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Artificial Intelligence (AI) in Early Childhood Education (ECE): Do Effects and Interactions Matter?

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Abstract

This article examines the integration of artificial intelligence (AI) into early childhood education and the noteworthy impacts it has on students' enjoyment, creativity, and development of soft skills. Artificial intelligence technology can help young pupils develop important soft skills like cooperation and communication through the use of interactive tools and individualized learning platforms. These technologies enable education to be customized to meet the needs of each student, boosting self-esteem and confidence. Additionally, they facilitate problem-solving by providing opportunities for research. Furthermore, AI encourages creativity in children by giving them new and creative ways to express themselves. This paper explores how gamified learning settings, interactive software, and creative tools that stimulate students' curiosity and foster creativity are transforming education through artificial intelligence (AI). It also highlights the challenges and ethical dilemmas surrounding the integration of AI. This essay emphasizes how important it is to employ AI ethically and cooperatively to support children's holistic development. By developing a framework based on the completed literature study, we will discuss the importance of artificial intelligence in early childhood education, the ethical conundrums raised by its use in ECE, and how it could foster children's creativity and soft skills.

Keywords: *Artificial Intelligence (AI), Early Childhood Education (ECE), Soft Skills, Fun and Creativity, effects and interactions, technical progress and technologies.*

INTRODUCTION

Artificial intelligence (AI) was defined by John McCarthy in 1956 as "the science and engineering of creating intelligent machines" (McCarthy, 2007; Su et al., 2023). The goal of artificial intelligence (AI) research is to create intelligent machines that can perform a variety of tasks using methods including machine learning, neural networks, and natural language processing (Mondal, 2020; Su et al., 2023). AI is revolutionizing a wide range of sectors, including science, psychology, public policy, and health (Su et al., 2023; Xu et al., 2021). Education can benefit from the use of artificial intelligence (AI) in a number of ways, including the automation of assessments, prediction of students' performance and learning status, and recommendation of learning resources (Crescenzi-Lanna, 2023; Mousavinasab et al., 2021; Su et al., 2023, 2022; Zawacki-Richter et al., 2019; Zheng et al., 2021). In order to support children's inquiry literacy, (Kewalramani et al., 2021) investigate the usage of robotic toys with interactive artificial intelligence (AI) in early childhood (EC) settings. The potential for integrating technology into children's play and education has generated a great deal of interest in the role of artificial intelligence (AI) in education. AI robotic toys were actively employed by teachers to maintain play engagement among 4- to 5-year-old students. The children's inventive peer collaboration was demonstrated by the data gathered from observational studies, instructor interviews, and student artifact analysis. Children's play with the AI robot cultivated inquiry literacy in cooperative, creative, and emotional domains (Kewalramani et al., 2021). Artificial intelligence (AI) is a topic that is becoming more and more popular in the field of education. The majority of research on the subject has been conducted on primary, secondary, and university education; very little has been done on AI in early childhood education (Su and Yang, 2023). According to Ng et al., 2023; Su et al., 2023, all students—even young ones—should read AI literature in order to properly prepare them for the challenge of tomorrow. The authors advise educators to teach children about the moral dilemmas raised by artificial intelligence (AI), the benefits and drawbacks of

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internet-of-things applications, and the process by which computers learn from data. Developing a conceptual study framework to understand artificial intelligence's (AI) role in early childhood education (ECE) is the main objective of this work. This study will help us with the following issues: What are the possible advantages of artificial intelligence (AI) for kids receiving early childhood education (ECE)? We will discuss the importance of artificial intelligence in early childhood education, the moral dilemmas associated with its application in ECE, and how it might encourage children's creativity and soft skills by developing a conceptual framework based on the finished literature research.

LITERATURE REVIEW

Artificial intelligence (AI)

