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Generative artificial intelligence and preschool education activities: ethical, pedagogical, and applied approaches

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Highlights:

- Generative AI enables preschool teachers to create personalized, age-appropriate, and engaging learning materials.
- Teachers must guide and ethically evaluate AI-generated content to ensure developmental appropriateness.
- AI literacy empowers early childhood educators to assess, adapt, and integrate digital tools critically.
- In-service training should develop teachers' technical, pedagogical, and ethical competencies in AI integration.
- Balanced use of AI with play-based learning supports holistic development in early childhood classrooms.

Abstract

This study aims to examine ethical, pedagogical, and applied approaches to the use of generative artificial intelligence (GAI) technologies in preschool education within a theoretical framework. GAI offers significant advantages for teachers, including creative content production, effective time management, and individualized learning opportunities. In particular, tools such as ChatGPT, DALL·E, and Suno AI can be used to quickly and effectively develop story, song, poster, animation, and game-based activities for preschool children. However, the integration of these technologies into the classroom environment requires teachers to possess multidimensional competencies such as ethical sensitivity, pedagogical intuition, digital literacy, and content control. A literature review reveals that teachers exhibit both promising and cautious attitudes toward AI. Issues such as data privacy, algorithmic bias, cultural appropriateness, and digital inequality are at the center of teachers' ethical concerns. Furthermore, considering the developmental characteristics of preschool children, it is emphasized that AI-based content should be designed in a game-based, interactive, and age-appropriate manner. In this context, the study offers a guiding framework for teachers and policymakers, identifying the key principles that should be considered when integrating AI technologies into early childhood education.

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1. Introduction

The integration of digital technologies into education has taken on a new dimension in recent years with the development of generative artificial intelligence (GAI) tools. Advances in areas such as natural language processing, visual production, and speech synthesis have the potential to transform various processes, from planning to presenting educational materials. This study is designed as a theoretical review and discussion paper, synthesizing current research findings and offering a conceptual framework alongside practical recommendations for early childhood education.

Generative artificial intelligence presents new opportunities for teachers in education, offering the ability to generate original content based on user input. However, it also entails ethical and pedagogical responsibilities. At the preschool level, learning experiences must be structured in a way that is appropriate for children's cognitive, linguistic, social-emotional, and motor development. In this context, teachers must create creative, engaging, and developmentally appropriate content in their activity planning. Generative artificial intelligence technologies can support teachers in this process; for example, by producing short stories, song lyrics, visuals, and presentation content for children. However, these opportunities should be evaluated based on important criteria such as pedagogical appropriateness, content reliability, and age appropriateness.

Research indicates that teachers are interested in generative artificial intelligence tools, but they require support in terms of proficiency, ethical concerns, and content control (Su, Ng, & Chu, 2023; Yang, 2022). Especially in early childhood education, it is considered critical that AI-developed content be compatible with child development and used under teacher guidance in order for technology to contribute to a healthy learning environment. Although interest in GAI tools is growing among educators, the literature reveals several critical gaps. First, there is a scarcity of research specifically addressing the integration of GAI into early childhood education, despite its increasing use in other education levels. Existing studies often focus on general educational contexts without fully considering the developmental needs of preschool-aged children. Second, most available resources emphasize the potential benefits of AI, while offering limited discussion on the risks of misuse, such as the generation of inappropriate content, increased screen time, or cultural bias, which could negatively affect children's learning and well-being. Third, the concept of AI literacy, while increasingly recognized as a necessary teacher competency, has not been thoroughly explored in relation to early childhood educators. Addressing these gaps is crucial for establishing a responsible and developmentally appropriate framework for the use of AI in preschool settings. Given this background, the aim of this article is to theoretically discuss the integration of generative AI tools into early childhood education activities within the framework of ethical principles, pedagogical competencies, and application examples. In this context, the evaluation will assess how and to what extent teachers can utilize these tools, the ethical issues they may encounter, and the pedagogical opportunities that arise.

In the following sections, the paper first explores the definitions of artificial intelligence and generative artificial intelligence, emphasizing their applications in education and their relevance to early childhood contexts. It then examines preschool teachers' perspectives, competencies, and readiness for integrating AI into their practice. Next, examples of AI-based educational applications designed for early childhood are presented, followed by a discussion of the associated ethical concerns and educational responsibilities. Finally, the paper concludes with key implications for policy, practice, and future research directions.

