos in Education

- **Teaching and learning:** The review of the studies highlights the transformative potential of GenAI, particularly ChatGPT, in teaching and learning. This transformative nature presents both opportunities and challenges. Just like the butterfly effect, ignoring these implications could lead to significant disruptions in the not-too-distant future. The opportunities identified from the data analysis fall into four key themes: enhanced learning experiences, teacher support, skill development and inclusive education. With enhanced learning experiences, ChatGPT fosters personalised learning environments where students can prompt the tool to simplify complex concepts and receive tailored feedback that aligns with their individual needs (Khan & Khan, 2023; Hong, 2023). The tool also provides students with real-world scenarios that deepen

their understanding of topics. Additionally, its prompt responses accommodate diverse learning styles that can empower students to take ownership of their education (Farrokhnia *et al.*, 2024; Kasneci *et al.*, 2023). Approximately two-thirds of the reviewed studies (13/21) highlighted ChatGPT's potential for personalisation and scaffolding.

With teacher support, ChatGPT assists teachers in developing lesson plans, curricula, assessments and task grading (Kasneci *et al.*, 2023; Tlili *et al.*, 2023). Such support reduces teachers' workload and enables them to create engaging and relevant teaching materials. As a result, students benefit from enhanced feedback and more dynamic learning experiences (Khan & Khan, 2023; Farrokhnia *et al.*, 2024). Roughly half of the studies (11/21) mentioned workload reduction as a key benefit.

Again, properly guided use of the tool can help students enhance their critical thinking and analytical skills (Garcia-Penalvo, 2023; Kasneci *et al.*, 2023). ChatGPT's capacity to present diverse perspectives encourages learners to explore topics from multiple angles, promoting deeper understanding and intellectual curiosity. Such guided interactions can build their foundational skills and prepare them for the demands of the workplace.

Another opportunity worth noting from the studies was ChatGPT's ability to provide real-time assistance and mimic authentic human interaction. These features allow for a more inclusive educational experience, which supports students with varying needs and proficiency (Hong, 2023; Kasneci *et al.*, 2023).

In terms of the chaos or challenges, key themes included the impact on student skills, issues with accuracy and depth, ethical concerns and teacher professionalism. Over-reliance on ChatGPT and diminished creativity or critical thinking were flagged in more than half of the studies (12/21). The challenge with over-dependence poses a high risk of students becoming less innovative, less critical, and weaker problem-solvers, ultimately hindering their cognitive development (Farrokhnia *et al.*, 2024; Tlili *et al.*, 2023). It can also reduce students' willingness to engage in intellectual effort, thereby compromising the learning process (Garcia-Penalvo, 2023). When students bypass critical engagement in favour of quick AI-generated answers, the depth and quality of their understanding are significantly reduced, posing long-term risks to their academic and professional growth.

Moreover, issues of accuracy and depth were also noted in the studies as a challenge affecting teaching and learning. ChatGPT's output often lacks depth, accuracy, and insight when engaging in higher-order learning (Farrokhnia *et al.*, 2024). Its reliance on outdated data (post-2021) and inability to comprehend nuanced contexts can also lead to biased or irrelevant responses (Kasneci *et al.*, 2023; Khan & Khan, 2023). Thus, critical evaluation and careful verification are always needed to avoid misinformation.

Issues such as plagiarism, academic integrity, and data privacy in the use of ChatGPT and other related chatbots raise ethical concerns, which further complicate its integration into education (; Kasneci *et al.*, 2023; Tlili *et al.*, 2023). Moreover, the potential for ChatGPT to perpetuate biases and spread misinformation underscores the need for cautious implementation and ethical oversight (Garcia-Penalvo, 2023; Kasneci *et al.*, 2023). At the same time, excessive dependence on ChatGPT risks diminishing teachers' professional

expertise, which shifts the focus away from their critical role in fostering a comprehensive learning environment (Hong, 2023).

- **Research:** The review further offers a detailed exploration of ChatGPT's role in academic research, highlighting both its advantages and limitations. Among its potential benefits, key themes include the facilitation of research processes, efficiency in writing and editing, and bridging gaps in knowledge. However, its limitations are equally noteworthy, encompassing themes such as limitations in literature review and citation accuracy, ethical and professional issues, risk of bias and misinformation and erosion of research skills. On the positive side, this review identified that ChatGPT provides valuable support to researchers across various stages of the research process. The tool assists in generating research ideas, developing structured outlines, refining research designs, organising arguments, and drafting manuscripts (Dwivedi et al., 2023; Hong, 2023; Kasneci et al., 2023). This capability is especially useful for students and early-career researchers who may find it difficult to navigate the complex nature of research (Khan & Khan, 2023; Tlili et al., 2023). By offering guidance and foundational insights, ChatGPT helps them build confidence and competence in their fields, making the research process more approachable and manageable. It is significant to state that approximately half of the studies (10/21) referenced efficiency in writing and editing, especially for non-native English speakers.