John McCarthy first used the phrase artificial intelligence (AI) in 1955 to describe a computer that could carry out a variety of cognitive tasks that are typically performed by humans, including speaking, thinking, learning, and solving problems (Nilsson, 1998). Artificial intelligence has been used to mimic intricate cognitive functions like sensing, learning, and prediction, claim Russell and Norvig (2010). Artificial intelligence, as described by Barabas et al. (2018) and Berendt et al. (2020), is the capacity of a digital computer or computer-controlled robot to carry out tasks that are frequently associated with intelligent individuals. The broad definition of artificial intelligence encompasses a wide range of technologies and algorithms (Baker and Smith, 2019; Jantakun et al., 2021). It is the study of using contemporary technology, such machine learning and neural networks, to solve problems (Wang, 2019; Yang, 2022). The advances in AI research across several fields have led to an increasing amount of literature (Andriessen and Sandberg, 1999; Clancey et al., 1979; Kaplan and Haenlein, 2019; Zdenek, 2003; Zhang and Aslan, 2021). Artificial intelligence (AI) finds use in many domains these days, including computer programs, robotics, natural language processing, embedded control systems in machinery, and identification by speech and vision (Jantakun et al., 2021). Certain robots are capable of communicating with humans through the use of technologies for visual and aural monitoring (Jantakun et al., 2021; Lathuilière et al., 2019; Li et al., 2020; Zhu, 2020). Artificial Intelligence (AI) is becoming the next big thing in technology because it can interact with humans and help them perform at higher levels (Lawler and Rushby, 2013; Zhai et al., 2021). Artificial intelligence is a key component of the fourth industrial revolution and has the potential to spark a fourth revolution in education, claim Zhao et al. (2021). Big data and artificial intelligence (AI) are collaborating to create inclusive, customized, adaptable, and engaging learning experiences (Berendt et al., 2020).

Advances in computer science and computational technology have led to the widespread usage of autonomous, adaptive, and efficient artificial intelligence (AI) systems across a range of academic disciplines. The primary objective of artificial intelligence in education is to apply it to support modifications to educational systems (Chen et al., 2020; Holmes et al., 2023; Hwang and Tu, 2021; Ouyang and Jiao, 2021; Xu and Ouyang, 2022). Researchers and educators are interested in artificial intelligence (AI) in education because of its potential to significantly improve education through the customization of learning experiences. Artificial Intelligence facilitates testing, learning, and teaching. (Su and Yang, 2022).

Early Childhood Education (ECE) with Artificial Intelligence (AI)

Future generations of children will interact with technology very differently from those of previous generations due to artificial intelligence (AI). AI is transforming our daily lives, work, and leisure (Ali et al., 2019). In early childhood education (ECE), artificial intelligence (AI) tools are being employed more and more to improve the learning and development of young children (Su and Yang, 2022). The majority of research demonstrated how AI has improved children's understanding of AI, robotics, computer science, machine learning, and related fields dramatically. Additionally, it has improved children's abilities in reading, creativity, emotional regulation, cooperative learning, and computational thinking (Su and Yang, 2022). In early childhood education (ECE), artificial intelligence (AI) tools are being employed more and more to improve young children's learning and development (Lin et al., 2020; Su and Yang, 2022; Vartiainen et al., 2020). For example, two recent studies examined the use of AI robots to teach machine learning to youngsters (Lin et al., 2020; Su and Yang, 2022; Vartiainen et al., 2020). Many previous studies have examined the best ways to teach AI principles and competence to college students (Kumar and Meeden, 1998;

McGovern et al., 2011; Torrey, 2012). There hasn't been much research on using AI in early childhood (ages 3 to 8) (Su and Yang, 2022). However, artificial intelligence (AI) devices—like voice assistants, networked smart toys, and household robots—are increasingly consuming children's life (Su and Yang, 2022; Williams et al., 2019). AI advances system performance and advancement (Su and Yang, 2022). AIECE examines not only computational thinking but also creation, perception, learning, actions, senses, and sense-making processes. According to Su and Zhong (2022) and Williams et al. (2019), younger children benefit most from hands-on learning approaches since they learn actively and intellectually. According to Su and Zhong (2022) there is a possibility for youngsters to begin basic education regarding artificial intelligence as early as three years old. (Kim et al., 2021) examined curriculum development for early childhood education from three angles in order to provide children with AI literacy: assist children in recognizing AI technologies in their daily lives, teach them programming so they can use the technology in real-world contexts, and increase awareness of any potential ethical concerns with using AI technologies. Consequently, they enumerated the following as the three requirements for becoming literate in AI: knowledge, skill, and attitude related to AI (Su and Zhong, 2022). Helping pupils understand the fundamentals of artificial intelligence is the aim of the AI Knowledge (Kim et al., 2021). The AI Knowledge competency is comprised of five clusters: "definitions and types of AI," "reasoning," "problem-solving and search," "applications," "data. In light of their programming The goal of the AI Knowledge is to assist students in comprehending the foundations of artificial intelligence (Kim et al., 2021). The five categories that make up the AI Knowledge competency are "definitions and types of AI," "reasoning," "problem-solving and search," "applications," and "data and machine learning" (Su and Zhong, 2022). AI-savvy students are able to think computationally by using their programming skills. The two prerequisites for AI capabilities are "using AI tools" and "computational thinking and programming" (Kim et al., 2021; Su and Zhong, 2022). Students that possess an attitude competency towards AI are more likely to generate thoughts about AI in general society. Kim et al. (2021) identify "social impact" and "collaborate with AI" as two aspects of the AI mindset. The AI mindset competency measures students' capacity for critical thought on the application of AI and their awareness of both the advantages and disadvantages of AI for society (Su and Zhong, 2022). Artificial intelligence (AI) affects children's rights to security, safety, and privacy even as it encourages creativity. Kids don't always have the means to voice their opinions and don't fully understand the ramifications of AI technology, which makes this particularly concerning. Artificial intelligence (AI) is now more approachable for younger students thanks to recent developments in tools and methodologies.

