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Generative artificial intelligence in education: A narrative literature review

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Abstract

One year after the release of ChatGPT, the literature on its usage in education has proliferated at a rapid pace. The present paper reviews the literature on generative artificial intelligence in education, providing a narrative account of the themes emerging from the burgeoning field. The review covers 121 peer-reviewed articles, analyzed through a two-stage inductive/deductive coding process. Findings are organized into thirteen distinct themes that characterize the reviewed papers, including such themes as adaptation, value alignment, and the loss of critical thinking. The findings within each theme are then discussed to elicit key questions that follow from the research published to date. The paper concludes with four synthesized pathways that the literature's themes evince: staying adaptable, embracing collaboration, prioritizing human considerations, and reimagining pedagogy.

***Keywords*:** Artificial intelligence; ChatGPT; educational technologies; language models

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1. INTRODUCTION

As the twenty-first century unfolds, the world is becoming increasingly characterized by advancements in artificial intelligence (AI). Among these advancements, generative artificial intelligence (GAI) has emerged as a particularly notable innovation, changing the way humans interact with technology and, in turn, the world around them (Yu & Guo 2023; Awidi, 2024; Banh & Strobel 2023). As of November 2022, with the public release of OpenAI's ChatGPT, GAI became an accessible tool for vast audiences, opening new doors in numerous sectors, with education being a primary area of interest (Barrot, 2023; Chang & Kidman, 2023; Lo, 2023). The inception of generative models such as GPT-4 offers an intriguing premise: AI capable of generating contextually relevant, coherent, and semantically meaningful text. But beyond the surface capabilities, the true potential of GAI lies in its myriad applications (Samala et al., 2024). With this technology, educators, researchers, and students can access instant, customized content ranging from answering complex questions to developing unique educational materials, potentially transforming pedagogical approaches (Dolezal et al., 2023; Huang et al., 2023; Seetharaman, 2023). Similarly, visually generative models, such as Midjourney and DALL·E, extend the boundaries of creativity, enabling the synthesis of images and videos that can be used for artistic, educational, or explanatory purposes (Bender, 2023; Reed, 2023).

While these developments promise a future of enriched learning experiences, they are not without concerns. The inherent challenges accompanying the introduction of GAI into education necessitate a thorough understanding and informed approach to its integration (Lodge et al., 2023). Such is the premise of this literature review. With education being a cornerstone of individual development and societal growth, it is imperative to examine how GAI intersects with educational practices, not only to harness its benefits but to anticipate, understand, and address potential risks. The impact of technology on education is hardly a novel subject of inquiry.

Historically, each wave of technological innovation, from the printing press to the internet, has been met with both enthusiasm and skepticism regarding its implications for learning (Saettler, 2004). The discourse surrounding GAI is a continuation of this trend but is distinct given the autonomy and intelligence perceived within these systems. Despite common references to the advent of the calculator, GAI distinguishes itself as a set of interactive, responsive, and adaptive entities that can shape and be shaped by human users in real time. Given the rapid pace at which GAI is being explored within educational settings, the objectives of this literature review become especially pertinent. By providing a narrative account of the existing scholarly discourse, we aim to enumerate themes emerging from educational research about GAI. Are we looking at a revolutionary tool that can democratize and personalize learning? Or are we on the precipice of introducing a potentially disruptive force that could compromise the very essence of education?

At this juncture, it is crucial to contextualize the importance of the present review. Although GAI has not been publicly available for very long, the incredible pace at which innovations have occurred and the critical capacities they engender necessitate a thorough, albeit early, look at the rapidly populating body of literature. As educators and policymakers race to integrate GAI into curricula and classrooms, having a consolidated understanding of its implications becomes a lynchpin for informed decisions. The stakes are high; on one hand, there is the potential to reshape education in unprecedented ways: making it more accessible, personalized, and dynamic (Abd-Alrazaq et al., 2023; Agathokleous et al., 2023; Sallam, 2023). On the other, there is the looming risk of exacerbating educational disparities, compromising academic integrity, and eroding the human-centric nature of teaching and learning (Arif et al., 2023; Colgan, 2023; Wang et al., 2023).

