

Generative Artificial Intelligence in Children's Education: Educational, Cognitive, Mental Well-Being, Creativity and Digital Safety Outcomes

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Abstract - Generative Artificial Intelligence (GenAI), particularly large language models such as ChatGPT is increasingly influencing educational practices and children's learning experiences. This study examines the educational, cognitive, mental well-being, creativity and digital safety outcomes associated with the use of GenAI in children's education. Based on recent peer-reviewed research this study synthesizes existing evidence using a structured systematic literature review approach to ensure methodological transparency, consistency and systematic analysis. The reviewed literature indicates that GenAI can support personalized learning, improve learner engagement, enhance creativity and provide adaptive instructional feedback when integrated with appropriate pedagogical strategies. However, significant challenges remain, including misinformation, hallucinated responses, algorithmic bias, privacy concerns, academic integrity issues and the requirement for age-appropriate AI literacy. The findings highlight that teacher guidance, parental involvement, ethical governance and responsible implementation are essential for maximizing the educational benefits of GenAI while reducing potential risks. Although Generative Artificial Intelligence demonstrates considerable potential in supporting children's learning and development, empirical evidence regarding its long-term effects on cognitive development, mental well-being and digital safety remains limited. This study identifies current trends, research gaps and future directions for responsible integration of GenAI in K-12 education.

Keywords - *Generative Artificial Intelligence, ChatGPT, Children, K-12 Education, Educational Technology, Personalized Learning, Cognitive Development, Creativity, Mental Well-Being, Digital Safety, AI Literacy.*

I. INTRODUCTION

Generative Artificial Intelligence has emerged as one of the most influential technological developments in education, enabling systems to generate human-like text, images, code and other digital content using advanced machine learning models. Unlike conventional artificial intelligence systems that primarily classify, predict or recommend information, Generative Artificial Intelligence generates new content by learning complex patterns from large-scale datasets. The rapid adoption of large language models (LLMs), particularly ChatGPT has accelerated interest in integrating Generative Artificial Intelligence into educational environments because of their ability to provide personalized learning support, interactive tutoring, automated feedback and educational content generation [4].

Educational institutions are increasingly exploring Generative Artificial Intelligence to enhance teaching and learning across different educational levels. AI-powered educational tools can support adaptive learning and improve learner engagement when integrated with appropriate pedagogical practices [4]. They can also facilitate lesson planning and assist students in problem-solving and knowledge acquisition [6]. UNESCO further emphasizes that artificial intelligence should complement rather than replace human teaching and highlights the importance of responsible implementation, equity and ethical governance in educational systems [1].

Although research on artificial intelligence in education has expanded considerably, earlier studies primarily focused on higher education and intelligent tutoring systems [2]. The emergence of GenAI has shifted research attention toward conversational AI systems capable of generating context-aware educational content. Recent reviews report increasing interest in ChatGPT because of its potential to support personalized instruction and collaborative learning [3]. Other studies highlight its role in language development and creative educational activities [8]. Researchers further emphasize that successful implementation depends on effective instructional design, teacher guidance and learners' ability to critically evaluate AI-generated information [5].

The growing use of Generative Artificial Intelligence in children's education presents both opportunities and challenges. The reviewed literature indicates that Generative Artificial Intelligence can support personalized learning, inquiry-based learning and learner engagement [4]. It can also promote creativity and assist teachers in preparing instructional materials and formative assessments [5]. Research on K-12 education further highlights its potential to support language development and AI literacy among school students [7]. However, concerns remain regarding misinformation, hallucinated outputs, algorithmic bias, academic integrity and excessive dependence on AI-generated content [5]. UNESCO also identifies privacy, ethical governance and children's digital safety as important considerations for the responsible use of AI in education [1].

Despite the growing body of literature, evidence regarding the long-term effects of Generative Artificial Intelligence on children's educational outcomes, cognitive development, creativity, mental well-being and digital safety remains limited. Much of the existing research consists of systematic reviews and exploratory investigations [6]. Other publications are primarily conceptual discussions that identify opportunities,

challenges and future research directions [8]. Large-scale longitudinal investigations involving school-aged learners remain comparatively scarce [10]. Furthermore, these important dimensions are often examined independently, limiting a comprehensive understanding of the overall impact of Generative Artificial Intelligence in children's education.