Soft Skills and AI

Artificial intelligence offers the potential to create customized, interactive learning experiences that can adjust to the needs and interests of young students. Strengthening personal competencies, developing a positive behavioral attitude, and encouraging a culture of continual learning and literacy are the main and direct components of skills preparation. Enhancing language, affective, and social interaction skills have been the goals of software treatments (Abirached et al., 2012; Beaumont and Sofronoff, 2008; Deng et al., 2013). (Barakova et al., 2007; Dautenhahn and Werry, 2004; Kandalaft et al., 2013; Kozima et al., 2009). (Bosseler and Massaro, 2003; Massaro and Bosseler, 2006; Rahman et al., 2011) state as much. Creative, collaborative, and communicative soft skills are crucial for leading young brains through interactive, adaptive AI-based learning. Furthermore, emotional intelligence plays a bigger role in the development of AI-enhanced learning environments. The concept's fundamental tenets are that people are born with certain natural abilities that can be considerably developed. These skills can be divided into two groups: self-related skills, such as emotional regulation, openness to guidance, time management, and maintaining an optimistic mindset; and interpersonal skills, such as group work and relationship building, etc. Soft skills and hard skills are seen to go well together. LaFrance (2016) asserts that developing and honing one's interpersonal and personal habits leads to improved performance. This includes qualities like confidence, adaptability, honesty, and moral rectitude. The phrase "soft skills" describes competencies and life lessons that are advantageous to individuals, groups, communities, and spirituality. One gains recognition in the community by developing these qualities, which are bolstered by emotional intelligence, communication, language proficiency, values, teamwork, ethics, and spirituality. The application of the hard skills is determined by the soft talents. Gaining

expertise in these areas is essential because they influence how one utilizes their scientific knowledge and abilities. According to Sailah (2008), soft abilities include the ability to build relationships with others and with oneself. Among these talents are values, conduct, routines, motivation, character, and attitude. These characteristics are influenced by an individual's patterns of thought, expression, and behavior. To put it briefly, soft skills are the intrinsic abilities that every individual possesses, are constantly in demand as supplements to hard skills, and are vital. When hard and soft skills run parallel to each other and share the same trajectory, they are in perfect balance. As seen, there is a rising push to use artificial intelligence and human intelligence techniques together to support learning. Baker (2016a). An artificial intelligence-powered adaptive learning platform's pedagogical benefits were investigated in a study by Zheng et al. (2020). The effectiveness of customizing language education to meet the unique needs of every student was demonstrated by their findings. The research emphasized the value of personalized evaluations and comments in raising students' engagement and progress. They examined the impact of AI-driven chatbots on language learning, highlighting their ability to provide real-time, interactive language practice. These chatbots enabled students to engage in natural language dialogues and receive personalized feedback, and they reported feeling more engaged and motivated as a result. These findings highlight the potential pedagogical advantages of AI technologies by allowing for tailored learning and encouraging student autonomy. As AI grows into a useful teaching tool, kids can acquire the social and cognitive skills required for effective communication, problem-solving, and critical thinking. People who get early childhood education that incorporates AI and soft skills are resilient, confident, and well-rounded individuals who can successfully navigate the complexities of a digital world that is changing quickly. Additionally, it prepares kids for a technologically evolved world. Students can receive customized educational content based on their interests and chosen learning styles thanks to AI-powered smart learning systems. Soft skill development is equally crucial, even though artificial intelligence (AI) can offer intriguing insights and flexible learning opportunities. Soft talents encompass a wide range of cognitive and interpersonal skills, such as critical thinking, creativity, teamwork, communication, and emotional intelligence. These skills form the basis of a comprehensive education that equips children for success in the classroom and in life beyond it.

