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Nexus between Early Childhood Education, Artificial Intelligence, and Education for sustainability

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Abstract

In the era of socio-ecological change, education for sustainability, or Efs, is becoming increasingly recognized on a global scale as a top priority for educational strategies. Present research investigates the use of Artificial Intelligence in ECE and significant impacts it has on children's classroom satisfaction. Artificial intelligence technology can help young children with personalized learning platforms and interactive tools. With the help of present techniques, ECE can be altered to gather the demands of individual school child, promoting worth and certainty. Furthermore, they assist to solve the problem by granting options for investigate. With the advent of dynamic software, innovative teaching methods, and engaging gamified learning environments, artificial intelligence (AI) is revolutionizing education, as this article explores. Thus, features the encounters and honorable impasses associated with integrating AI. In order to support children's overall development, the present examine point up in what manner essential using Artificial Intelligence responsibly together. To elaborate a model established by literature review, discussing in the future the benefits of AI in ECE as well as the honorable challenges concluded using this field.

***Keywords**: Education for sustainability, Early Childhood Education, Artificial Intelligence.*

Introduction

EFS and AI both have the potential to revolutionize ECE. It is possible to increase young children's awareness of environmental and social issues by incorporating IA tools that are appropriate for them, such as educational robots or entertaining applications. For instance, interactive games that use AI can teach kids about biodiversity or environmental management in a fun and personalized way. While developing the digital skills necessary for their future, this technology-pedagogy synergy encourages an early understanding of long-term principles.

Studying artificial intelligence (AI) uses methods like networks (neural), automated learning, and processing language to try to make intelligent computers capable of performing a variety of tasks (Mondal, 2020; Su and al., 2023). McCarthy defined artificial intelligence like "the knowledge and manufacturing of establishing intellectual engines" (Su and al., 2023; McCarthy, 2007). AI is changing a number of fields, including and public policy, science, health, and, psychology (Su and al., 2023; Xu and al., 2021).

Among the many applications in the field of education are test automation, learning tracking, performance prediction, and resource recommendation (Mousavinasab and al., 2021; Zheng and al., 2021; Crescenzi-Lanna, 2023; Zawacki-Richter and al., 2019; Su and al., 2023, 2022). Present study by Kewalramani and colleagues (2021) investigates using of interactional AI-enabled toys of robotic to engage children in preschool education. According to (Su and Yang, 2023) little research on AI in ECE; maximum studies on topic focus on secondary, primary and postsecondary schooling.

Whole schoolchildren, yet the youngest ones, obligatory reading Artificial Intelligence information, according to Su & al. (2023), and Ng & al. (2023) to adequately prepare them for the tasks of upcoming. This study will help answer the following questions: is there a connection between ECE, EFS, and artificial intelligence?

AI may increase the impact of ECE, which is crucial in advancing a culture of sustainability. Teachers can instill

ecological and social values in students from an early age by combining innovative teaching methods with AI systems that can tailor the content to each child's unique needs. Additionally, AI data analysis enables the evaluation of educational programs' efficacy and the modification of strategies to maximize their relevance. As a result, the convergence of AI, EFS, and pre-school education opens the door to a more responsible and aware generation that is ready to take on global challenges.

1. Literature review

1.1. Artificial intelligence

Artificial Intelligence is the major revolution that is radically altering how students learn, the roles that teachers play, and the skills that students must learn. Customizing educational paths according to each student's cognitive, emotional, and behavioral profiles is made possible by IA's capacity to process vast amounts of data, find models, and make adjustments in real time. Artificial Intelligence was first used by John McCarthy in 1955 computer is the referee was capable of a reach of cerebral functions that were similar to those carried out by including speaking, thinking, humans, solving problems, and learning.