Furthermore, technological capacities are not all that is at issue; significant ethical, societal, and philosophical questions are yet to be answered (Bearman & Ajjawi, 2023; Heimans et al., 2023; Lim et al., 2023). Can we entrust AI with the responsibility of educating future generations? What does it mean for the educator's role? How do we ensure equity in access and use? These are but a few of the many questions this review seeks to explore. In the sections that follow, the researchers will delve

into the study's methodology, providing a transparent account of how this rapidly emerging area was approached. The study then presents the findings, painting a comprehensive picture of the current scholarly landscape. Through the discussion, the researchers aim to stitch together the diverse perspectives, finding common ground, highlighting disagreements, and charting potential paths forward. Finally, the conclusion synthesizes the broader implications of our review, offering insights and recommendations for institutional stakeholders and policymakers involved in the educational ecosystem. In essence, this journey through the world of GAI in education is not just about understanding technology, but about envisaging the future of education in an AI-enabled world.

1.1. Purpose of study

The study aims to ensure that as AI becomes more pervasive, educators are prepared with clarity, foresight, and an understanding of how to best leverage GAI to nurture the holistic development of every learner.

2. METHOD AND MATERIALS

The quest to understand the landscape of GAI in education requires a methodological approach that is both comprehensive and rigorous. In crafting our review, we aimed to strike a balance between breadth, capturing the rapid proliferation of literature on this topic, and depth, providing a nuanced understanding of the selected works that illustrate broad themes occurring in the literature. To achieve this, we employed a narrative literature review methodology, a decision influenced by the nascent nature of the literature on GAI within educational contexts. Narrative literature reviews (Baumeister & Leary, 1997) provide comprehensive overviews of research on a particular topic by synthesizing findings into a cohesive picture, without employing systematic strategies or meta-analytical techniques. They are especially apt for topics that are emerging or where existing research is scattered, allowing for the development of valuable high-level perspectives and recommendations on still nascent or fragmented fields. Our goal was to weave together the diverse threads of existing research, identify overarching trends, pinpoint areas of contention, and highlight avenues that beckon further academic pursuit.

2.1. Procedure

The first step in our methodological journey was the selection of sources. We chose to focus exclusively on peer-reviewed articles. While this may have excluded some promising prepublication articles from repositories like arXiv and SSRN, our rationale was that the rigorous scrutiny that peer-reviewed articles typically undergo ensures a certain quality benchmark. Moreover, our temporal boundaries were set to consider articles published from 2023 onwards. The rationale for this choice is that 2023 marked a pivotal point in understanding GAI, particularly due to the public release of ChatGPT only a month prior, with no articles being able to get through the peer-review process between its release and the start of 2023. As the technology unveiled its vast potential and started permeating various sectors, academic interest has surged, which has led to rich and insightful discourse. In the quest for relevant articles, we deployed [our university's] library comprehensive search system. A mosaic of search terms was carefully chosen to ensure an extensive sweep. These included but were not limited to "generative AI," "ChatGPT," "large language models," "DALL-E," and "mid-journey," all of which were further refined by the addition of the keyword "education." This strategy ensured that the net we cast was wide yet focused, enabling us to fish out articles that were directly related to the application and implications of GAI in educational contexts.

This approach identified a total of 278 articles. However, not all of these were pertinent to our review's focus. The authors assessed each article for its direct relevance to education, discarding any articles that did not pertain to formal education (of any kind) and GAI. Also excluded were articles that measured GAI's performance on exams/tests unless the article discussed these in the context of educational implications. This led to a refined list of 121 articles, a collection that serves as the bedrock of our review. To decipher the vast amount of information within these articles and to extract

patterns, themes, and insights, a two-stage coding process was employed. Initially, abstracts of the articles were coded inductively, allowing us to approach the data without preconceived categories or themes. This organic process illuminated patterns and areas of emphasis within the literature. Post this, a collaborative endeavor led to the development of a codebook, a tool that guided the subsequent deductive coding process of the collected literature. With this structured approach, we ensured that each piece of literature was assessed consistently and systematically.

3. RESULTS

In the unfolding landscape of GAI within education, a multitude of insights emerged from the reviewed literature. To provide clarity and structure to the disparate data, our findings will be organized categorically by theme. Each theme, representing a prominent strand of thought or area of focus within the research corpus, will be delved into to capture the essence of scholarly discourse, debates, and insights surrounding it, using exemplar papers to highlight salient points. In addition, themes that only contain a few articles are furnished to indicate what the literature is not heavily focusing on (such as themes of 'Evil' and 'Visual Generation'). This thematic presentation aims to provide readers with a coherent, nuanced understanding of the multifaceted implications and perspectives of GAI in education.