Fun/creativity and AI

Numerous creative theories were used in the studies that we examined. It is advised that educational strategies incorporate AI and computational thinking in order to promote critical thinking, creativity, and problem-solving skills (Alam, 2022; Bocconi et al., 2022; Chassignol et al., 2018; Van Laar et al., 2020). Thanks to technology, educators and students should have more opportunities to work together and enjoy experimenting with novel teaching and learning approaches. 2020; Braun and associates. Furthermore, in a world where employment markets are dynamic and complex and where technology is advancing at a rapid pace, schools must provide a proper education. According to the creativity theory (Mednick, 1962), highly creative persons are able to establish more word associations in response to a stimulus than are less creative people (Vitrano et al., 2021). This method has been applied in previous studies on marketing creativity, including advertising (Smith and Yang, 2004) and product innovation management (Im et al., 2013). According to (Peters and Reveley, 2015), creativity arises from the development of a supra-individual collective intelligence. According to Chang et al. (2010) and Lee and Chang (2010), collective intelligence was viewed from a cultural perspective. According to Sawyer (2011), a team's combined efforts are more likely to yield creative results than an individual's. Amabile (1983) offered a "interactionist" reading of the componential theory of creativity, positing that it is a product of an individual's social surroundings and personal traits. According to Amabile (1983), creativity is a process that involves both significant breakthroughs in the arts and technology as well as slow creations. It has been suggested that applying generative theory (Epstein, 1991) can increase personal understanding, stimulate creativity, and challenge conventional behavioral and cognitive standards. Our surroundings have undergone significant transformation as a result of the digital revolution. It has been observed that children should be encouraged to develop critical thinking, problem-solving, communication, and teamwork abilities because these are essential for the development of creativity. (Trilling and Fadel, 2009). In real terms, problem-solving, collaboration, and communication skills will be required in the future. According to Ferrari et al. (2012), the employment of cutting-edge technological instruments is crucial for the development of 21st-century talents.

In the perspective of the education-related Activity Theory (Batiibwe, 2019; Engeström, 2014; Liu et al., 2011; Zhang et al., 2022), where new technologies function as a mediator between the players and the advancement of knowledge, this makes more sense.

Since it can enhance performance and information intake, motivate students, and spark their interest in the topic, creativity has a significant influence on computer science. (Israel-Fishelson and Hershkovitz, 2022a, 2022b). Furthermore, data suggests that little study has employed artificial intelligence (AI) as a tool to support children's development of problem-solving and creativity. Salisu et al., 2022). This primarily depends on how adeptly teachers discover resources and make use of these technological tools.

The Conceptual Framework

Artificial intelligence (AI) presents a unique opportunity in early childhood education to help young students develop their soft skills. While artificial intelligence is commonly linked to technology, there is increasing acknowledgment that AI can improve children's abilities in communication, critical thinking, teamwork, and adaptability. Through interactive platforms and customized learning experiences, artificial intelligence (AI) has the ability to enhance creativity, strengthen social relationships, and sharpen problem-solving abilities. Through the use of customized approaches and flexible algorithms, artificial intelligence (AI) has the ability to enhance the development of a wide range of soft skills and suit individual learning styles.

H_1: Soft skills have a good effect (positively) on the use of artificial intelligence in early childhood education.

Artificial intelligence (AI) offers an exciting opportunity to boost young students' creativity and enjoyment in early childhood education. Thanks to AI-powered tools and platforms, kids can engage in creative and engaging activities. This could pique their curiosity and encourage creative play. These sites offer customized learning opportunities that promote fun and playfulness in academic pursuits. Artificial intelligence (AI) has the potential to make learning activities more entertaining.

H_2: Artificial intelligence makes kids happier (fun) and more creative.

H_3: In early childhood education, creativity and enjoyment can enhance learning.