ChatGPT also enhances efficiency in academic writing and editing. Researchers can leverage the tool to draft articles by breaking down complex writing tasks into manageable components. It also assists in refining and improving the overall quality of academic writing, ensuring clarity and coherence (Dwivedi et al., 2023; Khan & Khan, 2023). This feature is particularly valuable for non-native English speakers, who can use ChatGPT for language editing, grammar correction, and improving the fluency of their academic work. Additionally, the tool enables users to create well-structured outlines and maintain coherence throughout their manuscripts, thereby streamlining research workflows and improving productivity (Kasneci et al., 2023).

However, ChatGPT faces significant challenges when used in research, especially regarding literature review and citation accuracy. At least 8 of the studies identified fabricated or inaccurate references (hallucination) as a critical concern. It lacks access to peer-reviewed articles in its training data and is unable to incorporate recent developments, relying instead on information up to the year the system was last trained (2021 in the case of this study), which makes it unsuitable for comprehensive literature reviews (Dwivedi et al., 2023). Moreover, ChatGPT frequently fabricates references as well as provides incorrect citations, potentially undermining the reliability of research output. Such limitations underscore the need for critical evaluation and cross-verification of any information sourced from ChatGPT.

Ethical and professional issues were raised in one-third (7/21), particularly in relation to authorship and responsibility. In some cases, researchers have controversially listed ChatGPT as a co-author, sparking debates about intellectual responsibility. This has led some organisations like the World Association of Medical Editors and the International Conference on Machine Learning to ban such practices to ensure transparency and accountability (Dwivedi et al., 2023; Khan & Khan, 2023).

Another challenge worth noting relates to bias and misinformation. ChatGPT outputs can perpetuate biases and misinformation if not critically evaluated. As noted by Kanseci et al. (2023), its lack of deep contextual understanding limits its ability to produce nuanced insights, which is particularly problematic for complex research topics. Moreover, its reliance on outdated information (training data up to 2021) poses additional challenges for research requiring the most recent data and findings (Khan & Khan, 2023).

Although ChatGPT can assist researchers in conducting their research, it also has the potential to diminish individual research skills. However, it is clear that over-reliance on AI tools like ChatGPT may hinder the development of essential skills such as critical thinking, problem-solving and writing proficiency (Tlili et al., 2023).

- **Institutional policy:** The reviewed studies highlight diverse institutional responses to the use of ChatGPT in educational settings, with policies reflecting both its potential and the challenges it introduces. Concerns over ChatGPT's impact on academic integrity have led some institutions to adopt restrictive measures. One-third of the reviewed studies (7/21) referenced bans or restrictions, such as those implemented in New York City. Similarly, some universities have implemented policies prohibiting the use of AI tools in essay writing and other academic submissions. The essence of this move is to preserve or promote originality and critical thinking in student work (Dwivedi et al., 2023).

To adapt to the changes introduced by AI technologies, some institutions are revising curricula to incorporate digital literacy and AI competencies (Farrokhnia et al., 2024). More than one-third (8/21) discussed policy revisions aimed at balancing regulation with innovation. This includes integrating higher-order learning outcomes and authentic assessments, such as self-assessment and collaborative tasks, to minimise the risks of academic dishonesty and reliance on AI for rote or mundane tasks. Furthermore, educators are encouraged to use ChatGPT as a tool to enhance critical thinking and problem-solving skills. For example, Garcia-Penalvo (2023) underscores the importance of training students in the ethical use of AI, equipping them with skills to critically evaluate AI-generated content rather than solely relying on it.

There is also a call for educational institutions to develop comprehensive guidelines to ensure equitable access and responsible use of AI. These guidelines should include training for both educators and students on ethical usage, proper citation practices, and awareness of AI limitations.

GenAI actual use cases

This section of the findings presents cases of GenAI's actual use. From the review, the studies demonstrate that GenAI, including ChatGPT, holds significant potential to transform teaching and learning practices, research and institutional policy. In terms of teaching and learning practices, AI tools provide educators and students with a powerful tool to enhance educational outcomes, but they also present challenges that require careful management.

- **Teaching and learning:** From the review, ChatGPT is considered a tool that provides tailored learning experiences by offering students tailored feedback and resources that cater to their individual needs. It also acts as a virtual tutor, helping students engage with content, practice skills, and prepare for exams

(Javaid et al., 2023; Rasul et al., 2023). Collaborative learning is encouraged through scenarios that promote teamwork, fostering a more inclusive and interactive environment (Baidoo-Anu & Owusu Ansah, 2023; Rasul et al., 2023). The tool also facilitates scaffolding in teaching by breaking down complex topics, aiding students in understanding and engaging with material at a deeper level (Cooper, 2023). ChatGPT can also support diverse learning styles and inclusive education (Kasneci et al., 2023).