Artificial Intelligence and Generative Artificial Intelligence in Education

Artificial intelligence (AI) is defined as an interdisciplinary field of science concerned with the design of systems that mimic and perform the cognitive functions of human intelligence. This field, which was first established by Alan Turing in the 1950s with the question "Can machines think?", has expanded into a wide range of applications over time through algorithms that perform mental processes such as learning, reasoning, natural language processing, and problem solving (Turing, 2009). Today, artificial intelligence is having a transformative impact in many sectors, including education, health, media, finance, and art.

In education, AI plays a range of roles, from creating personalized learning paths to monitoring student performance and delivering adaptive feedback. Especially after the transition to distance education following the COVID-19 pandemic, the integration of AI into education has accelerated, and the educational potential of technology has become more visible (Çam et al., 2021). Among the opportunities offered by AI in educational processes, personalized learning experiences, automated assessment systems, creating individual learning profiles, developing feedback mechanisms, and adaptive learning systems are

at the forefront (Bulathwela et al., 2024; Kış, 2019). VanLehn (2011) highlights that AI can function as a tutor, mentor, or decision-making assistant to teachers, in some cases approaching the effectiveness of human instruction. However, Roll and Wylie (2016) caution that while AI can simulate certain instructional functions, it cannot fully replicate the nuanced judgment, empathy, and adaptability of human teachers, limitations that must be considered in any AI integration strategy.

One of the most notable subfields of AI in recent years is generative artificial intelligence (GAI). Generative artificial intelligence is an advanced set of algorithms that can create original content such as text, images, audio, and video using deep learning methods on large data sets. These systems, which operate through models such as Generative Adversarial Networks (GANs) and Generative Pre-trained Transformers (GPT), are effectively used in many sectors that require creative production (Ch'ng, 2024). In education, GPT technologies are utilized in the creation of teaching materials through platforms such as ChatGPT, DALL·E, Canva, Suno AI, and Genially, providing teachers with the opportunity to design innovative, time-saving, and participatory learning environments (Yim & Su, 2024). For preschool teachers, these tools offer versatile uses such as story writing, poetry and song lyric production, interactive game design, visual material creation, and audio content production. Indeed, Chen et al. (2020) demonstrated in their studies that these tools foster creative productivity among teachers and enhance efficiency in classroom applications. Additionally, these tools create important opportunities for providing children with personalized learning materials.

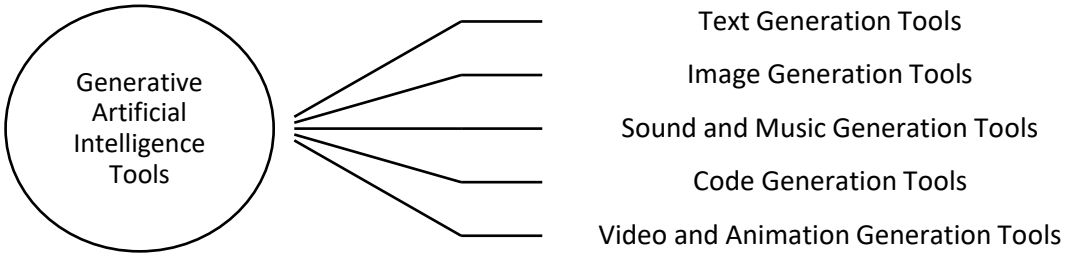

Figure 1. Generative Artificial Intelligence Tools

Artificial intelligence-based content creation tools offer preschool teachers significant opportunities to produce creative and pedagogically appropriate materials in text, visual, audio, and video formats (Fig. 1). To illustrate the diversity of possible applications, Table 1 provides an overview of how generative AI tools can be utilized in preschool education across different content types. This structured summary is intended to help educators identify suitable tools for specific pedagogical purposes while ensuring developmental and ethical alignment.