Accordingly, this study examines existing peer-reviewed research addressing the educational, cognitive, mental well-being, creativity and digital safety outcomes associated with Generative Artificial Intelligence in children's education. The study adopts a structured systematic literature review approach to ensure methodological transparency, consistency and reproducibility. By synthesizing recent evidence, identifying emerging trends, highlighting research gaps and discussing implications for educational practice and policy, this study aims to provide a comprehensive understanding of the opportunities and challenges associated with responsible Generative Artificial Intelligence adoption in K–12 learning environments.

II. LITERATURE REVIEW

Research on Generative Artificial Intelligence in education has expanded rapidly following the emergence of advanced large language models such as ChatGPT. Recent studies have explored the educational applications of Generative Artificial Intelligence, its potential to support teaching and learning and the ethical and implementation challenges associated with its adoption across different educational settings. The existing literature highlights five major themes relevant to children's education: educational outcomes, cognitive development and creativity, mental well-being and learner engagement, digital safety and ethics and emerging research directions.

A. Educational Outcomes and Personalized Learning

One of the most frequently reported advantages of Generative Artificial Intelligence is its ability to support personalized learning. By generating context-aware explanations, answering learners' questions, providing adaptive feedback and assisting in the creation of learning materials, GenAI has the potential to promote flexible and learner-centered educational experiences [4].

Recent studies suggest that ChatGPT and related Generative Artificial Intelligence tools can improve learner engagement and encourage self-directed learning [6]. Other studies report that these tools assist teachers in preparing instructional resources and formative assessments [3]. Research focusing on K–12 education further highlights the potential of AI to facilitate individualized instruction while promoting AI literacy among school students [7]. In language education, conversational AI has been reported to provide immediate feedback and interactive learning opportunities that may enhance students' language skills [9].

Although these findings demonstrate promising educational applications, much of the current evidence is based on review studies, conceptual discussions and small-scale investigations. Therefore, additional empirical and longitudinal studies are required to determine the long-term educational effectiveness of GenAI in children's education.

B. Cognitive Development and Creativity

The literature suggests that Generative Artificial Intelligence can support higher-order learning by encouraging creativity, brainstorming, inquiry-based learning and problem-solving [4]. It also has the potential to support language development through interactive educational activities [8]. Interactive conversational AI systems enable learners to explore different perspectives, generate ideas and receive immediate explanations during learning activities.

Several studies also indicate that Generative Artificial Intelligence can support creative writing, programming practice, project-based learning and other activities requiring idea generation and personalized guidance [3]. These capabilities may encourage active participation and knowledge construction [6].

However, researchers caution that excessive reliance on AI-generated responses may reduce opportunities for independent reasoning and critical thinking if learners accept generated content without appropriate evaluation [5]. Consequently, Generative Artificial Intelligence should be integrated into pedagogical practices that encourage analytical thinking and responsible AI use.

C. Mental Well-Being and Learner Engagement

Learner engagement represents another important theme in the literature. Generative Artificial Intelligence systems can provide immediate academic assistance, personalized explanations and continuous learning support, which may improve learners' motivation and confidence [4]. Conversational AI may also reduce learning anxiety by allowing students to seek academic assistance in a supportive and non-judgmental environment [6].

Despite these potential benefits, evidence regarding the effects of Generative Artificial Intelligence on children's mental well-being remains limited. Existing studies identify possible concerns related to excessive screen time, reduced peer interaction and increased dependence on AI-assisted learning [5]. Consequently, current evidence is insufficient to establish the long-term psychological and social effects of Generative Artificial Intelligence on children, highlighting the need for further longitudinal research [8].