Educators, on the other hand, also benefit from ChatGPT as it assists them in lesson planning, creating assessments, generating rubrics and reducing administrative workloads. Additionally, it enables teachers to save time in crafting high-quality teaching materials and innovative strategies for classroom engagement (Baidoo-Anu & Owusu Ansah, 2023; Kung et al., 2023). Furthermore, it helps in saving time, as it allows teachers to focus on higher-value activities, such as engaging directly with students and refining instructional approaches (Cooper, 2023; Kung et al., 2023).

Despite its advantages, the integration of ChatGPT in teaching and learning presents several challenges. One major concern is its impact on student skills. Over-reliance on ChatGPT can diminish creativity, critical thinking, and problem-solving abilities, which are essential for lifelong learning and workplace success (Javaid et al., 2023; Lim et al., 2023; Rasul et al., 2023). Students may also engage less in independent learning, relying instead on AI-generated content (Rasul et al., 2023). The tool has also been linked to academic dishonesty, with students sometimes copying AI-generated work without acknowledgement (Javaid et al., 2023; Rudolph et al., 2023). This undermines academic integrity and raises concerns about plagiarism (Kasneci et al., 2023). ChatGPT occasionally provides inaccurate, outdated, or biased information and struggles to verify the authenticity of its sources (Baidoo-Anu & Owusu Ansah, 2023; Cooper, 2023). Additionally, questions of data privacy and intellectual property remain unresolved, complicating its ethical use in education. Again, while effective for basic learning tasks, ChatGPT is less capable of producing content requiring higher-order thinking, which can stifle the cognitive development of students (Farrokhnia et al., 2024; Rudolph et al., 2023).

- **Research:** The review of the studies further reveals that using ChatGPT for research presents numerous benefits. It supports researchers in writing various sections of academic papers, organising ideas, and generating coherent arguments. Authors such as Salvagno et al. (2023) and Rasul et al. (2023) highlight its ability to provide language editing services and drafting assistance, which is particularly beneficial for non-native English speakers. Additionally, ChatGPT aids researchers in identifying gaps in the literature, generating new ideas, and answering questions that clarify misunderstandings. Javaid et al. (2023) and Rasul et al. (2023) also emphasise its utility as a research tool for detecting patterns in data and facilitating efficient data analysis. Furthermore, ChatGPT helps researchers save time by performing tasks like summarising academic literature and enhancing research workflows, as noted by Rudolph et al. (2023) and Rasul et al. (2023). It also provides insights into academic trends, helping to process and organise research data effectively.

Despite these advantages, significant challenges accompany the use of ChatGPT in research. Cooper (2023) and Lim et al. (2023) warn that ChatGPT often hallucinates by fabricating references, providing inaccurate information, and lacks evidence to support its outputs. Rasul et al. (2023) also note its

tendency to oversimplify complex ideas and generate fake references, undermining academic credibility. Ethical concerns are raised by Salvagno et al. (2023), Baidoo-Anu and Owusu Ansah (2023) and Rasul et al. (2023), who highlight issues such as potential plagiarism, bias in generated content, and over-reliance on AI, which could diminish critical thinking skills. Moreover, ChatGPT lacks the ability to generate truly original ideas and perform critical or deep analyses of complex subjects, as emphasised by Salvagno et al. (2023) and Rudolp et al. (2023). Further limitations of ChatGPT include its restricted knowledge base, which is constrained by the training data's cut-off date, leading to outdated or incomplete information, as noted by Baidoo-Anu & Owusu Ansah (2023) and Cooper (2023).

- **Institutional policy:** The findings reflect the evolving institutional approaches to the use of GenAI in education. Policies are shaped by the potential benefits and significant risks associated with their use, aiming to maximise their advantages while mitigating ethical and academic concerns. Institutions and stakeholders have emphasised the need for clear guidelines to regulate ChatGPT usage responsibly. This includes policies for ethical AI use, acknowledging its contributions transparently, and incorporating critical thinking into teaching practices (Baidoo-Anu & Owusu Ansah, 2023; Lim et al., 2023).

The role of AI in fostering equitable access to education is also emphasised, with policies advocating for a balance between innovation and accessibility to prevent widening the digital divide (Lim et al., 2023; Salvagno et al., 2023). These approaches highlight the importance of collaboration among educators, students, administrators, and policymakers to address the challenges and opportunities presented by AI technologies.

Institutions and publishers have taken proactive steps to address the ethical implications of Gen AI use in education. Leading academic publishers, such as Nature, prohibiting listing GenAI as an author, while mandating clear acknowledgement of its use in research (Cooper, 2023). The growing concerns surrounding AI's impact on academic integrity have led to calls for robust policies to detect AI-generated content and uphold the credibility of scholarly work (Salvagno et al., 2023). Some institutions have gone further, implementing outright bans on ChatGPT to prevent misuse and safeguard academic standards. However, such bans may have unintended consequences, potentially driving the covert use of AI tools and exacerbating the digital divide. Students and educators without equitable access to these technologies risk being left behind, creating further disparities in academic opportunities (Lim et al., 2023).