3.1. Promises and pitfalls

The 'Promises and Pitfalls' theme was markedly prevalent, featuring in almost half of the analyzed articles (60 out of 121). Central to this thematic strand was a recognition of the duality inherent in the deployment of GAI within educational settings, with articles on this theme commenting on both the positive and negative sides of the GAI coin. On one hand, the "promises" painted a tantalizing picture of the myriad ways in which GAI could revolutionize education. Enthusiastic proponents hailed its potential to offer personalized learning experiences, thereby catering to individual student needs and pacing (Farrokhnia et al., 2024). Moreover, there was an optimistic view that GAI could democratize access to information (Grabb, 2023; Khan et al., 2023), serving as a leveling force in education by offering consistent quality of instruction across diverse geographies and socioeconomic strata. Yet, juxtaposed against these promises were the very real "pitfalls." Concerns were raised about the possible perpetuation of biases within AI algorithms, which could inadvertently reinforce existing societal prejudices, leading to skewed or unfair educational experiences (Chang & Kidman, 2023). The potential for misinformation, either through inadvertent errors or malicious manipulation, also emerged as a significant challenge (Sedaghat, 2023; Rusandi et al., 2023). Some scholars further posited that an over-reliance on GAI could dilute the human element in education, potentially jeopardizing the critical emotional and social learning that human educators foster (Choi et al., 2023; Keiper et al., 2023). In essence, the 'Promises and Pitfalls' theme encapsulates a balanced view professed by many researchers who advocate for a judicious embrace of GAI. While at times discussions were polarized into promises or pitfalls, occasionally attention was paid to navigating these both in an integrated fashion (Frith, 2023; Tremblay, 2023).

3.2. Assessment

The 'Assessment' theme emerged prominently, featuring in 50 of the 121 articles, indicating a significant focus of the academic community on the intricate relationship between GAI and educational evaluation mechanisms. At the nexus of this theme lies a multifaceted question: As GAI revolutionizes pedagogical approaches, how does it influence the way we measure, evaluate, and validate student learning? Several articles within this theme delved into the transformative potential of GAI in tailoring assessment methodologies, allowing for dynamic and real-time evaluations that adapt to individual student needs (Byeon & Kwon, 2023; Hopfenbeck, 2023; Masters, 2023a). With the ability to assess not just content knowledge but also cognitive strategies, GAI promises more granular, immediate feedback loops, enabling educators to intervene and tailor instruction more effectively (Perkins, 2023). However, a significant portion of the discourse also revolved around challenges. Concerns were raised regarding the reliability of AI-driven assessments, potential biases

in algorithmic evaluations, and the overarching fear of reducing complex educational attainments to mere quantifiable metrics (Thurzo et al., 2023; Xia et al., 2024). There were also apprehensions about academic integrity, with GAI making it easier for students to access information instantaneously (Pavlik, 2023; Yeo, 2023). This raises questions about originality, especially in higher-order tasks like essays and research papers (Yeadon et al., 2023). Furthermore, some researchers opined that while GAI can optimize objective evaluations, assessing softer skills like empathy, teamwork, and moral judgment would still necessitate human oversight (Mbakwe et al., 2023; Mao et al., 2024). Moreover, the literature evinced a concern for understanding what 'authentic' assessment consisted of given GAI, indicating that soft skill assessment is more authentic when GAI is so cognitively powerful (Crawford et al., 2023). In essence, the 'Assessment' theme paints a landscape of immense possibilities paired with intrinsic challenges. As GAI becomes more intertwined with educational systems, the discourse suggests a pressing need for assessments that are fair, holistic, and genuinely reflective of student capabilities.

3.3. Adaptation

The 'Adaptation' theme resonated in 28 out of the 121 articles, firmly emphasizing the inherently adaptive nature of the educational system and the imperative for it to evolve in tandem with technological advancements, including the integration of GAI. These articles contended that educators must work with GAI rather than against it (Lancaster, 2023). For instance, educators must understand the latest digital writing tools if they are to teach effective digital writing pedagogy (Johinke et al., 2023). Furthermore, the role of educators is to help students navigate ethical and social problems that are relevant to their lives and thus must engage with emerging technologies like GAI (Lodge et al., 2023), modeling ethical use for students' learning (Masters, 2023b). Some adaptive reactions proposed by authors were 'returns' to tried and tested modes of education, such as character education (Crawford et al., 2023) or oral assessments (Pearce & Chiavaroli, 2023). However, many articles also cautioned against a passive or reactionary stance. Instead of viewing GAI's integration as an inevitability that the educational system will eventually catch up to, the scholars argued for proactive engagement (Miao & Ahn, 2023). By understanding, harnessing, and strategically integrating GAI, educators can ensure that its introduction amplifies the strengths of the educational system while mitigating potential pitfalls (Mejia & Sargent, 2023). In essence, the 'Adaptation' theme underscores education's resilient and evolving nature, but equally highlights the responsibility educators carry in shaping this evolution purposefully and positively.