Table 1. Examples of Generative Artificial Intelligence Use in Preschool Education

Content Type	Sample Applications	Generative AI Tools That Can Be Used
Text-Based Materials	Stories, song lyrics, classroom activity instructions, informational texts	ChatGPT, Claude, Google Gemini
Visual-Based Materials	Posters, brochures, infographics, activity cards, classroom bulletin board visuals	DALL·E, Canva, Microsoft Designer
Audio/Music-Based Materials	Educational songs, audio instructions, storytelling, podcasts	Suno AI, ElevenLabs, Voicemod
Video/Animation-Based Materials	Educational videos, animated content, virtual tours	Pictory, Animaker, Powtoon
Presentation/Game-Based Activities	Interactive presentations, digital game designs, learning scenarios	Genially, Thinglink, Scratch

As shown in Table 1, generative AI tools can facilitate the rapid production of text-based materials, visual resources, audio content, video animations, and interactive activities. These examples illustrate the potential for diversifying classroom materials and tailoring them to children's individual needs, provided that teachers actively evaluate and adapt them to the learning context. In particular, through generative artificial intelligence applications such as ChatGPT, which specialize in text production, stories, rhymes, riddles, dialogues, or game scenarios for children can be produced quickly and in a manner appropriate for the target age group (Su, Ng & Chu, 2023; Yim & Su, 2024).

In particular, through generative artificial intelligence applications such as ChatGPT, which specialize in text production, stories, rhymes, riddles, dialogues, or game scenarios for children can be produced quickly and in a manner appropriate for the target age group (Su et al., 2023; Yim & Su, 2024). These contents can both support children's language development and increase their awareness of themes such as the environment, health, and friendship. However, for these materials to have pedagogical value, they must be prepared under the guidance of teachers and evaluated in terms of their suitability for age, developmental level, and cultural context (Williams et al., 2019). Visual-based educational materials also play an important role in preschool education. Visuals such as posters, brochures, infographics, and maps facilitate learning by concretizing information, especially for children who have not yet developed reading and writing skills, and increase learning motivation (Chen et al., 2020; Lin et al., 2020). With tools such as DALL·E, Canva, and Microsoft Designer, teachers can quickly create visual content tailored to their classroom themes. However, it is important that the visuals used are compatible with the child's cultural environment and do not contain bias. Visual materials are expected to attract children's attention while also contributing to their conceptual development. Audio and music-based materials are tools that support children's learning through multiple sensory channels, enable them to form emotional bonds, and increase the retention of learned information through their rhythmic structure (Radesky et al., 2016; Hutton et al., 2024). Educational songs, audio stories, or thematic announcements prepared with tools such as Suno AI, Voicemod, or ElevenLabs can extend the attention span in the classroom and make learning more engaging. However, it is important for teachers to monitor these contents in terms of age appropriateness, sound level, and content accuracy, and to encourage careful use so that children's offline physical and social interactions are not harmed (AAP, 2016). Video, animation, and presentation-based materials are powerful tools that support children's cognitive development by making abstract concepts more concrete. Animated presentations created using platforms such as Animaker, Powtoon, or Genially can help connect topics to everyday life and increase children's active participation (Vartiainen et al., 2020; Hwang & Tu, 2021). In particular, it has been observed that children's environmental awareness develops with the support of visual storytelling in subjects such as science and social studies. However, the attention span, speed, and repetition rates of video content should also be regulated within the framework of pedagogical principles. For all these content types to be used effectively and safely, teachers must not only be producers but also take on the role of filters and guides. Generative artificial intelligence tools should be used in a way that supports pedagogical independence; they should not be integrated into the classroom in a way that bypasses teacher guidance. Additionally, it should not be forgotten that excessive use of digital content can increase screen time and limit physical activity and social interaction (Radesky et al., 2016; Hutton et al., 2024). Therefore, it is recommended that digital materials be balanced with traditional learning methods and that children's needs for play-based learning be taken into consideration. To guide the structured integration of artificial intelligence tools into preschool curricula, a set of core design principles has been identified based on the literature and best practices. These principles are summarized in Table 2, providing a concise framework for ensuring that AI-based educational content is developmentally appropriate, ethically sound, and pedagogically effective.

Table 2. Basic Principles for Curriculum Design in Preschool Artificial Intelligence Education

Principle	Explanation
1. Basic Cognitive Adaptation	Artificial intelligence concepts should be presented using concrete and experiential learning methods appropriate to children's developmental levels.
2. Conceptual Clarity and Ethical Awareness	The aim should be to teach children digital ethics, data sharing, and simplified decision-making processes.
3. Interactive and Creative Learning	Creative learning environments should be provided through tasks such as story creation, problem-solving, and drawing using artificial intelligence tools.
4. Teacher-Supported Applications	Teachers should be actively involved in the process as technology guides, ethical advisors, and pedagogical practitioners.