Implications

The findings of this study reveal a dualistic impact of GenAI, particularly ChatGPT, on education. These implications, through the lens of chaos theory, emphasise both the "order" (transformative potential) and the "chaos" (disruptive consequences) of these technologies. This perspective sheds light on the dual nature of GenAI's influence on teaching and learning. Chaos theory's central tenet, the butterfly effect, emphasises how small, seemingly insignificant changes in AI applications can lead to far-reaching consequences. For instance, the decision to use ChatGPT for personalised student feedback might catalyse broader institutional shifts, including changes in pedagogy, curriculum design and policy frameworks. This perspective reveals the unpredictable

and non-linear nature of AI's impact, emphasising the need for adaptive strategies to navigate these dynamic shifts effectively.

On one hand, ChatGPT and other GenAI tools enhance personalised learning, reduce teacher workload, and democratise access to knowledge. On the other hand, they raise significant concerns around academic integrity, data privacy, bias, and the erosion of critical thinking. Addressing this tension requires a deliberate balance between innovation and accountability. Educational institutions could develop comprehensive AI usage policies that promote transparency, safeguard ethics, and build critical AI literacy. For instance, policies might require both students and researchers to disclose when and how AI tools are used in academic work, ensuring clarity in attribution and accountability. Similarly, assessment practices may need to shift from rote memorisation toward authentic, problem-solving tasks that are less susceptible to AI-enabled shortcuts. Embedding AI literacy within teacher training and professional development would further prepare educators to guide students in critically evaluating AI-generated content while avoiding overreliance.

These implications are particularly pressing in under-resourced contexts such as African or other LMIC higher education systems. While GenAI could help bridge gaps in access to high-quality teaching and research support, limitations in digital infrastructure, affordability, and digital literacy risk widening the educational divide. In such settings, chaos theory's emphasis on sensitivity to initial conditions is particularly relevant, without targeted policy interventions and investments, minor disparities in access could snowball into systemic exclusion. Equitable AI adoption, therefore, requires capacity building, affordable access, and policy frameworks that explicitly account for structural inequalities.

Finally, this study highlights the need for future empirical research to move beyond conceptual reviews. Comparative studies across well-resourced and under-resourced institutions would shed light on how structural conditions shape GenAI adoption and outcomes. Longitudinal studies could also track how institutional policies evolve over time, offering insights into adaptive strategies that sustain resilience in chaotic and uncertain educational environments. By embedding these empirical approaches, future research can generate actionable evidence to guide inclusive, ethical, and context-sensitive AI integration in education.

Conclusion and Recommendation

The study provides a nuanced exploration of the transformative yet disruptive impact of GenAI tools like ChatGPT, on education. By applying chaos theory, the research reveals that AI's influence mirrors the duality of order and chaos, offering benefits such as personalised learning, teacher support, and efficiency in research while simultaneously presenting challenges related to academic integrity, ethical concerns and critical thinking. Through the lens of chaos theory, the study demonstrates how small changes, such as the introduction of AI tools in classrooms or research processes, can create far-reaching ripple effects across pedagogy, curriculum design, and institutional policies. These impacts highlight the need for adaptive strategies and ethical frameworks to navigate the unpredictable nature of AI in education.

Viewing from the lens of chaos theory, the study reveals the importance of resilience and adaptability in addressing AI's challenges. Institutions must recognise and embrace the interplay between structure and unpredictability, fostering systems that encourage innovation while mitigating risks. The findings further emphasise the necessity of policies that promote equitable access, responsible use, and critical

evaluation of AI tools. By doing so, the educational sector can leverage AI's potential while safeguarding academic standards and fostering a culture of ethical and informed technology integration.

Recommendations

To navigate the transformative yet disruptive impact of GenAI tools, educational institutions must develop adaptive policies that balance innovation with accountability. These policies should establish clear guidelines on how AI tools, such as ChatGPT, can be integrated into teaching, learning and research. Specific measures must address academic integrity, like plagiarism, misinformation, and data privacy concerns. Transparency in AI applications is critical to building trust and ensuring that students and educators use these tools responsibly. Again, policies should include mandatory documentation of AI contributions to ensure accountability in academic and professional contexts. Such policies must be revisited regularly to accommodate the rapidly evolving nature of AI technologies and their applications in education.

Educational institutions should consider revising their curricula to incorporate digital literacy and AI competencies, emphasising critical thinking, problem-solving, and ethical decision-making. Promoting AI literacy is essential for maximising the benefits of these tools while minimising their misuse. Through such revised curricula, students and educators would be equipped with the skills needed to critically evaluate AI-generated content and understand its limitations. Additionally, the curriculum should emphasise the ethical use of AI, helping students to recognise biases, inaccuracies, and ethical implications inherent in AI outputs. By fostering a culture of informed and responsible AI use, institutions can ensure that students and educators alike are prepared to leverage these tools effectively.