Artificial intelligence (AI) in early childhood education has the potential to significantly change how young children learn. A wider range of students can now access individualized learning that considers their individual preferences, learning style, and areas of strength and weakness, all made possible by AI-driven platforms and technology. Because of their interactive and flexible nature, these technologies offer more effective and engaging learning opportunities.

H_4: The implementation of artificial intelligence in early childhood education is advantageous.

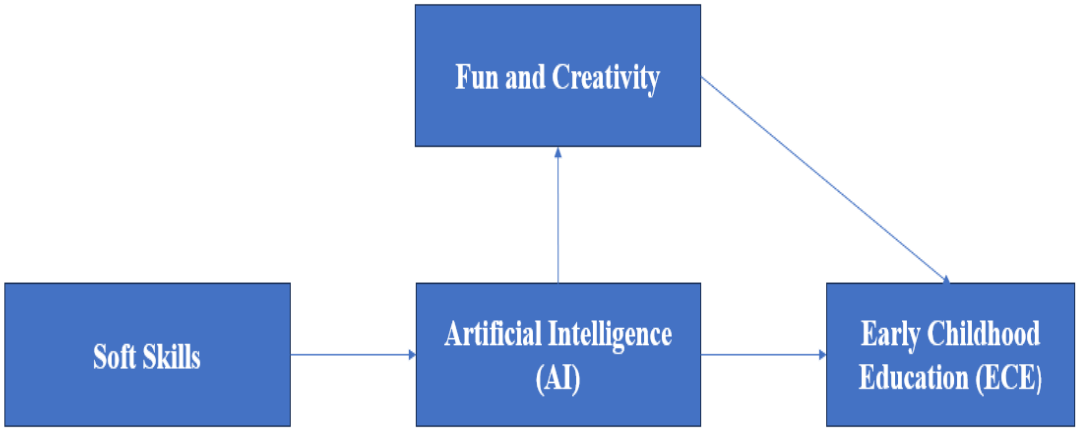

Figure 1: The Conceptual Framework.

Source: Own work**.**

AI could be used in early childhood education to help kids become more inquiry-literate. To guarantee that AI is utilized responsibly and ethically, regulations must be established and the ethical implications of AI must be considered. However, careful planning, ongoing evaluation, and an appropriate strategy that strikes a balance between children's overall development and technological innovation are required. Artificial intelligence (AI) has great promise for enhancing soft skill development and better preparing youth for the challenges of a world that is changing rapidly. Artificial intelligence has the potential to stimulate creativity in children by giving them access to design, music, and art resources. Children can express themselves freely and try out various ideas in a safe and encouraging learning atmosphere thanks to this. AI has a significant positive impact on early childhood education since it cultivates a lifelong love of learning. It also improves the learning experience. However, teachers continue to play a crucial role in directing and improving AI-enabled learning activities, assisting students in growing as social workers, offering emotional support, and imparting values that transcend technology.

CONCLUSION, IMPLICATIONS AND FURTHER STUDY CONSIDERATIONS

Artificial intelligence (AI) has the potential to completely transform early childhood education because it improves many aspects of learning. Artificial intelligence (AI) can be used to predict the learning status and performance of students, recommend learning resources, and automate assessments (Crescenzi-Lanna, 2023; Mousavinasab et al., 2021; Su et al., 2023, 2022; Zawacki-Richter et al., 2019; Zheng et al., 2021). The AI can assist in the development of critical thinking, communication, teamwork, and other essential soft skills through customized techniques. The development of specific skills required for children to properly navigate a complicated world is aided by customized education. By creating a creative and engaging environment that engages their younger senses, artificial intelligence (AI) integrated into educational systems can also assist younger students succeed. Children are encouraged to experiment, explore their imaginations, and express themselves freely through the use of AI-powered tools such as creative applications, interactive games, and adaptive tutoring systems. This innovative fusion of technology and education makes learning more enjoyable for pupils while also equipping them with the skills and mindset necessary for success in the future. In order to achieve a balanced approach that emphasizes holistic growth and fully utilizes the potential of AI in early childhood education, it is critical that educators get guidance on ethical issues and the application of AI in the classroom. While AI technology can provide tailored and interesting learning experiences, it cannot replace teachers in instilling moral principles, promoting social and emotional growth, and teaching vital life skills. Teachers are able to recognize each student's unique needs and give them individualized attention. To that end, we recommend conducting quantitative research that considers the role that teachers play in this process.

DISCLOSURE STATEMENT

No potential conflict of interest was reported by the author(s).

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