

## **Fostering Technology and Artificial Intelligence in Early Years**

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### **Abstract**

*The integration of technology and artificial intelligence in early year's education has become a subject of increasing concentration and debate. This paper explored the potential benefits, challenges and considerations associated with introducing these advancements to young learners while proponents argue that technology and Artificial Intelligence (AI) can enhance cognitive development, creativity and problem-solving skills, skeptics raise concern about potential negative impacts on social interactions. Additionally, attention spans and ethical considerations were designed. Issues related to accessibility, equity and the role of educators in facilitating meaningful technology integration are crucial to address. The paper provided an overview of current research highlights, key areas for further investigation, emphasized the importance of thoughtful and responsible implementation strategies to maximize the potential of technology and AI in early year education.*

**Keywords:** Artificial Intelligence, Technology, Children, Early years, and Education.

### **Introduction**

The term "early years" describes a child's life from birth to about age eight. Establishing the foundation for physical, cognitive, social, and emotional development requires this developmental stage. In addition to parental care and guidance during infancy and toddlerhood, it frequently incorporates early childhood education, such as preschool and kindergarten. A child's total development is greatly influenced by their early years. Several studies underscore the importance of this time frame, highlighting how early events mold the structure of the brain and impact subsequent learning, behavior, and health outcomes. Meloy, Gardner, and Darling-Hammond (2020), Harvard University's Centre on the Developing Child (2021), and the National Scientific Council on the Developing Child (2007).

Early childhood development is greatly aided by technology and artificial intelligence (AI), which offers individualized educational experiences, interactive learning resources, and access to a variety of developmental opportunities. These technologies also encourage creativity and problem-solving abilities. They may also adjust to different learning styles and speeds, providing individualized support for every child's needs. Nonetheless, to sustain development, it is essential to provide balanced use and supervision. Even though AI is good, useful technology are essential to early childhood education, Nigeria's early childhood system still lacks integration. Therefore, in order to promote technology and artificial intelligence in Nigerian early childhood education, the study raised awareness and sensitization.

### **The importance of introducing artificial intelligence and technology to young children.**

Incorporating technology and artificial intelligence (AI) into early childhood education has several advantages, including the creation of individualized learning opportunities. According to Park (2020), this can improve learning effectiveness and engagement. With interactive tools like coding applications, digital art platforms, and narrative software, technology may help young children develop their creativity. According to Hirsh-Pasek, Goinkoss, Berk, and Singer (2019), these platforms promote experimentation and discovery. Through the presentation of real-world problems and the safe experimentation with solutions, AI-based educational games and simulations can foster critical thinking and problem-solving abilities in kids (Ozcelick& Yildirim, 2020).

Additionally, technology makes a wealth of information accessible, enabling kids to pursue a wide range of interests and subjects. Platforms for education driven by AI can produce relevant content that encourages self-directed inquiry and learning (Feng, Wong, &Hossan, 2019). According to Couse and Chen (2010), exposing kids to technology at a young age helps them develop critical skills like digital literacy and technological proficiency, which are becoming more and more important in today's workforce. By providing accessibility

capabilities like text-to-speech, speech recognition, and captioning, technology can accommodate a range of learning needs and skills, guaranteeing that all kids can engage and learn efficiently (Bouck, 2019).

According to Flanigan and Babchuck (2019), technology makes it easier for parents and teachers to communicate, giving them information on their children's development and allowing for cooperative participation in their educational journey.

### **The significance of the early years**

#### **Cognitive Development**

Cognitive growth is rapid during the early years. When brain growth is at its fastest, during the first few years of life, more than a million new synaptic connections form in the brain per second (Centre National Scientific Council on the Developing Child, 2007). According to Shonkoff and Phillips (2000), these early linkages lay the groundwork for later cognitive abilities including memory, problem-solving, and language acquisition.

#### **Development of Emotions and Social Skills**

Emotional and social development also heavily depends on the early years. A sense of security and self-worth are fostered by a secure attachment to caregivers at this time, and these qualities are critical for positive social interactions in later life (Bowlby, 1988). A child's early experiences and connections can have a big influence on how well they can control their emotions and form healthy relationships (National Scientific Council on the Developing Child, 2004).