Moreover, ensuring equitable access to AI tools is essential to prevent the widening of the digital divide. Institutions should take proactive steps to make these technologies accessible to all students and educators, regardless of socio-economic status. Policymakers should also focus on providing underserved regions, especially the global south, with the necessary digital infrastructure and ensuring that AI solutions remain affordable and accessible. This effort requires collaboration between governments, private technology providers, and educational stakeholders to create opportunities for all institutions, regardless of their geographic or economic contexts. By bridging the digital divide, AI can be a force for democratising education rather than perpetuating inequalities.

Lastly, fostering collaboration among stakeholders is key to managing the complexities of AI adoption. Educators, administrators, students, and policymakers should work together to develop comprehensive strategies that address both the opportunities and challenges of AI integration in education. By fostering open dialogue and shared responsibility, stakeholders can collectively shape a future where AI enhances educational outcomes while preserving ethical and pedagogical standards.

Limitations

This study offers an insightful analysis of the integration of GenAI, particularly ChatGPT, in education. However, several limitations must be considered to provide a nuanced understanding of the findings. One notable limitation of the study is its primary focus on ChatGPT, which, while highly influential, represents only one among

many GenAI tools. This narrow scope excludes other emerging technologies that may have similar or distinct functionalities, potentially limiting the broader applicability of the findings across the diverse landscape of AI-driven tools. Additionally, the study draws heavily on recent literature from 2023 onward, ensuring its relevance but potentially omitting foundation research or earlier trends that could provide a more comprehensive historical perspective.

Again, as an integrative literature review, the study synthesises existing research without conducting primary empirical investigations. While this approach effectively identifies trends and patterns, the findings lack direct observational or experimental validation, which could have strengthened the evidence base. By acknowledging these limitations, the study highlights the need for continuous research, empirical validation, and contextualised approaches to fully understand and harness the transformative potential of GenAI in education while mitigating its risks.

Lastly, it should be noted that this study is based on a qualitative synthesis of existing literature. As such, while proportional trends (e.g., "x out of 21 studies") are reported to highlight recurring patterns, these should not be interpreted as statistical generalisations. Instead, they provide an indicative sense of the dominant conversations emerging in the rapidly evolving discourse on GenAI in education.

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Appendix

Table 2: Chaotic discussions of GenAI in education across the three themes

No.	Author/Year	Title	Category	Findings
Tlili et al. 2023		What if the devil is my guardian angel: ChatGPT as a case study of using chatbots in education	Teaching and Learning Practices	ChatGPT is used by both teachers and students to obtain baseline knowledge of essential and complex topics.
				ChatGPT use by learners can also diminish their innovative capacities and critical thinking.
				It can lessen teacher workload, such as preparing teaching content,
			Research	There are issues of response quality, personality and emotions, academic integrity, and other ethical issues Some researchers took humanisation to another level by treating ChatGPT as a human, where they listed it as one of the co-authors in an article published in an academic journal
Khan & Khan 2023		ChatGPT Reshaping medical education and clinical management	Institutional Policy	New York City decided to ban it in its schools
				Educators can use ChatGPT to assess the work of students, help break complex concepts into understandable formats and enable educators to create and engage students through relevant content and pedagogy
				Can be adjusted to suit the learning styles of students and assist in personalised learning
			Teaching and Learning Practices	Assist students and professionals with accurate and up-to-date information on medical topics Provide students with real-world clinical scenarios to gain a deeper understanding of topics

		Sometimes ignores the context of the prompt and produces irrelevant information
		Lack of data input after 2021
		May lack human-like understanding
	Research	Provide research assistance to students at various stages of the research
	Institutional Policy	ChatGPT has been rejected as an author by the World Association of Medical Editors
Dwivedi et al., 2023	Opinion paper: "So what if ChatGPT wrote it?" Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy	Research AI chatbots can assist in writing articles, data analysis and assist in the entire research process ChatGPT can aid in writing and language editing to bridge the English gap for non-native speakers ChatGPT cannot perform literature review because it lacks peer reviewed articles in its training Attempt to make ChatGPT/ other AI chatbots co-authors Outsourcing the crafting of papers to AI programmes
	Teaching and Learning	ChatGPT can help to improve the critical thinking skills of students through the critique of ChatGPT outcomes

ChatGPT can provide students with personalised feedback

Instructors can use AI to grade students, which will reduce the workload of instructors

ChatGPT can assist teachers in lesson plans and developing curriculum

ChatGPT support diverse learning styles and promotes inclusive learning

ChatGPT outputs are mostly biased and sometimes not accurate

ChatGPT erodes academic integrity

Some of the information provided by ChatGPT are not update and gets confused with complex questions

Quotes from ChatGPT are not reliable and are attributed to wrong or fake authors

Frequent use of ChatGPT by students can limit their skills in writing, critical thinking, problem solving and creativity.