3.4. Assistance

The 'Assistance' theme resonated through 26 of the 121 articles, emphasizing a discerning perspective on GAI's role within the educational sector. These works collectively underscored the idea that GAI should not be viewed as an agent of radical transformation, but rather as a sophisticated tool designed to enhance and support existing educational paradigms. These authors envision GAI as a partner in the educational journey, complementing human expertise rather than usurping it (Oh et al., 2023). Many of these articles highlighted the idea that GAI, with its vast knowledge repositories and rapid analytical capabilities, is ideally positioned to handle tasks that are routine, data-intensive, or require instant access to vast amounts of information (Humphry & Fuller, 2023). For instance, GAI could assist educators in grading objective assignments, providing instant feedback, or curating personalized reading lists for students based on their learning trajectories (Kung et al., 2023). Such utilizations would not only enhance efficiency but also free educators to invest more time and energy into the nuanced, complex aspects of teaching that require human touch, intuition, and emotional intelligence. However, a crucial takeaway from this theme is the caution against excessive dependence on GAI or the misperception of it as a panacea for educational challenges where the unique capacities of humans are still required, such as behavior regulation, instilling of social values, and more (Eager & Brunton, 2023; Luo et al., 2023). The 'Assistance' perspective accentuates the irreplaceable value of human educators, asserting that while GAI can provide invaluable support, the essence of education, that is fostering critical thinking, nurturing creativity, and building character, remains a deeply human

endeavor. In this schema, GAI represents capacity-building for human endeavors, amplifying human potential without overshadowing or diminishing it.

3.5. Good

Emerging from a substantial portion of the corpus, the 'Good' theme, encapsulated in 20 of the 121 articles, paints a decidedly optimistic picture of the confluence between GAI and education. This cluster of scholarship resonates with palpable enthusiasm, heralding GAI as a revolutionary force poised to propel education into an unprecedented era of accessibility, personalization, and innovation. Central to this sanguine perspective is the belief in GAI's potential to affect education's questioning of itself. Proponents argue that these tools can break down long-standing norms, clarifying the value of education and the questions it asks (Rospigliosi, 2023; Situmorang et al., 2023). Such optimistic articles also emphasized GAI's potential in creating hyper-personalized learning experiences, tailoring educational pathways to individual learners' needs, strengths, and aspirations, thereby marking a significant departure from a 'one-size-fits-all' approach often employed in education (Huang et al., 2023). Furthermore, these scholars lauded GAI's potential as a collaborative partner, capable of freeing educators from routine administrative tasks, and thus allowing them to devote more time and energy towards fostering deeper cognitive and emotional engagements with their students (Reed, 2023; Seetharaman, 2023). The envisioning of classrooms transformed by the fusion of human empathy and AI efficiency paints a tantalizing image of the future of education. Yet, it is crucial to note that this unwavering faith in GAI's potential, while inspiring, largely sidesteps critical engagements with potential pitfalls. As a consequence, the 'Good' theme serves both as an aspirational blueprint of GAI's promise and a reminder of the importance of holistic evaluations when considering the integration of such transformative technologies in education.

3.6. Human Necessity

The 'Human Necessity' theme resonated across 15 of the 121 articles, highlighting a sentiment that, while the capabilities of GAI are impressive and can offer myriad benefits to the educational sector, the indispensability of the human touch in education remains paramount. This theme underscores a deeply held belief that education, at its heart, is a profoundly human endeavor, imbued with emotional, social, and moral dimensions that transcend the capabilities of even the most advanced artificial systems (Duha, 2023). Proponents of this theme often juxtaposed the computational prowess of GAI with the innate human capacities for empathy, intuition, and mentorship (Ross et al., 2023). While GAI can process vast quantities of information at incredible speeds and personalize learning pathways, it cannot replace the nuanced understanding, mentorship, and guidance that human educators provide (Choi et al., 2023). Teachers, mentors, and educators play a pivotal role in understanding the emotional and psychological needs of their students, offering support, and motivation, and often acting as role models (Koga, 2023). Furthermore, human supervision was seen to be necessary for response to GAI simply being fallible, often producing 'hallucinations', a term co-opted by the tech industry to describe fabrications or falsifications by LLMs (Megahed et al., 2024; Shaw et al., 2023). Conclusively, the 'Human Necessity' theme reverberates with a clarion call to cherish and prioritize the irreplaceable human essence in the realm of education, even as we navigate the promising frontiers of GAI integration.