D. Digital Safety, Ethics and Responsible AI

Digital safety and ethical considerations are consistently identified as important aspects of Generative Artificial Intelligence adoption in education. UNESCO emphasizes that educational AI should be implemented using principles of transparency, fairness, accountability, privacy protection and human oversight [1]. Recent studies also discuss challenges associated with misinformation, hallucinated outputs, algorithmic bias, copyright, academic integrity and data privacy in educational applications of Generative Artificial Intelligence [5]. These challenges have also been highlighted in studies examining the educational implementation of ChatGPT [3].

Children may be particularly vulnerable to these challenges because they often possess limited AI literacy and digital literacy skills for evaluating AI-generated information. Accordingly, the literature recommends strengthening AI literacy education and implementing age-appropriate

safeguards [7]. It also recommends developing institutional policies to support the responsible use of Generative Artificial Intelligence in schools [10]. Although ethical AI governance is widely recognized as essential, empirical evidence evaluating the effectiveness of existing governance frameworks in protecting children's rights and digital safety remains limited.

E. Emerging Trends and Research Directions

Recent research demonstrates a growing shift from examining the technical capabilities of Generative Artificial Intelligence toward understanding its educational, ethical and societal implications. Current studies increasingly emphasize responsible AI adoption and AI literacy [6]. Other studies highlight the importance of teacher professional development, curriculum integration and evidence-informed educational policies [10]. Recent reviews also identify the need for continued evaluation of educational outcomes and responsible implementation strategies [8].

Despite this growing body of research, several knowledge gaps remain. Existing evidence is largely derived from review articles, conceptual analyses and exploratory investigations, while large-scale longitudinal studies involving school-aged learners remain comparatively limited. In addition, standardized frameworks for evaluating educational outcomes, creativity, cognitive development, mental well-being and digital literacy have not yet been widely established.

Overall, the existing literature indicates that Generative Artificial Intelligence has considerable potential to enhance children's education when implemented responsibly. At the same time, further empirical evidence is required to evaluate its long-term educational impact, address ethical and digital safety concerns and support the development of evidence-based policies for the effective integration of Generative Artificial Intelligence into K–12 education.

III. RESEARCH GAP

The rapid adoption of Generative Artificial Intelligence has led to a growing body of research examining its educational applications. Existing studies have primarily explored the pedagogical potential of ChatGPT and other large language models, emphasizing personalized learning and instructional support [4]. Other studies highlight learner engagement and responsible AI use in educational settings [6]. Recent reviews have also discussed broader educational applications and future research directions for Generative Artificial Intelligence [8]. Research has further focused on AI integration in K–12 education [7], UNESCO's policy recommendations for responsible AI adoption [1] and teacher preparedness for AI-supported learning environments [10]. While these studies provide valuable insights, several important research gaps remain.

First, much of the existing literature focuses on higher education or general educational settings, with comparatively limited attention given to school-aged children [2]. Although research on K–12 education is increasing [7], empirical evidence specifically examining children's educational, cognitive, mental well-being, creativity and digital safety outcomes remains limited [10].

Second, previous studies often investigate individual aspects of GenAI adoption, such as educational effectiveness [3], AI literacy and teacher perspectives [6] or ethical issues

[8]. Few studies examine educational outcomes, cognitive development, creativity, mental well-being and digital safety together, limiting a comprehensive understanding of GenAI's overall impact on children's education.

Third, much of the available evidence is derived from review articles [6], conceptual discussions [8], exploratory investigations and short-term classroom implementations. Large-scale longitudinal studies evaluating the long-term educational and developmental effects of Generative Artificial Intelligence on children remain relatively scarce [10].

Fourth, although concerns regarding misinformation, hallucinated outputs, algorithmic bias, privacy, academic integrity and responsible AI governance are widely discussed [5], UNESCO has emphasized the importance of ethical governance and child protection in AI-supported educational environments [1]. However, limited empirical evidence is available regarding the effectiveness of policies and safeguards designed to protect children.

Finally, considerable variation exists in research designs, educational contexts, participant populations and evaluation methods, making direct comparison across studies difficult [8]. The development of standardized evaluation frameworks would improve the consistency and comparability of future research.

In response to these gaps, this study synthesizes recent peer-reviewed evidence on the educational, cognitive, mental well-being, creativity and digital safety outcomes associated with Generative Artificial Intelligence in children's education.