**Institutional
Policy**

AI tools have been banned for writing papers by the International Conference on Machine Learning, but can be used to edit and improve text

			Gen AI has been banned as an author, and when it is used in research, it must be documented
			Some universities have instituted policies to prohibit the use of AI in essays
			Access to ChatGPT has been banned in New York City Schools
Farrokhnia al., 2024	etA analysis of ChatGPT: Implications for educational practice and research	SWOT of Learning Practices	and ChatGPT produces more credible and plausible responses
			ChatGPT can produce context driven information based on the personalised needs of the learner and at a faster pace
			Provide both students and teachers with access to information in real-time towards teaching and learning
			Provide students with customised feedback and instructions
			Assists teachers in preparing lesson notes, assessments, and providing students feedback
			Information provided by ChatGPT on topics may lack depth, insight, accuracy and dated
			Produce bias and discriminatory information
			Inability to produce higher-order thinking information and stifle the cognitive skills of students

			Lacks a deep understanding of the learning styles of students as well as the curriculum for a particular topic
			Use of it in answering exams questions poses a threat to academic integrity
			High risk of plagiarism and misinformation
		Institutional Policy	Adjusting curricula to incorporate the use of new technologies and higher-order learning outcomes with appropriate tasks
			Adopt authentic assessment with self-assessment
Kasneci et al., 2023	ChatGPT Good? opportunities and challenges of large language models for education	Teaching and Learning	LLM enhance the learning experiences of students by providing prompt feedback and personalised learning ChatGPT assist teachers in their lesson planning, giving assessment feedback and saves time Questions and prompts generated can stimulate students' critical thinking and writing skills Provides an opportunity for inclusive education for all AI can support students in collaborative learning and writing LLM can perpetuate societal/context biases Stifle the creativity, critical thinking and problem-solving skills of students and teachers Ethical concerns, including plagiarism, data privacy and affects academic integrity

			Outputs of AI-generated text may lack accuracy
		Research	Assist in generating research outlines and research process
Garcia-Penalvo, 2023	The perception of Artificial Intelligence in educational contexts after the launch of ChatGPT: Disruption or Panic?	Teaching and Learning	ChatGPT has the capacity to promote critical analysis, having access and generating appropriate questions and a source of comparison Loss of authorship attribution when ChatGPT is used without reference or proper citation Prone to error without verification of responses Students are likely to bypass intellectual effort ChatGPT has the limitation of reasoning and can spread misinformation with its easy-to-use functionalities
		Institutional Policy	Call for educators to help train students to use it ethically
			Educators should incorporate critical thinking in their teaching methods
Hong, 2023	The impact of ChatGPT on foreign language teaching and learning: Opportunities in education and research	Teaching and Learning	Enable students to engage in authentic conversations that mimic human interaction Enable students to get immediate feedback and act as personalised tutor Enable teachers to mark and provide students with appropriate feedback, as well as reduce workload ChatGPT and other AI tools undermine academic integrity and the validity of academic activities like assignments May limit teachers' professional expertise when teachers over rely on it
		Research	ChatGPT can help to generate research ideas
King, M. R., & ChatGPT. (2023)	A conversation on artificial intelligence, chatbots, and plagiarism in	Teaching and Learning	ChatGPT acknowledged that plagiarism is a concern for higher educational institutions because of the way students access and use information

	higher education.			ChatGPT suggests academics should adopt a variety of assessment methods to reduce plagiarism
				Academic institutions should have stricter policies on plagiarism and stronger forms of punishment
				Institutions should use plagiarism detection software
		Research		ChatGPT generated fake authors as references
Haug & Drazen (2023)	Artificial intelligence and machine learning in clinical medicine, 2023	Research		AI could help to improve and simplify clinical trials through comprehensive analyses of data.
				AI has the potential to create synthetic control groups
				AI can help predict and understand the outcomes of events
		Institutional Policy		There are uncertainties in using AI and machine learning for clinical trials, especially in protocols and reporting, which must be addressed
Singhal et al. (2023)	Large language models encode clinical knowledge	Teaching and Learning		Large language models (LLMs) facilitate human-AI interaction by helping learners to ask complex medical questions and receive well-structured answers.
				LLMs can help align with specific learning domains for structured learning
				LLMs support education and medical learning by providing students with relevant clinical knowledge through reasoning abilities
				Responses and knowledge contained within LLMs can be biased and limited due to the training of the data used
				LLMs are limited by the knowledge contained within their training data
		Research		LLMs can help retrieve relevant literature, summarise key medical findings
Thirunavukarasu et al. (2023)	Large language models in medicine	Teaching and Learning	and	LLMs act as virtual tutors and assist students in explaining complex medical concepts, provide instant feedback and guide in problem-solving