3.7. Loss of Critical Thinking

The 'Loss of Critical Thinking' theme, echoed in 15 of the 121 articles, underscores a profound and shared apprehension regarding the unintended repercussions of GAI's immersion in educational spaces. This cluster of academic discourse grapples with a profound question: In an age where answers are instantaneously available at the tap of a key, what becomes of the intellectual rigor, curiosity, and resilience that characterize genuine educational journeys? The central concern here is twofold. Firstly, with the sheer efficiency and speed of GAI's responses, students might inadvertently shift from being active seekers of knowledge to passive recipients of information (Rusandi et al., 2023). The traditional process of grappling with challenging questions, seeking multiple viewpoints, and synthesizing diverse

sources of information, all foundational elements of critical thinking may be overshadowed by the convenience of immediate, AI-generated answers (Luo et al., 2023). Secondly, the scholars who voiced these concerns argue that an over-reliance on GAI might diminish students' resilience to ambiguity and complexity (Arif et al., 2023; Lyell, 2023). By always seeking the 'right' answer from an AI, students might lose the capacity to comfortably navigate the grey areas, wrestle with uncertainty, and cultivate the intellectual flexibility that is critical in our complex, rapidly evolving world (Vartiainen & Tedre, 2023). While recognizing the manifold advantages of GAI, these articles serve as a call to educators and policymakers regarding the indispensable nature of critical thinking as an educational cornerstone and caution against the inadvertent erosion of this skill in the face of dazzling technological advancements. The 'Loss of Critical Thinking' theme, therefore, underscores the profound responsibility of ensuring that, even in our technologically enriched classrooms, the cultivation of discerning, analytical minds remains paramount.

3.8. Regulation

The theme of 'Regulation' emerged with a distinctive voice, even though it was represented in a smaller fraction of the articles, with only 9 out of the 121 articles addressing it directly. The core assertion underscoring this theme is the perceived urgency to implement regulatory frameworks, usually at the institutional (school) level, in response to the swift integration of GAI into educational paradigms. Those who championed this theme maintained that the transformative potential of GAI, while profound, also brings with it a series of challenges that could have lasting implications if left unchecked (Zumsteg & Junn, 2023). A prominent concern within this theme revolved around the ethical considerations of GAI deployment, ranging from data privacy issues to algorithmic biases (DuBose & Marshall, 2023). Some researchers stressed the importance of having standard guidelines to ensure that GAI applications in education respect students' rights, especially concerning data privacy (Dwivedi et al., 2023). In summation, the 'Regulation' theme underlines a call to action for policymakers, educators, and AI developers to collaboratively craft regulatory frameworks that maximize GAI's benefits while mitigating potential hazards in the educational sphere.

3.9. Conceptualization

Within the academic discourse on the interplay between GAI and education, the 'Conceptualization' theme arose in 9 of the 121 articles, signaling a deeper, philosophical engagement with the foundational principles and understandings surrounding both domains. At its core, this theme grapples with the imperative of constructing a robust pedagogical theory to fathom the profound shifts brought about by GAI's introduction into educational landscapes. A segment of these articles sought to critically assess the metaphors education should use to understand GAI, ranging from surgical metaphors (Anderson, 2023) to paradoxical metaphors (Lim et al., 2023). Of already popular metaphors, such as the ‘black box,’ some research indicated that educators must learn to work with complexity (Bearman & Ajjawi, 2023). Additionally, typical roles of the teacher were called into question, with some researchers suggesting that teachers should take on roles such as ‘orchestrator’ or ‘enabler’ (Jeon & Lee, 2023). Lastly, scholars raised questions about how GAI was discussed by education scholars, claiming that the current discourse was “bullshit” (Costello, 2024) and missing historical context (Jandrić, 2023). However, the research does raise questions about the essential value of education in the age of GAI (Heimans et al., 2023). With an entity capable of delivering vast knowledge instantaneously, what, then, remains the true essence of education? Is it mere content delivery, or does it signify a deeper voyage into cognitive, emotional, and moral terrains? Collectively, the 'Conceptualization' theme emphasizes the need for profound introspection and dialogue, ensuring that as GAI reshapes education, the foundational ethos and values of the educational journey are neither lost nor diluted.

