

Building Children's Digital Resilience in the Age of Artificial Intelligence: A Critical Review of Critical Thinking, Online Safety, and Responsible Digital Decision-Making

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Abstract: Artificial Intelligence (AI), particularly Generative Artificial Intelligence (GenAI), is rapidly transforming children's digital experiences by influencing learning processes, information access, creativity, communication, and decision-making practices. AI-enabled systems provide significant opportunities through personalized learning support, adaptive feedback, interactive knowledge exploration, and improved accessibility. However, the increasing integration of AI into children's digital environments also introduces challenges related to misinformation, privacy risks, algorithmic influence, biased outputs, dependency on automated systems, and ethical concerns. These challenges highlight the importance of developing children's digital resilience to ensure safe, responsible, and meaningful participation in AI-mediated digital societies.

This study presents a critical literature review examining how artificial intelligence influences children's digital resilience with specific focus on critical thinking, online safety, AI literacy, and responsible digital decision-making. The study synthesizes recent research on generative AI in education, children's interaction with intelligent systems, digital resilience development, AI literacy frameworks, parental mediation, and school-based digital resilience interventions. The review identifies that effective engagement with AI requires more than technical knowledge; children need cognitive abilities to evaluate AI-generated information, recognize limitations of intelligent systems, understand ethical implications, and make informed digital choices.

The findings indicate that AI literacy, critical thinking, and digital resilience are interconnected competencies that enable children to navigate AI-driven environments effectively. While AI technologies can enhance learning and creativity, their benefits depend on appropriate guidance from educators, parents, policymakers, and technology developers. The study emphasizes the need for a human-centered approach where artificial intelligence supports children's learning and development without reducing independent reasoning, creativity, and ethical judgment. The paper proposes an integrated perspective combining AI literacy, critical evaluation skills, online safety awareness, and responsible digital behavior as essential foundations for preparing digitally resilient children in the age of artificial intelligence.

Key Words: Artificial Intelligence, Generative AI, Children's Digital Resilience, AI Literacy, Critical Thinking, Online Safety, Digital Citizenship, Responsible Digital Decision-Making.

1. INTRODUCTION:

Artificial Intelligence (AI) has rapidly transformed digital environments, influencing how children learn, communicate, create, and access information. Unlike earlier digital technologies that primarily delivered static content, modern AI systems can generate text, images, explanations, recommendations, and personalized learning experiences. The emergence of Generative Artificial Intelligence (GenAI), particularly large language models such as ChatGPT, has further expanded educational opportunities by providing interactive learning support, immediate feedback, and enhanced access to knowledge. Despite these advantages, the increasing use of AI also presents significant challenges, including misinformation, privacy concerns, algorithmic bias, automated influence, and ethical issues that require careful attention in children's digital experiences [1].

Recent studies highlight both the educational potential and the limitations of AI. Kasneci et al. reported that large language models can improve learning through personalized guidance and adaptive feedback, but emphasized that AI-generated content may contain inaccuracies or biases, making critical evaluation essential [1]. Similarly, Lo identified improved accessibility, engagement, and learning support as key benefits of ChatGPT while raising concerns about

academic integrity, reliability of AI-generated information, and excessive dependence on intelligent systems [2]. These findings suggest that effective use of AI depends not only on technological access but also on children's ability to critically interpret and responsibly use AI-generated information.

As AI becomes integrated into children's everyday digital experiences, **digital resilience** has emerged as a key competency. Digital resilience extends beyond traditional online safety by enabling children to recognize digital risks, respond appropriately to challenges, recover from negative online experiences, and make informed decisions in technology-rich environments. Hammond et al. described digital resilience as a socio-ecological process shaped by children's individual abilities together with support from families, schools, and society [6]. In AI-enabled environments, this concept must also include the ability to understand AI systems, evaluate AI-generated content, recognize technological limitations, and make ethical digital decisions.