Source: Yang (2022)

As indicated in Table 2, these principles emphasize aligning AI content with children's developmental stages, fostering ethical awareness, promoting interactive and creative learning, and ensuring active teacher involvement throughout the process (Yang, 2022). Such principles serve as a guide for integrating AI tools into early childhood settings in a balanced and developmentally appropriate manner. Overall, the effective adoption of AI in preschool education requires not only technical proficiency but also robust pedagogical and ethical competencies. Teachers must act as content evaluators, instructional designers and ethical overseers, ensuring that AI-enhanced activities complement rather than replace traditional, play-based learning experiences.

The current literature indicates that AI-supported educational technologies are relatively new at the preschool level, with a limited number of applications and studies in this field (Su et al., 2023; Yang, 2022). However, the integration of AI tools into preschool education requires more sensitivity and originality than other levels of education. Preschool children have a high need for concrete experiences, play-based learning, and face-to-face interaction in their learning processes. Therefore, it is of great importance for AI applications to be presented in a simplified, interactive, and gamified format that is developmentally appropriate for this age group (Li & Taber, 2022). Jin (2019, as cited in Su & Yang, 2022) highlights four key areas of AI use: child assessment systems, AI teaching software, AI robots, and virtual reality-based teaching environments. Each of these tools captures children's attention and helps them internalize abstract concepts more easily. Similarly, Lin et al. (2020) state that AI-based chat systems that support language learning develop visualization and conceptual relationship-building skills in younger age groups, while Nan (2020) states that AI-supported collaborative learning environments increase children's motivation to learn. A systematic review study by Hwang et al. (2021) indicates that artificial intelligence applications play four key roles: intelligent tutor, student (tutee), learning partner, and educational policy advisor. In this context, preschool teachers are expected to guide these technologies toward pedagogical goals and play an active role in the process, not only as users but also as content designers and ethical guides. These developments demonstrate that teachers need to be equipped not only with technical knowledge but also with digital literacy, ethical awareness, and pedagogical assessment skills. Artificial intelligence literacy is a crucial concept at this point, enabling teachers to utilize these technologies with a critical perspective, recognize potential ethical dilemmas, and assess the compatibility of content with child development (Williams et al., 2019).

AI literacy refers to individuals' ability to understand, use, critique, and evaluate the social impacts of AI technologies (Williams et al., 2019). Artificial intelligence literacy is increasingly recognized as a foundational competency for teachers in the 21st century, particularly in early childhood education where the developmental appropriateness of digital content is paramount. It encompasses not only the ability to operate AI tools but also the capacity to critically evaluate their outputs, understand their underlying mechanisms, and anticipate their ethical and social implications (Su et al., 2023). At this point, AI literacy emerges as a critical concept in teacher education.

Recent studies emphasize that AI literacy enables educators to identify potential algorithmic biases, ensure cultural and developmental relevance, and integrate AI-generated materials into pedagogically sound, play-based learning experiences (Pei et al., 2025; Kölemen & Yıldırım, 2025). For preschool teachers, this skill set is essential to transform AI from a mere technological novelty into a supportive educational partner that enhances, rather than undermines, traditional learning methods. For preschool teachers, these tools offer versatile applications, including story writing, song lyric creation, interactive activity planning, and visual material design (Yim & Su, 2024). Various studies have emphasized that these tools save time and support creativity for teachers working with limited resources (Chen et al., 2020). However, for generative AI tools to be used effectively in education, teachers must possess a comprehensive set of competencies that includes not only technical knowledge but also ethical awareness, digital content evaluation skills, and knowledge of pedagogical appropriateness. Without adequate AI literacy, teachers may rely on intuition or trial-and-error approaches, leading to inconsistent practices and potential risks in content selection (Su et al., 2023). Therefore, integrating AI literacy training into both pre-service teacher education and in-service professional development has become a critical priority for ensuring that AI tools are used effectively, ethically, and in alignment with the goals of early childhood pedagogy.

Preschool Teachers' Use of Artificial Intelligence

Artificial intelligence (AI) is emerging as an innovative field that offers teachers a wide range of tools to support them in everything from designing teaching materials to assessing processes in educational settings. This transformation is redefining the professional roles of teachers, especially those working with young children, and making AI literacy skills essential. Preschool teachers' perspectives on AI technologies directly influence the level of classroom use of these tools and the success of their pedagogical integration (Su & Yang, 2022). However, the effective use of these technological tools is not only dependent on hardware capabilities but also on teachers' guidance and pedagogical knowledge. Indeed, the majority of teachers report that they lack sufficient knowledge about AI education and feel uncertain about how to integrate these technologies into the classroom environment (Lin et al., 2020).