According to (Russell and Norvig, 2010) AI using to imitate thinking processes as perception, prediction, and learning. According to Yang and Wang (2019, 2022), there is disagreement over the use of opinion-of-upkeep techniques like artificial intelligence and neural networks to solve problems. Artificial Intelligence like a power of or machine a computer achieveing jobs that are normally wrought by people's intelligent (Barabas et al., 2018; Berendt and al., 2020). Processes and knowledge are equally preserved by Artificial Intelligence (Jantakun and al., 2021; Baker and Smith, 2019). AI research advances in various subjects get guided to a significant growth in the collected works (Zhang et Aslan, 2021; Clancey and al., 1979; Kaplan and Haenlein, 2019; Zdenek, 2003; Andriessen et Sandberg, 1999).

Real spoken language dealing out, computer programs, robotics, machine control systems, and optical and hearing establishment are among the subjects that currently make use of AI (Jantakun et al., 2021). Some machines can now communicate with humans through the use of vision-hearing technologies (Li et al., 2020; Lathuilière et al., 2019; Zhu, 2020; Jantakun et al., 2021 ;). Because of its capacity to interact with people and direct them toward better performance, fully developed AI is considered one more important technological advancements (Zhai et al., 2021; Lawler et Rushby, 2013).

AI in the fourth industrial revolution is crucial element of and has the potential to drastically change the education sector, claim Zhao et al. (2021). When combined with big data, it permits the development of contemporary, tailored, flexible, and comprehensive acquisition methods (Berendt et al., 2020). Applying AI to finance modifications to learning schemes is the primary goal of AI in education (Ouyang and Jiao, 2021; Hwang and Tu, 2021; Holmes et al., 2023; Xu and Ouyang, 2022; Chen et al., 2020). Because it has the potential to significantly enhance education.

AI makes learning, research, and experimentation easier. Yang and Su, 2022). However, these opportunities do necessitate transparent governance, adequate teacher training, and robust infrastructure. AI might draw attention to inequality, implement digital surveillance techniques, or even standardize human intelligence based on technical standards in the absence of clear regulations and strong ethical principles. Consequently, education has two responsibilities: making use of IA's educational potential and encouraging critical thinking about its uses. Therefore, incorporating into education in a humanist, ethical, and intelligent way could make schools more engaging, equitable, and up to date with today's learning challenges.

1.2. Artificial Intelligence and Early Childhood Education

youthful's interest in AI can be sparked in their early years. ECE is one of the most crucial educational phases since it teaches children in what manner to work together with teachers, peers, and helps them take up interests that will motivate them for the rest of their lives. According to Gammage (2006), ECE typically lays the groundwork for future academic success in secondary and post-secondary education According to (Su and Yang 2022).

Establishing a contemporary setting for early childhood education where kids can acquire foundational skills is essential to their success in the future. For children to understand AI in the future, it is imperative that AI concepts be incorporated into ECE (Su and Yang 2022). There aren't many examine editorials covering the lessons of AI in ECE, even though there are a few that have already reviewed the studies of AI in related education (such as medical education and music education). According to (Fikri & Rhalma, 2024) research indicates that developing systems' AI empowering kids achieve for themselves, skills' developing critical thinking, and proof directed alone studying is essential.

AI boosts system efficacy and advances progress (Su and Yang, 2022). Youthful kids gain greatest as of practical learning methods because of their active and intellectual learning styles (Williams et al., 2019; Su and Zhong, 2022). it is believed that children as young as three years old could begin learning about artificial intelligence in a basic and

straightforward way Su and Zhong (2022). They studied prospectus growth for ECE departure of three different approaches to deliver kids by Artificial Intelligence knowledge: contribution kids in knowing AI know-hows in their everyday , explain them encoding consequently they can practice the skill of technologies in practical situations, and growth consciousness of some possible right apprehensions with by means of AI technologies Kim et al. (2021).