IV. RESEARCH QUESTIONS

Based on the identified research gaps, this study addresses the following research questions:

RQ1: What educational outcomes have been reported regarding the use of Generative Artificial Intelligence in children's education?

RQ2: How does Generative Artificial Intelligence influence children's cognitive development, creativity, critical thinking and problem-solving?

RQ3: What evidence exists regarding the impact of Generative Artificial Intelligence on children's mental well-being, learner engagement and social interaction?

RQ4: What ethical, privacy, digital safety and algorithmic challenges are associated with the use of Generative Artificial Intelligence in children's education?

RQ5: What research gaps and future directions have been identified to support the responsible integration of Generative Artificial Intelligence in K–12 education?

V. RESEARCH OBJECTIVES

This study aims to examine recent peer-reviewed literature on the application of Generative Artificial Intelligence in children's education and to synthesize current evidence regarding its educational outcomes including personalized learning, learner engagement and instructional support. It further seeks to examine the reported effects of GenAI on children's cognitive development, creativity, critical thinking and problem-solving, as well as to analyze existing evidence

related to children's mental well-being, learner engagement, AI literacy and digital literacy in AI-supported learning environments. In addition, the study aims to identify ethical, privacy, algorithmic bias, misinformation, academic integrity and digital safety issues associated with the educational use of Generative Artificial Intelligence, while also identifying current research gaps and providing recommendations for future research, educational practice and responsible policy development to support the effective integration of Generative Artificial Intelligence in K–12 education.

VI. REVIEW METHODOLOGY

This study adopts a Qualitative systematic literature review approach to examine the educational, cognitive, mental well-being, creativity and digital safety outcomes associated with the use of Generative Artificial Intelligence in children's education. The review synthesizes findings from recent peer-reviewed journal articles and internationally recognized policy reports to identify current trends, opportunities, challenges and future research directions. A predefined search strategy, inclusion and exclusion criteria and thematic analysis were employed to enhance transparency, consistency and reproducibility throughout the review process.

A. Literature Search Strategy

Relevant peer-reviewed literature was identified through systematic searches using Google Scholar and the online journal platforms of SpringerLink, MDPI, SAGE Journals and Taylor & Francis Online. The search primarily covered publications published from 2021 to 2026, together with one foundational review published in 2019 to provide background on Artificial Intelligence in education [2]. Search terms included "Generative Artificial Intelligence" AND children, "Generative AI" AND education, "ChatGPT" AND K–12, "ChatGPT" AND children, "Large Language Models" AND education, "AI literacy" AND school education and "Generative AI" AND digital safety. Boolean operators (AND, OR) were used to combine these keywords and identify relevant peer-reviewed studies for qualitative synthesis.

B. Inclusion and Exclusion Criteria

Studies were included if they were published between 2021 and 2026, with one foundational review from 2019 included to provide background context on Artificial Intelligence in education. Eligible studies comprised peer-reviewed journal articles and internationally recognized policy reports focusing on Generative Artificial Intelligence, ChatGPT, or large language models in educational settings. The selected studies discussed children, K–12 education, or AI applications relevant to school education and examined educational, cognitive, creativity, mental well-being, AI literacy, ethical, or digital safety outcomes. Studies were excluded if they were editorials, news articles, book reviews, conference abstracts, or opinion papers, lacked sufficient methodological information, focused exclusively on higher education without relevance to children's education, or were unrelated to the educational applications of Generative Artificial Intelligence. The initial search yielded a larger number of publications.

After applying the eligibility criteria and removing duplicate and irrelevant publications, 11 studies were retained for qualitative thematic synthesis.

C. Data Extraction

Information was extracted from each selected publication, including the author(s), publication year, study objective, educational context, research methodology, key findings, reported limitations and implications for children's education. These data were systematically recorded to facilitate comparison across studies and support the qualitative thematic synthesis.