AI literacy plays a central role in developing these competencies. Ng et al. defined AI literacy as a combination of knowledge, practical skills, and ethical understanding required for meaningful interaction with AI technologies [14]. Alongside AI literacy, **critical thinking** is essential because AI-generated outputs, although often persuasive, are not always accurate, complete, or unbiased. Jeon and Lee emphasized that AI should complement rather than replace human reasoning, while Zhai argued that AI-supported learning should promote inquiry, reasoning, and conceptual understanding instead of passive acceptance of machine-generated responses [5], [16].

The integration of AI has also broadened the scope of online safety. In addition to established concerns such as cyberbullying, harmful content, and privacy violations, children now encounter AI-generated misinformation, synthetic media, algorithmic influence, and personalized persuasion. Livingstone and Third argued that children's digital participation should balance protection with empowerment, ensuring that young users can engage confidently and responsibly with emerging technologies [8]. These evolving challenges require educational approaches that emphasize responsible digital participation rather than simply restricting technology use.

Research further indicates that digital resilience can be strengthened through purposeful educational interventions. School-based programs improve children's awareness, coping strategies, and responsible online behavior, while supportive parental mediation and educator guidance contribute significantly to children's digital literacy and ethical technology use [10], [11], [13]. These findings demonstrate that preparing children for AI-driven environments requires collaboration among schools, families, and policymakers.

Although previous studies have investigated AI in education, AI literacy, online safety, and digital resilience individually, limited research has examined how these concepts collectively support children's development in AI-mediated environments. Addressing this gap, the present study critically reviews recent literature to examine the relationships among AI literacy, critical thinking, online safety, responsible digital decision-making, and digital resilience. By integrating technological, cognitive, ethical, and social perspectives, this review provides a comprehensive understanding of how children can be prepared to engage safely, responsibly, and effectively in an AI-powered digital world. It also offers practical insights for educators, researchers, policymakers, and technology developers seeking to promote children's well-being and responsible AI use.

This review differs from previous studies by integrating AI literacy, critical thinking, online safety, and responsible digital decision-making into a unified perspective on children's digital resilience. It identifies conceptual relationships, research gaps, and future directions that can support educational practice, policy development, and responsible AI adoption.

2. LITERATURE REVIEW:

Artificial intelligence (AI) has fundamentally changed children's digital experiences by influencing how they learn, communicate, and access information. While AI offers opportunities for personalized learning and improved educational support, it also introduces challenges related to misinformation, algorithmic bias, privacy, and ethical decision-making. Current research suggests that the benefits of AI depend not only on technological access but also on children's ability to critically evaluate AI-generated information and use intelligent technologies responsibly [1].

Generative AI has attracted considerable attention in education because of its ability to provide adaptive explanations, immediate feedback, and personalized learning experiences. However, AI-generated outputs may contain inaccuracies, fabricated information, or embedded biases, highlighting the importance of critical thinking and human judgment during AI-supported learning [2]. Research also indicates that AI should be viewed as a learning support tool rather than a replacement for independent reasoning or teacher guidance [3].

Successful integration of AI into education depends largely on educators' preparedness. Teachers require sufficient AI knowledge and pedagogical competence to help students interpret AI-generated information, recognize its limitations, and apply ethical judgment when using intelligent technologies [4]. Similarly, AI-supported learning is most effective when it encourages inquiry, reasoning, and problem-solving instead of passive acceptance of automated responses [5].

The concept of **digital resilience** has expanded in response to AI-driven digital environments. Unlike traditional online safety, which mainly focuses on protecting children from cyberbullying and harmful content, digital resilience emphasizes children's capacity to recognize digital risks, adapt to changing situations, recover from negative experiences, and make responsible decisions online [6]. It is increasingly recognized as a competency that develops through interactions among children, families, schools, and communities rather than through individual skills alone [7]. A rights-based perspective further argues that children should be empowered to participate safely and meaningfully in digital environments instead of simply being protected from technology-related risks [8]. Consequently, AI-enabled systems should support children's developmental needs, creativity, and well-being while minimizing algorithmic influence and other emerging digital risks [9].