According to (Su and Zhong, 2022) the triple supplies for being AI well-educated are summarized as follows: The capacity, aptitude, and mentality of AI. According to (Kim et al., 2021) help students know the basics of AI is the scope of the Artificial Intelligence curriculum of knowledge. In plus, Su and Zhong (2022) Artificial Intelligence awareness capability is divided into bunches: "meanings and forms of Artificial Intelligence, «cognitive," search "problem-solving," "applications, data and machine learning". Kim & al (2021) considering their programming the aim of Artificial Intelligence awareness aid school learner in understanding the basics of AI.

Students' critical thinking about the application of AI and their capacity to identify both the advantages and disadvantages of AI for society are evaluated using the AI mindset competency (Su and Zhong, 2022). The Cozmo robot, Google's AIY, Cognimates, eCraft2Learn, ensorFlow Playground, and other helpful tools and resources are included in Touretzky's (2017) list for educators and students to utilize (Druga et al., 2019; Touretzky, 2017). AI might draw attention to inequality, implement digital surveillance techniques, or even standardize human intelligence based on technical standards in the absence of clear regulations and strong ethical principles.

Consequently, education has two responsibilities: making use of AI's educational potential and encouraging critical thinking about its uses. Therefore, incorporating AI into education in a humanist, ethical, and intelligent way could make schools more engaging, equitable, and up to date with today's learning challenges. As long as the person stays in the middle. Thus, our hepothesis:

H1: Artificial intelligence boosts positively impact the ECE

1.3. Early Childhood Education and Education for sustainability

In order to ensure a more equitable, ecologically responsible, and cohesive future, the relationship between ECE and EfS is becoming increasingly recognized as strategic and crucial. Although a person's early years are critical for shaping their values, attitudes, behaviors, and social skills, education for long-term development is all too often approached at a later stage of schooling.

According to (WCED 1987), by meeting their basic needs—clothing, food, and shelter—SD seeks to improve the majority of people's quality of life in developing nations. SD urges the extension of prevailing occasions to collect everyone's requirements and prospects advance living into incident of other disasters and ecological in a globe where inequality and poverty are the norm. Plus, according to (UNESCO 1997) education is seen as a crucial tool for delivering SD because of its sociocultural, economic, and environmental pillars.

People can participate in decisions about actions that will improve the quality of life today without jeopardizing humanity's future on a local, social, and global level by acquiring the knowledge, values, and skills required through Education for Sustainability (EfS). Education for sustainable development should be incorporated into all educational levels, starting with ECE. By embracing attitudes and behaviors that support a sustainable future for all, people should actively engage in and assume responsibility for a sustainable world from an early age (Kahriman-Pamuk et al. 2019).

People's attitudes toward the world and the environment are thought to be shaped by their early experiences (Wilson 2012). Since children's home environment, which includes their parents' beliefs, attitudes, conduct, and skills, is formed from ECE, starting EfS around this time will have a more lasting effect. It is well known that children's behavior-oriented learning develops through observations because learning is a cognitive process that occurs in a social context and is influenced by social norms (Bandura 1986).

By incorporating EfS into early childhood programs, the groundwork for ecological awareness, collaboration, diversity respect, empathy, and group responsibility is laid at a very young age. Lastly, combining EfS and ECE also means addressing social injustices early on because equal access to high-quality education promotes civic engagement, future integration, and the empowerment of kids from disadvantaged families. Decision-makers are assisting in the structural, long-term, and generational transformation of societies by funding this synergy between ECE and EfS, which is founded on prevention rather than reparation.

If we are to produce a generation that is cognizant, sensitive, and dedicated to the issues of our day, this paradigm shift in education is imperative. This research underlined the

significance of personalised considerations and response in raising student engagement and progress. Thus, our hepothesis:

H2: ECE benefits from application of EFS.