3.10. Value Alignment

The 'Value Alignment' theme, though observed in only 6 out of the 121 articles, carries profound implications for the interplay between GAI and education. Rooted in the belief that technology should

serve the overarching objectives of the educational realm, this theme contends that the true worth of GAI in education is determined by how well it aligns with, and promotes, the core values that education seeks to uphold. Articles espousing this view championed the idea that GAI should not merely be seen as a novel tool for content dissemination, but rather, its deployment should resonate with the ethos of fostering holistic moral development, critical thinking, and lifelong learning (Abdulai & Hung, 2023). In this context, there were concerns about GAI's potential to encourage rote learning or spoon-feeding information, which could potentially run counter to the deeper objectives of fostering critical thought and inquiry in students (Wang et al., 2023). Moreover, scholars aligned with this theme underscored the importance of ensuring that GAI does not compromise on the foundational principles of equity, inclusivity, and social justice in education (Lodge et al., 2023). There were calls for educators to consistently monitor value alignment to ensure GAI use remained beneficial for education (Eager & Brunton, 2023). In a nutshell, the 'Value Alignment' theme stands as a poignant reminder that while GAI offers vast potential, its incorporation into education must be driven by a commitment to uphold and amplify both educational and social values that undergird the educational process.

3.11. Prompt Engineering

The 'Prompt Engineering' theme, though identified in only 6 out of the 121 articles, emerged as a potentially critical skill for effective GAI utilization within education. These articles accentuated the importance of tailoring the interaction with GAI systems to extract desired outputs, underscoring that the quality of response from GAI is profoundly influenced by the nature and specificity of the prompt provided. Delving into the intricacies of prompt engineering, some articles highlighted it as an art, that is, a nuanced exercise that blends clarity, precision, and creativity (Hwang & Chen, 2023). For educators, mastering this art could unlock the potential of GAI to its fullest, allowing them to tap into the wealth of knowledge and analytical prowess these systems offer (Eager & Brunton, 2023). For example, a well-crafted prompt can transform a generic GAI response into a highly specific, context-relevant, and insightful answer, enhancing the teaching and learning experience (Eysenbach, 2023).

Furthermore, the articles emphasized that prompt engineering must be taught to students. Research called for educators to guide students in effective prompting (Shoufan, 2023) which not only would generate better responses but also build information literacy (Lo, 2023). In conclusion, while GAI systems like ChatGPT have brought transformative capabilities to the educational forefront, the 'Prompt Engineering' theme reiterates that their efficacy is closely tied to the quality of human interaction, reinforcing the symbiotic relationship between educators, students, and AI in the quest for knowledge.

3.12. Evil

The relatively infrequent, but deeply evocative theme of 'Evil' surfaced in 5 of the 121 articles, representing a cohort of academic voices expressing grave concerns regarding the integration of GAI into educational spheres. These voices harbored profound apprehensions about the deleterious impact of GAI, perceiving it not merely as a disruptive technology, but as an entity capable of eroding the foundational ethos of education itself (Colgan, 2023). Central to this perspective was the argument that GAI, with its ability to instantaneously produce vast swathes of information, might inadvertently nurture a culture of intellectual passivity (Arif et al., 2023). Rather than fostering genuine curiosity, exploration, and critical thinking, there is a risk that learners could become overly reliant on AI-generated answers, thereby curtailing their intellectual journey (Shaw et al., 2023).

Moreover, these scholars highlighted the potential for GAI to exacerbate existing educational inequalities, especially concerning including marginalized research in GAI outputs (Colgan, 2023). Furthermore, concerns extended to the realm of hallucinations, contributing to an atmosphere of misinformation (Megahed et al., 2023). In sum, the 'Evil' theme, while representing a minority viewpoint, serves as a stark reminder of the potential dangers of uncritically embracing technological advancements. It underscores the need for cautious, thoughtful, and ethically grounded adoption of

GAI in educational contexts, ensuring that the technology truly serves humanity, rather than inadvertently diminishing the very essence of the educational endeavor.

3.13. Visual Generation

The 'Visual Generation' theme, although present in a mere 2 of the 121 articles, opens up an intriguing domain of exploration, presenting a slightly uncharted territory within the academic discourse on GAI in education. It becomes particularly noteworthy given the extensive capability of GAI in generating intricate and meaningful visuals, which could revolutionize many areas within education, from screen media (Bender, 2023) to the visualization of popular representations of nursing (Reed, 2023). One might infer from the paucity of articles on this subject that the education sector has yet to fully grasp the transformative potential of visually generative AI.