Evidence suggests that digital resilience can be strengthened through structured educational interventions. School-based programs improve children's awareness of online risks, coping strategies, and responsible digital behavior [10]. Likewise, comprehensive digital resilience initiatives support not only technical knowledge but also emotional regulation, decision-making, and ethical awareness [11]. Early AI literacy education further helps children understand intelligent technologies before they become routine users of AI systems [12].

Parents and teachers remain essential in supporting children's digital development. Supportive parental mediation promotes safer and more responsible technology use through communication and shared learning experiences rather than restrictive supervision alone [13]. AI literacy therefore extends beyond technical knowledge to include critical evaluation skills and ethical understanding that enable responsible interaction with intelligent systems [14].

Recent reviews consistently emphasize that AI implementation in education should adopt learner-centered, pedagogically informed, and ethically responsible approaches [15]. Human judgment and teacher involvement remain indispensable because AI cannot replace social interaction, contextual understanding, or ethical reasoning [16]. Furthermore, responsible governance and educational policies are necessary to maximize AI's benefits while minimizing unintended consequences [17]. Advances in intelligent tutoring systems, adaptive learning, and educational analytics demonstrate AI's growing educational potential, but these innovations must be accompanied by appropriate safeguards and human oversight [18]. Learner-centered AI research should therefore integrate technological effectiveness with cognitive, social, and ethical considerations [19].

Although AI in education, AI literacy, online safety, and digital resilience have been widely investigated, these topics have largely evolved as separate research streams. An integrated understanding of how AI literacy, critical thinking, online safety, and responsible digital decision-making collectively strengthen children's digital resilience remains limited. This review addresses that gap by synthesizing these interconnected dimensions to provide a comprehensive perspective on preparing children for safe, ethical, and meaningful participation in AI-driven digital environments.

3. OBJECTIVES OF THE STUDY:

The primary objective of this study is to critically examine how artificial intelligence influences children's digital resilience and to understand the competencies required for safe, responsible, and meaningful participation in AI-mediated digital environments. The study focuses on the relationship between artificial intelligence, critical thinking, AI literacy, online safety, and responsible digital decision-making among children.

The specific objectives of the study are:

- To examine the influence of Artificial Intelligence and Generative Artificial Intelligence technologies on children's learning experiences, digital interactions, and information access patterns.
- To analyze the importance of critical thinking skills in helping children evaluate AI-generated information, identify inaccuracies, and make independent digital decisions.
- To explore the role of AI literacy in developing children's understanding of artificial intelligence capabilities, limitations, ethical implications, and responsible usage practices.
- To investigate emerging online safety challenges associated with AI-driven digital environments, including misinformation, privacy concerns, algorithmic influence, synthetic content, and digital manipulation.
- To examine the contribution of parents, educators, and educational institutions in developing children's digital resilience and supporting responsible engagement with AI technologies.
- To review existing educational interventions and digital resilience frameworks that aim to strengthen children's cognitive, ethical, and behavioral capabilities in digital environments.
- To identify existing research gaps and propose future directions for developing an integrated framework that combines AI literacy, critical thinking, online safety awareness, and responsible digital decision-making for children in the age of artificial intelligence.

4. RESEARCH METHODOLOGY:

This study employs a **Critical Literature Review (CLR)** approach to examine the relationship between artificial intelligence (AI), AI literacy, digital resilience, critical thinking, online safety, and responsible digital decision-making among children. Unlike systematic reviews that primarily emphasize evidence aggregation, a critical literature review focuses on interpreting, evaluating, and synthesizing existing knowledge to identify conceptual relationships, research gaps, and future directions.