The literature indicates that preschool teachers' attitudes toward AI generally vary between two extremes: on the one hand, viewing it as a supportive tool in teaching processes, and on the other hand,

tending to remain cautious due to concerns regarding ethics, technology, and pedagogy. For example, a review study conducted by Su, Ng, and Chu (2023) noted that teachers' positive perceptions of AI were based on practical benefits, such as time management, content production, and facilitating individualized instruction. Similarly, studies conducted in Turkey highlight teachers' views that AI tools increase children's interest, enable the diversification of creative activities, and save time in producing visual and auditory materials (Küçükkara et al., 2024). However, alongside these positive attitudes, it has also been reported that AI tools are not sufficiently explained pedagogically, that they are difficult to adapt to the classroom level, and that teachers have ethical concerns (Durrani, Iqbal & Akram, 2024). Another concern frequently expressed by teachers is the extent to which AI tools are impartial and reliable in decision-making processes. Teachers working with younger age groups, in particular, are aware of the guiding power of these tools and emphasize that their pedagogical roles should not be transferred to AI (Yi, Liu & Lan, 2024).

For preschool teachers to utilize AI tools effectively, they must possess not only technical knowledge but also multidimensional competencies, including pedagogical knowledge, digital literacy, and ethical awareness. In Su & Yang's (2022) study, it was noted that most teachers working in early childhood education lack sufficient knowledge about how to utilize AI technologies in the classroom and often proceed without guidance. This situation is also observed in Turkey. In a study by Uyak et al. (2023), it was noted that preschool teachers are enthusiastic about incorporating AI into classroom activities; however, due to a lack of knowledge, inadequate infrastructure, and a lack of practical guidance, they make limited use of these technologies. In this context, it is recommended that teachers be supported through in-service training programs and that their skills in preparing technology-based pedagogical content be enhanced.

In international examples, AI tools are used in preschool classrooms for activities such as creative writing, storytelling, image production, and rhythmic learning. For example, text-based models like ChatGPT can be used to produce creative stories, while visual production tools like DALL·E can provide materials that support children's visual perception. While some teachers describe these tools as "inspiring aids," others express concern that excessive use may threaten pedagogical independence (Su & Zhong, 2022). In Turkey, teachers' familiarity with AI tools is mainly limited to individual efforts or experiences gained through social media; these technologies are not systematically introduced in formal teacher training processes (Uyak et al., 2023; Mart & Kaya, 2024). This situation may cause teachers to rely on their own pedagogical intuition when using AI, leading to non-standard practices. However, preschool teachers are not entirely negative about AI. Research shows that teachers also have positive expectations. In particular, teachers emphasize the benefits of AI applications, such as saving time, ease of use, supporting the teaching process in the classroom, and contributing to teachers' personal development (Kalaba Yıldırım & Önder, 2025). Preschool teachers are aware that AI technologies can enrich their teaching by offering educational opportunities tailored to children's individual needs (Küçükkara et al., 2024). Understanding how these responsibilities are operationalized in practice is essential for translating theoretical benefits into effective classroom strategies. The following example illustrates, in a concrete manner, the pedagogical, guiding, and ethical roles that a preschool teacher may undertake when integrating generative AI into instructional activities. A preschool teacher plans to conduct a thematic activity on "Healthy Eating." She/he decides to use a generative AI tool to create a short story for her/his class. After entering the prompt "a fun story about fruits and vegetables for 5-year-old children," the AI generates a colorful and engaging narrative. Before introducing it to her/his students, the teacher carefully reviews the story, identifying a section that portrays certain foods with exaggerated health claims. Acting as a filter, she/he edit the text to remove misleading information and ensure that the vocabulary is age-appropriate. In her/his role as a guide, she/he designs accompanying activities, such as role-playing a fruit market, to encourage active participation and reinforce the story's message. Finally, as an ethical decision-maker, she/he ensures that the visuals accompanying the story do not reinforce cultural stereotypes and that all materials respect the diversity of her classroom. This process illustrates how a preschool teacher can critically evaluate, adapt, and integrate AI-generated content to enhance learning while safeguarding developmental and ethical standards.