D. Data Synthesis

Owing to the heterogeneity of the selected studies in terms of research objectives, methodologies, participant characteristics and educational contexts, a qualitative thematic synthesis was conducted instead of a quantitative meta-analysis. Educational outcomes were synthesized using findings reported by Montenegro-Rueda et al. [3], Su and Yang [4] and Albadarin et al. [6]. Cognitive development and creativity were synthesized using evidence reported by Su and Yang [4] and Zhai [8]. Mental well-being and learner engagement were examined using findings reported by Tlili et al. [5] and Albadarin et al. [6]. Digital safety and ethical considerations were synthesized using UNESCO guidance [1], Tlili et al. [5] and Marzano [10]. This thematic organization enabled the identification of common findings, emerging trends and existing research gaps.

E. Reliability of the Review

To enhance the credibility and reliability of the review, priority was given to peer-reviewed journal publications [3], systematic literature reviews [6], review articles [8] and internationally recognized policy guidance [1]. Multiple scholarly databases and publisher platforms were searched to improve the comprehensiveness of the literature search. Although every effort was made to include relevant and up-to-date studies, the findings remain dependent on the available literature and the rapidly evolving nature of Generative Artificial Intelligence research. Therefore, future empirical investigations are needed to strengthen the evidence base for the educational use of GenAI among children [10].

VII. RESULTS AND SYNTHESIS

The selected literature indicates that Generative Artificial Intelligence is emerging as an important technology with the potential to influence children's education [4]. Analysis of the selected publications revealed five major themes: educational outcomes, cognitive development and creativity, learner engagement and mental well-being, digital safety and ethical considerations and future research directions. The reviewed studies consistently indicate that the educational value of Generative Artificial Intelligence depends on its responsible integration into teaching and learning through appropriate pedagogical practices [3]. UNESCO further emphasizes that effective implementation requires ethical governance, transparency and continuous human oversight [1].

A. Educational Outcomes

The selected publications suggest that Generative Artificial Intelligence can enhance personalized learning by providing adaptive explanations [4], immediate feedback [4], automated content generation [3] and interactive tutoring [6]. These capabilities may help students learn at their own pace while assisting teachers in preparing instructional resources [3] and

formative assessments [4]. Studies focusing on K–12 education also indicate that AI-supported learning can improve learner engagement [7] and facilitate individualized instruction when integrated into appropriate classroom practices [10].

However, the current evidence is derived mainly from review-based and exploratory research. Consequently, further empirical investigations involving school-aged learners are required to determine the long-term impact of Generative Artificial Intelligence on academic achievement and learning outcomes.

B. Cognitive Development and Creativity

The available literature suggests that Generative Artificial Intelligence has the potential to support creativity [4], brainstorming [8], inquiry-based learning [4], language development [8] and problem-solving through personalized learning assistance [3]. Conversational AI systems can encourage learners to explore multiple perspectives [4], generate ideas [8] and obtain timely explanations during learning activities [3].

At the same time, several publications highlight that excessive reliance on AI-generated responses may reduce opportunities for independent reasoning and critical thinking if learners accept generated content without appropriate evaluation [5], [8]. Therefore, Generative Artificial Intelligence should be used as a supportive learning resource that complements rather than replaces students' own cognitive efforts.

C. Mental Well-Being and Learner Engagement

The selected literature indicates that conversational AI can improve learner engagement [4], motivation [6] and confidence by providing immediate academic support [4] and personalized explanations [6]. Some studies also suggest that AI-assisted learning environments may reduce learning anxiety by allowing students to seek assistance in a supportive and non-judgmental manner [4].

Nevertheless, evidence concerning the long-term effects of GenAI on children's mental well-being remains limited. Existing publications identify potential concerns related to increased screen time [5], reduced peer interaction [8] and growing dependence on AI-assisted learning [5]. Additional longitudinal research is therefore required to better understand the psychological and social implications of GenAI use among children.

D. Digital Safety and Ethical Considerations

Digital safety and ethical issues are consistently highlighted throughout the selected literature. Frequently reported concerns include misinformation [3], hallucinated AI outputs [5], algorithmic bias [5], data privacy [1], academic integrity [3], copyright [5] and responsible AI governance [1]. These issues are particularly significant for children, who may have limited AI literacy and digital literacy skills for evaluating AI-generated information.