Relevant peer-reviewed journal articles, review papers, and empirical studies published in recent years were examined. The literature was selected based on its relevance to AI in education, generative AI, AI literacy, digital resilience, online safety, digital citizenship, and the role of parents and educators in supporting children's digital development. Priority was given to high-quality publications from recognized academic databases and reputable journals. The literature was primarily identified from Scopus, Web of Science, IEEE Xplore, SpringerLink, ScienceDirect, and ERIC using combinations of keywords including "Artificial Intelligence," "Generative AI," "AI Literacy," "Digital Resilience," "Critical Thinking," "Online Safety," and "Children." Studies were selected based on their relevance to children's education, AI applications, digital resilience, and online safety. Peer-reviewed English-language publications with clear methodological quality and theoretical relevance were prioritized, while editorials, opinion articles, duplicate records, and non-peer-reviewed sources were excluded.

The selected literature was critically examined using thematic analysis to identify recurring concepts, emerging themes, and research gaps. Each publication was examined for the objectives and focus of research, major findings, theoretical contributions and limitations. The analysis emphasized similarities, contrasting viewpoints, and emerging issues rather than providing descriptive summaries of individual studies.

Based on the synthesis, six major themes were identified: (i) AI-enabled learning opportunities, (ii) critical thinking for evaluating AI-generated information, (iii) AI literacy as an essential digital competency, (iv) online safety in AI-driven environments, (v) digital resilience, and (vi) the contribution of parents, educators, and institutions to responsible technology use. These themes were integrated to develop a comprehensive understanding of children's preparedness for AI-mediated digital environments.

A critical interpretive perspective was adopted throughout the review to evaluate the strengths and limitations of existing research and to identify areas requiring further investigation. By integrating technological, educational, cognitive, ethical, and social perspectives, this study proposes a holistic framework for understanding children's digital resilience in the age of artificial intelligence and provides recommendations for future research and educational practice.

5. CONCEPTUAL FRAMEWORK: BUILDING CHILDREN'S DIGITAL RESILIENCE IN THE AGE OF ARTIFICIAL INTELLIGENCE

The growing use of artificial intelligence (AI) in children's digital environments requires a broader understanding of digital resilience than that offered by conventional digital literacy and online safety. Based on the critical review of existing research, this study proposes an integrated conceptual framework in which AI literacy, critical thinking, online safety awareness, and responsible digital decision-making collectively strengthen children's digital resilience. The proposed framework is presented in Fig. 1.

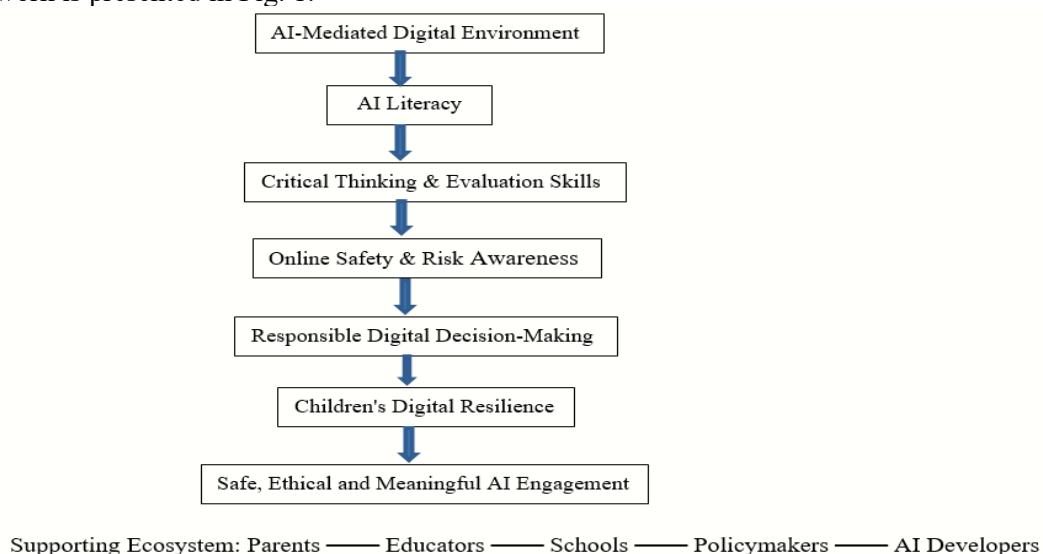


Figure 1. Proposed Conceptual Framework for Children's Digital Resilience in AI-Mediated Environment