GAI, with its ability to produce unique, detailed, and contextually relevant visuals, could serve as a powerful pedagogical tool (Reed, 2023). It could help students better understand abstract concepts, inspire art students, or even challenge them to interpret AI-generated artwork or facilitate more engaging and immersive visual content across a multitude of disciplines (Bender, 2023). The 'Visual Generation' theme, albeit underrepresented in the literature, hints at a vast expanse of untapped potential. It serves as a gentle reminder that the intersection of GAI and education may still hold many unexplored frontiers, with visually generative AI being a prime exemplar of the nascent territories awaiting scholarly exploration.

4. DISCUSSION

The extensive examination of GAI in education, represented through thirteen prominent themes, presents a multifaceted tapestry that delineates the opportunities and challenges that this technology brings into the realm of education. Synthesizing these findings brings forth crucial insights that carry significant implications for educators, policymakers, and stakeholders at large.

Firstly, the recurring concern about the 'Loss of Critical Thinking' stands as a testament to the educational community's belief in the centrality of critical thought in shaping well-rounded learners. Historically, the value of education has never been restricted to mere content acquisition; it transcends into fostering abilities to question, analyze, and critique. The concern about GAI potentially stymieing these skills is not merely about preserving tradition but about ensuring that learners can navigate an increasingly complex world where discernment is paramount. This sentiment echoes the themes of 'Evil' and 'Assessment,' suggesting that an uncritical embrace of GAI could inadvertently prioritize rote over reason, shifting the assessment landscape to favor regurgitation over rigorous reflection. An optimistic view on this topic present in the ‘Assistance’ theme shows the potential for GAI to free up educators' time spent on more routine tasks to focus on teaching critical thinking skills, however, several pitfalls must be avoided to make this vision a reality.

Alongside critical thinking, the findings hint at an implicit call for a renewed focus on character education. The themes of 'Value Alignment' and 'Human Necessity' converge on the idea that while GAI can be an influential tool, the human element, grounded in values, ethics, and empathy, remains irreplaceable. The development of character education entails the cultivation of qualities such as responsibility, respect, and resilience; in a world impacted by GAI, these characteristics will help students use technology ethically and responsibly. The dichotomy present in the 'Promises and Pitfalls' theme supports this perspective. While the promises of GAI are vast, the pitfalls are equally significant, including algorithmic oppression, violations of privacy, and more, necessitating students to wield this powerful tool with discernment and responsibility.

Another poignant observation is the need for clarity on the intrinsic value of education. With GAI's capability to generate vast amounts of content and assist in various educational tasks, what then is the core purpose of education? Moreover, the explicit nature of educational technologies such as GAI (that is, lacking the intuition and malleability of human educators) requires equally explicit educational objectives and pedagogies. Themes like 'Conceptualization' and 'Assessment' highlight this quest for

clarity. If educators are to harness GAI meaningfully, there must be a profound understanding of education's fundamental purpose and the role that GAI will play within it. Is it content mastery, character formation, skill acquisition, or a combination of these and more? The presence of GAI in the educational scene is akin to holding up a mirror, reflecting deep-seated questions about education's true objectives. With GAI's capabilities, educators are called to introspect on what they are truly assessing: is it a student's ability to regurgitate information, or is it their capability to synthesize, analyze, and extrapolate upon their knowledge?

However, despite the challenges and introspections GAI provokes, it is essential to recognize its vast potential. The themes of 'Visual Generation,' 'Assistance,' and 'Adaptation' underscore GAI's capability to augment traditional pedagogical methods, creating rich, personalized learning experiences. By generating visuals or assisting educators in administrative tasks, GAI can free up time and resources, allowing educators to focus on the nuanced, human-centric aspects of teaching, such as mentoring, counseling, and providing personalized feedback. In addition, the scale at which GAI can produce individualized content affords a level of personalization within education never before practical and promises the vision of a future in which each student is taught in their ideal way. The theme of 'Adaptation' encapsulates this perspective aptly: education, as a dynamic and evolving entity, has always adapted to technological innovations. GAI, with its revolutionary capabilities, offers yet another avenue for such evolution.