Artificial Intelligence-Based Educational Applications for Early Childhood

Early childhood is a critical period when individuals experience the most rapid cognitive, social, and emotional development. Technology-supported educational applications designed in line with the developmental characteristics of children during this period can make learning experiences more interactive, personalized, and enjoyable. The growing interest in the use of artificial intelligence (AI)-based applications in early childhood education over the past few years has also raised questions about how these tools can be effectively structured for younger age groups. The literature suggests that AI-based

educational tools designed for preschool children can yield effective results, particularly in areas such as cognitive development, language acquisition, problem-solving, and emotional awareness (Druga et al., 2019; Su & Yang, 2022; Yi, Liu, & Lan, 2024). In particular, AI-enabled robots with speech capabilities, such as KIBO, LEGO, PopBots, and Zhorai, provide children with positive learning experiences and help them develop a basic understanding of AI (Lin et al., 2020; Williams et al., 2019). AI-enabled technologies provide individualized learning opportunities, allowing children to progress at their own pace. For example, an AI-integrated number recognition system has helped children reinforce their number knowledge and develop their motor skills in writing (Villegas-Ch et al., 2022). Similarly, activities conducted through Google's "Teachable Machine" application have been found to support children's reasoning skills (Vartiainen et al., 2020). These robotic systems support the early development of children's skills, such as algorithmic thinking, problem-solving, sequencing, and pattern recognition, while also presenting technological concepts through a game-based approach. On the other hand, social robots also stand out as an effective element in learning environments. In a study conducted with the PopBots robot, significant improvements were observed in the learning processes of children with special needs (Williams et al., 2019). Similarly, KIBO robots have been used to teach children basic coding and logical thinking skills, and meaningful improvements in children's creative problem-solving and teamwork skills have been observed (Su, Ng & Chu, 2023). Furthermore, it has been noted that robots can increase children's social participation and learning motivation at an early age (Prentzas, 2013).

AI-based toys and digital content also play a supportive role in children's cognitive and emotional development. Indeed, it has been observed that children's empathy skills increase and their creativity develops thanks to an AI-equipped toy (Kewalramani et al., 2021). Additionally, it has been reported that the Smart Early Childhood Education Service System, an animation-based educational system, has improved both emotional development and teacher-parent communication (Wei et al., 2020). All of these technological applications increase children's interest in the lesson and facilitate the acquisition of new skills by providing a fun and interactive learning experience (Su & Yang, 2023). However, the process of integrating artificial intelligence into preschool education programs is also the focus of academic studies. Su & Zhong (2022) emphasized that this process involves various difficulties in the stages of goal setting, content development, teaching methods, and evaluation, and stated that successful integration is directly related to teachers' knowledge and skills. Similarly, a study conducted by Li and Taber (2022) found that technologies such as augmented reality and artificial intelligence are used to a limited extent in early childhood; however, positive changes in children's interaction levels have been observed due to artificial intelligence-supported materials developed in the context of science education. While these applications offer significant opportunities for enriching early learning, researchers also caution against potential risks if they are misused, including the reinforcement of bias, increased screen time, and exposure to developmentally inappropriate content (Nguyen et al., 2023; Xia et al., 2022).

Ethical Concerns and Educational Responsibilities

Although the use of generative artificial intelligence in early childhood education is considered promising by many educators and experts, it is also emphasized that its misuse carries serious social and developmental risks. In particular, privacy violations, confidentiality breaches, and data security issues in AI-based materials for children are causing serious concerns (OECD, 2025; Öztürk, 2025). In addition, errors such as cultural biases and gender- and race-based stereotypes that may be present in content generated by generative models can lead to the reflection of incorrect messages in children's perceptions (Krakowski, 2025). Furthermore, some preliminary findings suggest that live interaction with artificial intelligence may affect young children's trust, empathy development, and brain structure (Robb & Mann, 2025). For example, UNICEF (2022; 2025) states that equipping AI systems with "persuasive techniques" that specifically target children could make them dependent and weaken genuine human relationships. Attention is drawn to the need to develop protective measures and design principles against such potential dangers. Therefore, the use of generative AI tools in early childhood education may lead to unintended and potentially harmful outcomes if not supported by teacher supervision, ethical evaluation, and principles of developmental appropriateness. Addressing these risks requires a proactive and well-defined role for teachers, ensuring that the integration of AI is guided by ethical, pedagogical, and developmental considerations.