	LLMs assist in generating medical case studies, quizzes and other educational materials
	LLMs support self-directed learning in creating study plans and tracking progress
	LLMs can generate misleading or incorrect medical information
	LLMs can facilitate academic dishonesty
Research	LLM assist researchers to efficiently review and synthesise literature by extracting key insights from published medical research and identifying gaps
	LLMs facilitate research writing and reporting, and the content can be tailored for different audiences
	LLMs support peer reviewers to detect plagiarism, identify errors and potential biases in research papers
	They can support analysing large datasets and generating synthetic medical data
	LLMs can produce factually incorrect or fabricated information and responses require rigorous validation
	Responses may fail to incorporate the latest scientific discoveries and guidelines due to the dataset used to train the LLMs
	The sources of information from LLMs are mostly not known, which makes it difficult to account for the accuracy of their outputs
	LLM training data are often biased, have privacy and data security risks, risk of plagiarism and scientific misconduct
Institutional Policy	Cambridge University Press has given out explicit guidance on the use of AI
	Some peer-reviewed journals have placed an outright ban on the use of LLMs
	Call for clear policies to regulate AI use in medicine

Strict guidelines on patient data protection are required and should be aligned with other laws

Call for strict enforcement of regulations developed

Table 3: Actual use cases of GenAI in education across the three themes

No.	Author/Year	Title	Category	Findings
				Order Chaos
Salvagno et al., 2023	Can artificial intelligence help for scientific writing?	Research	ChatGPT can help researchers in writing an article and provide appropriate justification when necessary	Cannot replace human judgement and expertise AI cannot generate new ideas May be difficult to identify text written by ChatGPT and humans
				Will need human guidance, supervision and input to produce an appropriate scientific paper
				Violate academic integrity by committing plagiarism May produce bias and inaccurate data and results
				ChatGPT is faster than humans in comprehending a text Increase in publications deeply and connecting without a corresponding evidence to draw conclusions
				Create further digital divide with payment options
			Institutional Policy	Call for programmes to detect written content generated by AI
Kung et al., 2023	Performance of ChatGPT on USMLE potential for AI-assisted medical education using a large language model	Teaching and Learning	ChatGPT has an increasing accuracy to pass USMLE without prior training	The ability of ChatGPT depends on human input and, therefore, may provide biased information on the subjective view of the trainer or information
				ChatGPT can support medical students to understand complex concepts with clear

			and logicalChatGPT may provide explanations inaccurate information as well as perform ChatGPT can performpoorly based on a a comprehensivedomain-specific prompt reasoning and provide insight to validate clinical concepts ChatGPT can ease the burden of educators by helping to create content for medical education
Cooper, 2023	Examining science education in ChatGPT: An exploratory study of generative artificial intelligence	Teaching and Learning	ChatGPT can supportChatGPT lack the educators in theirrequired evidence to teaching pedagogy support the output from prompt ChatGPT can provide students with an understanding of concepts through scaffolding Outputs are biased and cannot verify the ChatGPT can reduceauthorship of the the workload ofinformation provided teachers in creating learning materials ChatGPT can supportChatGPT raises questions on data students and teachersprivacy in their writing skills Allowing students to generate text first before searching for references to back the text is unethical Over-reliance on ChatGPT by students reduces their creativity and critical thinking skills
		Research	ChatGPT can supportProvide inaccurate and in language editing non-existing references ChatGPT can help to organise ideas and generate arguments The author has instructed his students not to reference ChatGPT directly in their assignments

Institutional Policy		ChatGPT has generated debates among editors, researchers and other stakeholders as to accept it as an author or not
		Nature and all Spring Nature journals do not accept any large language model as an author, and authors who use LLM must acknowledge it in the method or acknowledgement sections
Lim et al., 2023	Teaching and learning Generative AI and the future of education: Ragnarok or reformation? A paradoxical perspective from management educators	Gen AI is a transformative resource that can assist educators and students in assessing information, assessment, creating critical thinking assignments, and empower progress through idea generation. Generative AI may provide false information and create knowledge gaps Generative AI can promote plagiarism Generative AI can promote cognitive bias
		Gen AI have rich resource collection and can provide timely and elaborate responses Responses from Generative AI may not be reliable
		Hinder the democratization of knowledge and widen the socio-economic gap Gen AI has increased access to improved education and democratisation of knowledge
Research		References provided by ChatGPT are not reliable
Institutional Policy		Has been banned in some schools Placing a ban on it may rather increase its use
		A call to integrate its use, but a policy to increase the digital divide Placing a ban is likely to increase the digital divide

			regulate the extent of use
			Share responsibility among educators, students, institutions and administrators in dealing with Gen AI-related challenges and opportunities
			Guidelines should be provided to guide practice and research in education
b	Javaid et al. (2023)	Unlocking the opportunities through ChatGPT tool towards ameliorating the education system	Teaching and learning ChatGPT is a great resource for student through the creation of customised learning plans, explanations and clarification of concepts, improving outcomes, opportunity to practice and help to prepare for exams ChatGPT sometimes provide incorrect and unethical responses. Reduce students' ability to engage in independent learning and critical thinking Students have been encouraged to copy the work of ChatGPT as their own without acknowledgement ChatGPT provide biased information and raises concerns on data security, intellectual property and privacy Provide students with immediate feedback and act as a teaching assistant Assists educators to develop class activities to help students bring out their creativity, evaluate students and develop rubrics
		Research	Provide students with research tools that help them to generate ideas, answer