The synthesis of these findings leads to a cautious yet optimistic outlook. GAI's integration into education should be marked by a collaborative spirit where educators work hand-in-hand with this technology, leveraging its strengths while being acutely aware of its limitations. The overarching narrative suggests that GAI is neither a panacea nor a harbinger of doom but a tool. Like all tools, its value is determined not merely by its inherent capabilities but by the wisdom with which it is wielded. As educators venture into this new frontier, the call is clear: harness GAI's potential, prioritize critical thinking and character, clarify the true objectives of education, and forge ahead with a vision that seeks to unlock the boundless learning potentials of students.

5. CONCLUSION

The exploration of GAI within the educational sector, as chronicled through our comprehensive review, has illuminated the multifaceted role and impact of this pioneering technology on learning environments, pedagogical approaches, and overarching educational values. The questions that arose were not merely technical or practical but fundamentally philosophical: How does GAI redefine the essence of education? Can it complement the human touch or by very definition, does GAI’s machine-like design and presence erode it? Where can GAI enact positive change and where does it stand as a potential impediment to the organic processes that have long characterized the realm of education? Our methodology, grounded in a narrative literature review, ensured a meticulous and broad-based exploration of available academic literature. By analyzing 121 articles, this study delved deep into the nuances, arguments, and perspectives presented by researchers, educators, and stakeholders.

The meticulousness of our approach ensured a comprehensive understanding, capturing the multifarious dimensions of the GAI-education interface. The findings, classified into thirteen distinct yet interrelated themes, offered a panoramic view of the discourse surrounding GAI in education. Ranging from the balanced perspectives of 'Promises and Pitfalls' to the more cautionary stances such as 'Loss of Critical Thinking' and the optimistic tones of 'Assistance' and 'Good', the spectrum was vast and revealing. It became evident that while GAI is undoubtedly a powerful tool, its implications for education are complex, requiring a nuanced understanding and adaptive strategies.

The discussion synthesized these findings, weaving them into an integrated narrative. Firstly, the integration of GAI into education underscores the imperativeness of fostering critical thinking skills, ensuring that learners can discern, analyze, and critique in an era marked by information overload. Secondly, the discussion emphasized collaboration. GAI, with its transformative capabilities, should not be viewed as a competitor but as a collaborator. Its potential, when harnessed judiciously, can

augment and enrich the educational landscape, complementing human efforts rather than supplanting them. Lastly, the advent of GAI prompts a profound reflection on the very essence of education. Beyond content mastery, the value of character education, rooted in virtues such as responsibility, respect, and resilience, assumes paramount importance. Drawing these threads together, several implications and pathways emerge for the future of education in a world increasingly influenced by GAI:

1. Stay Adaptable: The 'Adaptation' theme encapsulates the dynamism inherent in education. As GAI continues to evolve, so too must educational strategies, ensuring that they remain current, relevant, and effective.

2. Embrace Collaboration: As highlighted, GAI should be viewed as a partner in the educational process. Though its adoption is not a foregone conclusion, the history of similar technologies suggests that there is no putting the genie back in the bottle. The key lies in ensuring that this partnership is harmonious, with GAI amplifying human efforts rather than overshadowing them. This is all the more reason for educators and other key stakeholders to be experimenting with GAI so that they may have an active, informed voice in the development and deployment of future systems.

3. Prioritize Human Considerations: As we integrate GAI into education, ethical considerations, such as data privacy, fairness, and responsible use, become paramount. Equally important is the identification and protection of the human values we hold dear in education: critical thinking, building character, and nurturing creativity. The design of GAI systems may at times oppose these values and it is of utmost importance that we avoid a complete mechanization of education.

4. Reimagine Pedagogy: With GAI's capabilities, educators have the opportunity to reinvent pedagogical strategies, incorporating personalized learning, adaptive content generation, and enhanced visual experiences. However, as the 'Assessment' theme underscores, these strategies must remain anchored in fostering holistic development rather than mere content acquisition. GAI should be approached as a tool to reimagine education from a foundational perspective, not simply to automate and optimize outdated or broken pedagogy.

In summary, our exploration into GAI's role in education paints a picture of immense potential juxtaposed with numerous challenges. Yet, history has shown that education, as a field, has always been marked by its adaptability, resilience, and commitment to nurturing learners. As we stand at this crossroads, with GAI poised to shape the future, the call is for judicious, informed, and visionary integration. As educators, policymakers, and stakeholders, our responsibility is to ensure that this integration prioritizes learners, fostering an environment where technology and humanity coexist in symbiotic harmony, propelling education into a promising and impactful future.

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