The integration of AI into educational environments is not merely a technical or pedagogical transformation, but also brings about a multi-layered change that includes ethical responsibilities and educational tasks. Teachers are not merely technology users in this transformation; they assume the roles of content selectors, implementers, supervisors, and guides (Chen et al., 2020; Horton & Horton, 2003; Ng

et al., 2023). Research findings in the literature reveal that negative beliefs about the use of artificial intelligence in education are based on factors such as artificial intelligence systems not being sufficiently transparent and impartial in decision-making processes, posing potential risks in terms of justice and equality principles, and the inadequacy of the ethical framework (Nguyen et al., 2023; Xia et al., 2022). In this context, teachers' responsibility to evaluate the accuracy, pedagogical appropriateness, and developmental adequacy of AI-based content comes to the fore. The suitability of AI-recommended content for children's age and developmental level, its consideration of cultural sensitivities, and its consistency with learning objectives should be among the educational responsibilities of teachers. Primarily during the preschool period, children's relationship with digital content should be structured with the active guidance of teachers. Children's learning styles, interests, and social-emotional development should be taken into account in content selection (Su et al., 2023).

Superficial knowledge shaped by the media and popular discourse can also influence teachers' perceptions. This situation can pave the way for the development of negative beliefs about the use of AI in education. For example, concerns that AI is not transparent and impartial in decision-making processes, that it may create problems in terms of justice and equality, and the general uncertainty of ethical norms are among the main concerns expressed by teachers (Kalaba Yıldırım & Önder, 2025). As a natural consequence, some teachers may exhibit negative attitudes toward AI, believing that it could be misused or unreliable in the classroom. For example, an AI application that ignores linguistic or cultural diversity could put some children at a disadvantage. Therefore, the impartiality and equality of AI-based content and algorithms are important criteria for educators. The literature also emphasizes the need to be cautious about different types of bias and the risk of discrimination in the use of AI in education (Borenstein & Howard, 2021; Nguyen et al., 2023). The benefits provided by AI tools must be made available to all segments of society. However, due to socioeconomic differences or regional inequalities in opportunities, not every school or family may have access to these technologies. Research highlights that lack of technological access can lead to inequality of opportunity among children (Druga et al., 2019). AI-supported materials need to be designed in an accessible and inclusive manner for children with special needs or students in disadvantaged areas. Otherwise, AI applications may deepen the existing digital divide in education (Rivas & Zhao, 2023).

Face-to-face interaction and active play are essential for the healthy development of children in the preschool period. Excessive use of AI-supported screen applications can increase children's screen time, limiting physical activity and peer interaction. Experts therefore recommend that the use of digital content be limited in an age-appropriate manner and balanced with traditional games. Technology should remain a tool in children's learning experiences; it should never replace real-world exploration and social play (Hutton et al., 2024; Radesky et al., 2016). Teachers also point out that AI applications can be misused or make unexpected mistakes. For example, AI's potential to generate incorrect or false information necessitates that content used in education be subject to teacher oversight. Additionally, in some commercial content, AI may unknowingly steer children toward a specific product or brand, leaving them vulnerable to advertising and consumption (Dodhia, 2024). Therefore, educational materials must be independent of commercial influences and serve pedagogical purposes. It is recommended that teachers continuously observe how children use digital content and intervene when necessary. A comprehensive ethical framework is needed for AI to be adopted responsibly and safely in education. Recent studies emphasize the need to establish ethical principles and even legal regulations regarding the use of AI in educational settings (Akgun & Greenhow, 2022; Carrillo, 2020). In this context, it is crucial to establish guiding principles that address key issues, including privacy, surveillance, autonomy, data security, bias, and discrimination. The literature on preschool teachers' use of artificial intelligence highlights the significant potential and exciting innovations in this field, while also identifying areas that require attention. It is considered critical for preschool teachers to be aware of artificial intelligence and prepared for the dilemmas they may encounter in the classroom in order to integrate technology consciously.

2. Conclusion and Implications

This article has examined the integration of generative artificial intelligence (GAI) technologies into early childhood education activities from ethical, pedagogical, and practical perspectives. Based on the findings and literature-based discussions, it can be concluded that GAI technologies offer teachers valuable opportunities in terms of creative content production, time efficiency, material diversity, and the ability to provide individualized learning experiences. However, particularly in early childhood education, which is a sensitive and developmentally critical period, the use of these technologies requires a careful and multi-

dimensional approach. Key factors such as teacher competencies, ethical awareness, digital inequalities, and content safety must be taken into account.