2. The conceptual framework

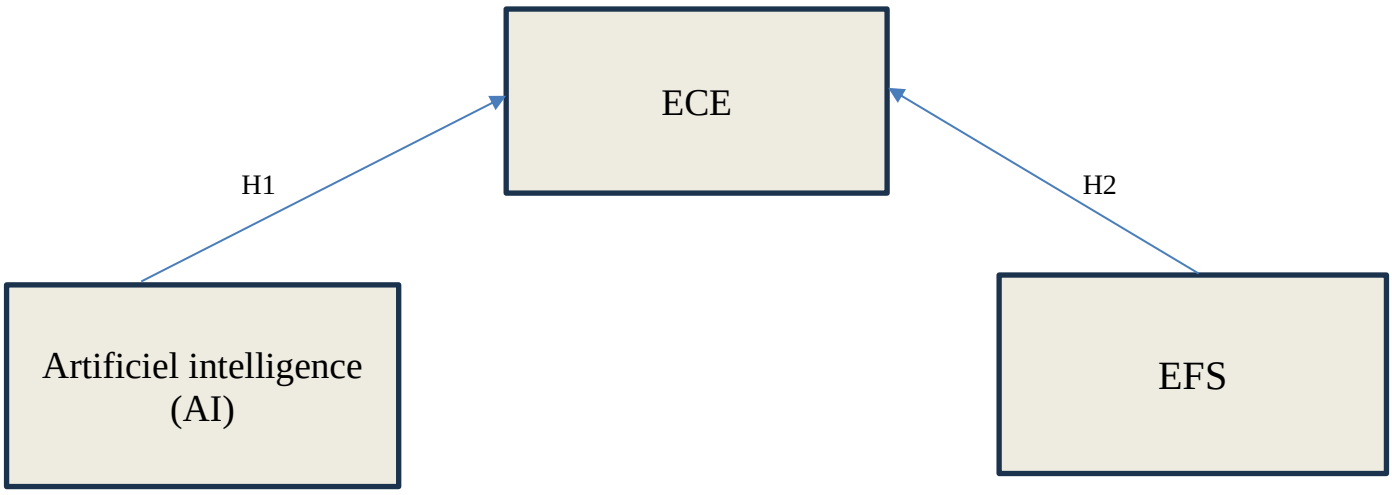

Figure 1: The Conceptual model
Source: Author

Conclusion

At the nexus of technological revolution, climate challenges, and educational transformations, a robust and structural connection has emerged between artificial intelligence (AI), EfS, and ECE. Preparing future generations to live, learn, and act in a complex, uncertain, and interconnected world is the common goal shared by these four seemingly unrelated components. Even though AI is a cutting-edge technology, it needs to be used in conjunction with education that promotes ethics, empathy, critical thinking, and teamwork - all soft skills that neither machines nor algorithms can replace. Furthermore, the foundation needed to address the difficulties presented by social and environmental issues - which are at the heart of EfS - is formed by these human skills.

By improving numerous planes of knowledge, artificial intelligence (AI) has the probable to reform preschool education. Teachers should obtain preparation on moral issues and the using of Artificial Intelligence in the schoolroom to promote a balanced approach that orders global expansion while optimizing the potential of AI in ECE. Artificial intelligence knowhow container create personalized and stimulating knowledge practices, but it cannot substitute educators in teaching life skills, social and emotional development, or moral values.

Educators are talented to determine specific wants of respectively schoolchild and afterward deliver personalized teaching. We suggest carrying out a quantitative study that takes educators' roles in this process into account to accomplish this goal. It's important to lay these foundations early on. ECE has an impact on character development, interpersonal relationships, nature, and emerging technologies. A powerful and progressive educational approach is created by carefully relying on AI while combining teaching techniques that develop creativity, emotional intelligence, and ecological consciousness.

The objective is not only to incorporate these components but also to express them in a logical and comprehensive educational vision in which technology promotes long-term human growth. Indeed, this link is necessary and exists. It pushes us to rethink education as more than just a way to transfer knowledge; rather, it is a way to create personal, societal, and ecological change, where people, the living, and technology interact in a responsible and integrated way.

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