			questions and clarify misunderstanding
Baidoo-Anu & Owusu Ansah, 2023	Education in the era of generative artificial intelligence (AI): Understanding the potential benefits of ChatGPT in promoting teaching and learning	Teaching and Learning	ChatGPT has enabled educators to save time in creating testing exams, as well as generating rubrics ChatGPT sometimes fabricate references and provide incorrect information ChatGPT has limited knowledge beyond 2021 ChatGPT and other Gen AI can provide students with continuous feedback and act as a virtual teacher by providing students with explanations of complex concepts Increase students' dependence on AI leading to students' inability to think critically ChatGPT can promote collaboration among students by providing them with collaborative scenarios ChatGPT can assist teachers to come out with high-quality assessment practice
		Institutional Policy	A call for institutions to embrace ChatGPT and other Gen AI into education and regulate its use Some institutions have banned the use of ChatGPT for teachers and students Institutions to rethink their traditional assessment methods A call for integrating the use of AI in teacher education and training
Rudolph et al., 2023	ChatGPT: Bullshit spewer or the end of traditional assessments in higher education?	Teaching and Learning	ChatGPT can help students to understand concepts and provide quick responses ChatGPT is less competent in providing higher-order thinking content ChatGPT is a threat in assessing students

		ChatGPT can provide based on traditional personalised assessment methods assistance to students like written in solving problems assignments
		ChatGPT has helped to ChatGPT can generate reduce the workload in inaccurate information of teachers and innovate teaching strategies
		ChatGPT lack deep understanding of subject matter and Assist students to critical analysis access information and formulate ideas
		A threat to academic integrity, as it allows ChatGPT can provide students to plagiarise assistance to teachers without being caught. in their writing and providing assessments on students
		ChatGPT can support students to work as a team and promote collaboration
	Research	ChatGPT can help to ChatGPT provide improve data incorrect references and processing and inaccurate information analysis efficiently
		Can assist in ideas Oversimplify complex summarising academic literature and identifying trends
		Provide biased data based on it training
Rasul et al., 2023	The role of ChatGPT in higher education: Benefits, challenges, and future research directions	ChatGPT can help teachers to provide support to students by and engage in creating personalised learning experience plagiarism undermining academic integrity
		ChatGPT can provide a tailored learning

	experience accordingSome of the information to the needs of eachprovided may be student inaccurate and biased ChatGPT can provide students with personalised feedbackMay limit critical and resources tograduate skills like enhance learningcollaboration, critical outcomes thinking and problem-solving skills required at Reduce administrativethe workplace workload ChatGPT can make it ChatGPT can help todifficult to assess create assessmentsstudents' critical that will fosterthinking and collaboration andcollaborative skills critical thinking
Research	ChatGPT can provide aChatGPT generate fake summary of research,references which could generate drafts andundermine the support writing,credibility of academic especially for non-work native English speakers Help to save time for students and researchers Assist in data analysis by detecting patterns in data and supporting research efforts Provide writing assistance for researchers
Institutional Policy	A call for institutions to implement training programs for both students and academics on the responsible use of ChatGPT Redesigning assessment and integration of AI in the curriculum

		Developing ethical guidelines and policies to curtail the unethical aspects of ChatGPT
		Develop policies to help ensure equitable access
Gilson et al., (2023)	How does ChatGPT perform on the United States Medical Licensing Examination (USMLE)? The implications of large language models for medical education and knowledge assessment	Teaching and learning ChatGPT's conversational interface helps students receive feedback, explanations, and follow up on USMLE related questions. ChatGPT's responses are limited to information available up to its training data cutoff in 2021 ChatGPT demonstrates a higher accuracy level in answering questions compared to previous models ChatGPT provides students with interactive learning opportunities similar to peer discussions.
Wang et al., (2023)	Scientific discovery in the age of artificial intelligence	Research AI enhance scientific discoveries which cannot be easily probed The large datasets of AI may likely lead to incomplete and biased results AI reduces the need for manual and repetitive tasks in research labs AI systems can be misused for unintended applications It may be difficult to enable scientists to replicate research focus on high-level results using AI because of the nature of training and evolving datasets Large-scale experimental data can be processed by scientists more efficiently through the use of AI It may be difficult to understand how AI models arrive at their conclusions Over reliance on AI tools may affect researchers critical analysis skills AI can facilitate hypothesis generation, accelerate the research process

and experimental procedures scientific investigations	optimise forPotential breaches intellectual theft	of data and property
AI models can provide highly accurate simulations		

Authors

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