Within this framework, digital resilience refers to children's ability to understand AI technologies, critically evaluate AI-generated information, recognize digital risks, adapt to emerging challenges, and make informed decisions while interacting with intelligent systems. This perspective extends traditional online safety by emphasizing informed and responsible engagement with AI rather than protection alone.

AI literacy provides the knowledge required to understand AI capabilities, limitations, and ethical implications, enabling children to interact with intelligent systems in an informed manner [14]. Critical thinking complements this competency by helping children question AI-generated information, identify inaccuracies or bias, and apply independent judgment before accepting automated responses [1]. Human reasoning therefore remains essential when AI is used for learning and decision-making [16].

The framework also recognizes online safety awareness as an essential competency for addressing AI-related challenges, including misinformation, synthetic media, algorithmic influence, and privacy risks. Developing awareness of these issues enables children to participate more safely and responsibly in AI-enabled digital environments while supporting their rights and well-being [8]. Child-centred digital environments should also reflect children's developmental needs and rights [9].

Finally, responsible digital decision-making transforms knowledge into ethical practice by encouraging appropriate AI use, protection of personal information, and accountability for digital actions. Parents, teachers, schools, policymakers, and technology developers all help children develop digital resilience through guidance and support [6]. Supportive educational and social environments further encourage adaptive and responsible digital behaviour [7].

Overall, the framework presented in Fig. 1 demonstrates that children's digital resilience emerges from the interaction of technological knowledge, critical evaluation, ethical decision-making, online safety awareness, and continuous social support. This integrated perspective provides a practical foundation for designing educational strategies and policies that prepare children for responsible participation in AI-driven digital environments.

The proposed framework is intended as a conceptual guide for future empirical validation rather than a predictive model. Its components provide a foundation for designing educational interventions that strengthen children's digital resilience in AI-enabled environments.

6. THEMATIC FINDINGS AND DISCUSSION:

The critical review identified six interconnected themes that contribute to children's digital resilience in AI-enabled environments. AI enhances learning through personalized instruction, adaptive feedback, and improved access to information; however, its educational benefits depend on informed and responsible use rather than unquestioning acceptance of AI-generated content [1]. Developing critical thinking enables children to evaluate AI-generated information, recognize inaccuracies and bias, and make informed digital decisions [16]. AI literacy further strengthens responsible technology use by helping children understand AI capabilities, limitations, and ethical implications [14]. The review also highlights that AI has introduced emerging online safety challenges, including misinformation, synthetic media, algorithmic influence, and privacy concerns, requiring greater awareness and responsible digital behaviour [8]. In addition, parents, educators, schools, and policymakers play a vital role in supporting children's digital resilience through guidance and educational support [6]. Overall, the findings indicate that integrating AI literacy, critical thinking, online safety awareness, and responsible digital decision-making provides a comprehensive foundation for preparing children to participate safely and ethically in AI-driven digital environments.

7. CONCLUSION:

Artificial intelligence is rapidly reshaping children's digital experiences by creating new opportunities for learning, creativity, and collaboration while simultaneously introducing challenges related to misinformation, privacy, algorithmic influence, and ethical use. These developments require a broader understanding of digital resilience, extending beyond conventional digital literacy and online safety to include competencies that enable children to engage critically and responsibly with AI-enabled technologies.

The review demonstrates that responsible AI use depends on developing children's ability to evaluate information critically rather than relying on AI-generated responses without reflection.