The literature recommends strengthening AI literacy education [7], providing teacher professional development [10], establishing institutional policies [1] and ensuring continuous human supervision when Generative Artificial Intelligence is used in educational settings [5]. These measures

can help promote the safe and responsible use of AI technologies in children's education.

E. Overall Synthesis

Overall, the selected literature suggests that Generative Artificial Intelligence has considerable potential to enhance personalized learning [4], creativity [8], instructional support [3] and learner engagement [6] in children's education. However, these opportunities are accompanied by important ethical [1], cognitive [5] and digital safety challenges [10] that require careful management. The current evidence base is still developing, with relatively limited long-term empirical research involving school-aged learners. Consequently, future investigations should focus on evaluating the sustained educational, cognitive and social effects of Generative Artificial Intelligence while supporting responsible implementation through collaboration among educators, parents, policymakers, researchers and technology developers.

VIII. DISCUSSION

The findings of the present review suggest that Generative Artificial Intelligence has considerable potential to support children's education by enhancing personalized learning, promoting creativity and improving learner engagement. The selected literature indicates that conversational AI systems can provide adaptive explanations [4], immediate feedback [4] and individualized learning support [6], enabling learners to progress according to their educational needs. These findings are consistent with UNESCO's recommendation that artificial intelligence should complement human teaching while promoting equitable, inclusive and learner-centered education [1].

The available literature further indicates that Generative Artificial Intelligence may contribute to the development of higher-order learning skills, including creativity [4], inquiry-based learning [4], language development [8] and problem-solving [8]. Unlike conventional educational technologies, conversational AI enables interactive dialogue that can encourage learners to explore ideas [4], refine their understanding [8] and engage in self-directed learning [4]. However, these potential benefits depend on effective instructional design, appropriate teacher guidance and meaningful classroom integration. Without adequate pedagogical support, learners may become overly dependent on AI-generated content rather than actively constructing knowledge.

Another important observation emerging from the selected literature is the need to critically evaluate AI-generated information. Several publications identify challenges associated with hallucinated outputs [5], misinformation [3], algorithmic bias [5] and factual inaccuracies [8], which may influence learning outcomes if AI-generated responses are accepted without verification. Consequently, AI literacy and critical thinking should be considered essential competencies for both students and educators. Generative Artificial Intelligence should therefore be viewed as a supplementary educational resource that supports, rather than replaces, independent learning and critical evaluation.

The review also highlights ethical and digital safety considerations as important factors influencing the responsible adoption of Generative Artificial Intelligence in educational

settings. Issues related to data privacy [1], academic integrity [5], copyright [5], transparency [1] and responsible AI governance [7] are consistently emphasized across the selected literature. Since children may have limited experience in evaluating AI-generated information, schools should establish appropriate institutional guidelines, strengthen teacher and parent involvement and promote responsible AI practices within educational environments.

Although the available literature demonstrates promising educational applications of Generative Artificial Intelligence, the overall evidence base remains limited. Much of the existing research comprises review papers [6], conceptual discussions [8] and exploratory investigations [10], while large-scale longitudinal studies involving school-aged children remain comparatively scarce. Furthermore, variations in research design, educational context and evaluation methods make direct comparison across studies challenging. Future research should therefore focus on longitudinal empirical investigations that examine the long-term educational, cognitive, psychological and social effects of Generative Artificial Intelligence among children.

Overall, the findings indicate that the educational value of Generative Artificial Intelligence depends not only on technological capability but also on responsible implementation, effective pedagogical practices, ethical governance and continuous human oversight. When integrated appropriately into child-centered learning environments, GenAI has the potential to enhance learning experiences while supporting children's academic development, well-being, creativity and digital safety.

IX. PRACTICAL IMPLICATIONS

The findings of the reviewed literature have important implications for educators, school administrators, policymakers, parents and educational technology developers. As Generative Artificial Intelligence becomes increasingly integrated into educational settings, its effective adoption requires responsible implementation and appropriate human oversight [1]. The reviewed studies indicate that successful integration of GenAI depends on the adoption of effective pedagogical practices [3], the use of personalized learning strategies [4], responsible and ethical AI use [5], the promotion of AI literacy in K–12 education [7], teacher preparedness and effective classroom implementation [10] and the continuous evaluation of educational practices and learner outcomes as GenAI technologies evolve [8].