The incorporation of GAI tools into educational settings positions teachers not merely as technology users but also as content developers, ethical decision-makers, pedagogical practitioners, and digital guides. Therefore, teachers need to cultivate not only technical skills but also ethical sensitivity, critical digital literacy, and strong pedagogical judgment. Given that children in early childhood primarily learn through concrete experiences, GAI-generated content should be designed to be developmentally appropriate, interactive, and play-based, meeting their unique learning needs.

Research indicates that teachers hold both optimistic expectations and considerable concerns regarding the use of GAI. While some describe these tools as inspirational assistants that support instructional creativity and efficiency, they also express caution about the potential risks of using AI-generated content without proper pedagogical oversight. These mixed attitudes suggest several areas in which educators require support, including ethical decision-making, aligning technology with pedagogical goals, and selecting content suitable for young learners. One of the major concerns involves the lack of transparency in GAI decision-making, the presence of algorithmic biases, and the ethical implications of data privacy. Teachers have also voiced concerns about possible linguistic, cultural, or social biases embedded in AI tools that could inadvertently contribute to discrimination among children. This highlights the importance of ensuring that content selection reflects principles of diversity and inclusion, particularly in multicultural classrooms. Moreover, digital access remains a significant challenge. Not all schools or teachers have equal access to GAI tools, especially those working in socioeconomically disadvantaged areas. This unequal access may deepen existing disparities in educational opportunities. For this reason, education policies should be designed to ensure fair and equitable access to technological resources for all educators and students, regardless of their geographical or socioeconomic background.

From a pedagogical perspective, it is not enough for teachers to simply use GAI to generate content. They must also critically evaluate whether these materials are appropriate for the developmental levels of their students. For example, if the linguistic structure, conceptual complexity, or emotional content of a story is not suited to preschool-age children, it may lead to confusion or misinterpretation. In this context, the teacher's role as a guide, evaluator, and adapter of content is essential to the learning process.

In terms of ethical responsibilities, educators must also be aware of the potential negative impacts of GAI on young children's development. Overuse of screen-based technologies may reduce opportunities for physical activity, face-to-face interaction, and social play, all of which are essential for healthy development. Therefore, it is recommended that digital content be balanced with traditional play activities and that its use be moderated under the guidance of both teachers and parents.

In terms of policy and practice, the effective, ethical, and pedagogically appropriate use of generative artificial intelligence (GAI) tools in early childhood education requires the continuous professional development of teachers. To ensure the effective, ethical, and developmentally appropriate integration of generative AI into early childhood education, in-service training programs for preschool teachers should be designed to address both technical and pedagogical competencies. Such training should include fundamental knowledge of AI and its applications in education, strategies for aligning AI-generated content with developmental stages, methods for detecting and mitigating algorithmic bias, and approaches for ensuring cultural and linguistic inclusivity in instructional materials. In addition, sessions should focus on developing teachers' skills in critically evaluating the accuracy and appropriateness of AI-produced resources, integrating AI tools into play-based and experiential learning contexts, and managing potential risks such as excessive screen time or exposure to inappropriate content. By incorporating these key components, in-service training programs can equip teachers with the expertise and ethical awareness necessary to harness the potential of generative AI while safeguarding the holistic development of young children. Furthermore, integrating generative AI literacy into teacher education curricula and adapting it appropriately for early childhood education is essential. This will enable both teachers and children to approach technological content critically and consciously.

Another critical issue is addressing the current regional and socioeconomic disparities in access to technology. Priority should be given to schools in disadvantaged areas by providing the necessary infrastructure and software support to ensure equitable learning opportunities for all children. In addition, in order to monitor children's exposure to digital content not only in school but also at home, parent-focused information and guidance programs should be implemented, and teacher-parent collaboration should be strengthened. Such initiatives will facilitate the development of a consistent and holistic approach to the use of GAI.

From a research perspective, there is a growing need for more practice-oriented and context-specific studies within the Turkish early childhood education landscape. Experimental and longitudinal studies examining the impact of GAI content on different areas of child development can provide concrete evidence of its educational benefits. Moreover, increasing the number of qualitative studies exploring how teachers navigate ethical dilemmas and make decisions regarding GAI use will significantly contribute to shaping both policy and teacher training programs.

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