This critical literature review identifies AI literacy, critical thinking, online safety awareness, and responsible digital decision-making as the core dimensions of children's digital resilience. When developed together, these abilities enable children to engage with AI more thoughtfully, question machine-generated information, identify potential risks, and act responsibly in digital environments. Preparing children for AI-enabled societies therefore requires strengthening their reasoning, ethical awareness, and independent judgment rather than simply increasing access to AI technologies. The review also demonstrates that responsible AI use is a shared responsibility. Parents, educators, schools, policymakers,

and technology developers each contribute to creating environments that support safe, ethical, and meaningful engagement with AI. Educational institutions should integrate AI literacy and critical thinking into existing digital education, while technology developers should prioritize transparency, fairness, privacy protection, and child-centered design.

A key contribution of this study is the integration of AI literacy, digital resilience, online safety, and critical thinking into a unified conceptual perspective. Although these topics have received considerable attention individually, their combined role in preparing children for AI-mediated environments has received comparatively limited scholarly attention. This integrated framework provides a foundation for future educational strategies, policy development, and research on children's interaction with intelligent technologies.

Preparing children for an AI-enabled future requires a shift from technology restriction to responsible empowerment. As AI becomes part of everyday life, education should enable children to approach intelligent technologies with curiosity, careful judgment, and ethical responsibility rather than avoiding their use.

The proposed conceptual framework may assist curriculum designers, educators, and policymakers in integrating AI literacy with digital resilience education.

Future research should prioritize empirical evaluation of AI literacy programs and digital resilience interventions involving children, educators, and parents across diverse educational settings and cultural contexts. Such evidence will support the development of effective educational practices and policies that encourage responsible AI adoption while safeguarding children's well-being.

Ultimately, children's digital resilience will depend on balancing technological competence with human values. By combining AI literacy, critical thinking, ethical awareness, and collaborative support from families, educators, policymakers, and technology developers, AI can become a powerful tool for promoting children's learning, creativity, and responsible participation in an increasingly AI-driven digital society.

8. LIMITATIONS:

This study has several limitations. First, as a Critical Literature Review (CLR), it is based solely on published research and does not include primary data from children, parents, educators, or other stakeholders. Consequently, the findings represent a synthesis of existing knowledge rather than direct empirical evidence.

Second, the rapid advancement of artificial intelligence presents a challenge because emerging AI technologies, applications, and associated risks continue to evolve. Therefore, the findings reflect the current state of research and may require revision as AI develops further.

Third, the reviewed studies originate from diverse educational, cultural, and technological contexts. Variations in educational practices, digital access, and AI adoption may influence children's experiences, limiting the universal applicability of the findings.

Finally, existing research often examines AI literacy, digital resilience, online safety, and critical thinking as separate topics. This review integrates these domains conceptually but does not provide empirical validation of the proposed framework. Future studies should use empirical and longitudinal approaches to evaluate children's digital resilience across diverse educational and cultural settings.

In addition, no quantitative synthesis or meta-analysis was performed because the reviewed studies differed considerably in their research designs, participant groups, and outcome measures.

9. FUTURE RESEARCH DIRECTIONS:

Future research should extend the present conceptual review through empirical investigations that examine how AI literacy, critical thinking, online safety awareness, and responsible digital decision-making influence children's digital resilience. Future studies should also validate the proposed conceptual framework through longitudinal and cross-cultural empirical investigations. Longitudinal investigations are needed to understand the long-term effects of AI on children's learning, cognitive development, ethical reasoning, and digital behavior.

Further studies should evaluate the effectiveness of AI literacy programs, school-based digital resilience initiatives, and teacher training across different educational and cultural contexts. Further research should develop standardized instruments for measuring children's AI literacy and digital resilience across different age groups. Research is also needed to design and assess child-centered AI systems that prioritize transparency, privacy, fairness, and age-appropriate interaction. Finally, interdisciplinary collaboration among computer science, education, psychology, and public policy will be essential for developing evidence-based strategies that support children's safe, ethical, and responsible engagement with artificial intelligence.

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