For educators, the reviewed studies suggest that GenAI can serve as a valuable instructional support tool by assisting with lesson planning [3], generating learning resources [4], preparing formative assessments [4] and providing personalized feedback to learners [3]. However, the literature emphasizes that AI should be integrated within learner-centered pedagogical approaches that promote critical thinking, creativity and independent problem-solving rather than encouraging excessive reliance on AI-generated responses [5]. Teacher supervision remains essential to evaluate the accuracy of AI-generated content [1] and ensure its educational suitability for classroom use [3].

The reviewed literature also highlights the importance of strengthening AI literacy within K–12 education [7]. UNESCO recognizes digital literacy and responsible engagement with

artificial intelligence as fundamental competencies that should be cultivated among learners in modern education [1]. Students should be equipped with the skills needed to critically evaluate AI-generated information, recognize misinformation and hallucinated outputs [5], understand the potential effects of algorithmic bias [5] and use AI technologies responsibly [1]. Incorporating these competencies into existing digital education initiatives may better prepare learners for the increasing use of AI technologies in society.

For policymakers and educational authorities, the literature suggests the need for institutional guidelines that support the ethical use of Generative Artificial Intelligence in schools. Such guidelines should address data privacy and transparency [1], promote academic integrity and copyright protection [5], ensure age-appropriate access to AI technologies [1] and establish responsible data governance practices that are consistent with existing child protection principles [1].

The reviewed studies also indicate that parents can contribute to the responsible use of Generative Artificial Intelligence by encouraging appropriate digital habits, discussing online safety and information verification [1] and supporting children's responsible engagement with AI technologies [7]. Collaboration between schools and families may further promote safe, ethical and effective AI use among children [10].

Finally, the literature recommends that developers of educational AI systems adopt child-centered design principles by improving transparency, explainability and fairness [1] while enhancing the reliability of AI-generated content [5]. The inclusion of age-appropriate safety measures, privacy safeguards and mechanisms for human oversight can further support the responsible use of Generative Artificial Intelligence in children's education [1].

Overall, the reviewed literature suggests that the potential educational benefits of Generative Artificial Intelligence can be enhanced through collaborative efforts involving educators, parents, policymakers, researchers and technology developers. Responsible implementation, supported by sound pedagogical practices and appropriate governance frameworks [1], is likely to contribute to safe, equitable and effective AI-supported learning environments for children.

X. LIMITATIONS

This study has several limitations that should be considered when interpreting its findings. First, the review is based on the selected literature included in this study, comprising peer-reviewed journal publications and an internationally recognized policy report available at the time of the review. Given the rapid evolution of Generative Artificial Intelligence, newly published studies may provide additional evidence that was not available during the review process.

Second, the review primarily synthesizes evidence from systematic reviews, review articles, conceptual studies and exploratory research. Comparatively few large-scale empirical investigations have examined the long-term effects of Generative Artificial Intelligence on children's educational achievement, cognitive development, creativity, mental well-being and digital safety. Therefore, the findings should be

interpreted as reflecting the current state of knowledge rather than providing definitive conclusions.

Third, the selected studies vary considerably in research design, educational context, participant characteristics, outcome measures and evaluation methodologies. This methodological diversity limits direct comparison across studies and precludes quantitative synthesis through meta-analysis.

Fourth, although this review focuses on children's education, some selected publications discuss broader educational applications of Generative Artificial Intelligence or include findings from educational settings beyond K–12. Consequently, some observations have been interpreted within the context of children's education based on their relevance to the objectives of this review.

Finally, this review considered only English-language publications included in the selected literature. Consequently, relevant studies published in other languages may not have been represented, introducing the possibility of language bias. Despite these limitations, the review provides a comprehensive synthesis of the current literature and identifies important directions for future research on the responsible use of Generative Artificial Intelligence in children's education.

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