#### **Health and Well-being**

Early life events can have a lasting impact on one's physical health and general well-being. According to Felitti, Anda, Nordenberg, Williamson, Spitz, Edwards, and Marks (1998), adverse early life events including abuse or neglect can result in mental health disorders, chronic health difficulties, and a shortened lifespan. On the other hand, favorable health outcomes and a lower risk of chronic diseases are associated with favorable early experiences, such as a supportive environment and sufficient nutrition (Shonkoff, Boyce, & McEwen, 2012, Oduntan, 2010).

#### **Educational Outcomes**

During early childhood, the groundwork for lifelong learning is laid. Excellent early childhood education programmes have been demonstrated to enhance academic performance, school preparedness, and even long-term educational attainment (Heckman, 2011). Early education has a lasting effect, as seen by the higher likelihood of improved academic performance and graduation for children who attend high-quality preschool programmes (Reynolds, Temple, Robertson, & Mann, 2001).

#### **Impact on the Economy**

There are substantial financial returns on investments made in early childhood development. James Heckman, the Nobel winner, has shown that early interventions can improve adult output and reduce the need for remedial schooling, resulting in a good return on investment (Heckman, 2006).

Early childhood programmes may result in lower social costs and higher economic production, which makes them a prudent social investment (2004) National Scientific Council on the Developing Child. The significance of early childhood education, especially from birth to age five, is well acknowledged and backed by a substantial amount of research. The basis for lifetime learning and wellbeing is laid during these critical years for cognitive, social, emotional, and physical development.

Early childhood is when the brain develops the fastest; by the age of five, up to 90% of a child's brain structure has been created. Neural connections are formed at this time at a startling rate, greatly impacted by the child's experiences and surroundings.

Children who are exposed to language early on—through talking, reading, and singing—have been demonstrated to improve their vocabulary and language abilities, which are essential for success in school later on. According to Di Liberto, Attaheri, Santisani, Reily, Nichoiedlbha, Rocha, Brusini, and Gosami (2023), children who get regular reading instruction are more likely to acquire excellent reading abilities, which are fundamental for learning in all subject areas.

Children who receive early education benefit from improved resilience and emotional control. Children learn to control their emotions and form safe attachments through responsive interactions with caregivers, both of which are critical for mental and social well-being. In 2023, Conkbayir; Chang, Negi, Samphel, & Won (2024).

### **Research –Based Methods for Early Education**

**Early Learning Supported by Research Learning through Play:** Play-based learning is a very successful strategy in early childhood education, according to research. It encourages the development of cognitive, social, and emotional skills through entertaining and instructive activities.

**Parental Involvement:** It is essential that parents and other caregivers participate in early learning. Better results in terms of children's growth and academic achievement are frequently observed in programmes that incorporate parental engagement. Barr and Lucas (2021)

**Early Education Programme Quality:** The caliber of early childhood education initiatives has a big influence on results. A number of important factors influence how effective these programmes are, including content, learning environment, class size, and teacher qualities. 2020's (National Association for the Education of Young Children, 2020)

### **Early Childhood Education and Technology: A Comprehensive Review**

There is a lot of discussion and study surrounding the use of technology in early childhood education. It is essential for educators, parents, and legislators to comprehend how technology affects young children's cognitive, social, and emotional development. Drawing from a wealth of research, this review explores the many facets of early childhood education and technology to offer a thorough summary.

**Improving Education via Interactive Media** Interactive media, such instructional games and applications, can greatly improve young children's cognitive development. According to research, technology can help children develop their critical thinking, problem-solving, and early reading skills when utilized properly.

In contrast to children who used traditional books, children who used digital storybooks showed better emergent literacy skills, according to a study by Neumann (2014).

### **The function of screen Time**

The type and quantity of screen time are important considerations, even when technology can be helpful. Children between the ages of two and five should only spend an hour a day on screens, with an emphasis on high-quality content, according to the American Academy of Pediatrics (2016). Delays in language development, sleep issues, and attention issues have all been related to excessive screen use.

### **Development of Social and Emotional Skills**

#### **Digital Platforms for Social Interaction**

Video calls and other digital platforms that promote social engagement can be useful in preserving social ties, especially when in-person interactions are scarce. According to research, video conferencing with well-known people can help young children develop their language skills and strengthen their social ties. In 2023, Berk, Golinkoff, and Hirish-Pasek; in 2022, Berbe, Agarwal, and Peters

### **Emotional Control and Technology Utilization**

Technology use may also affect one's ability to control their emotions. While some digital tools can help people learn how to recognize emotions and cope with them, excessive use of them—especially of non-interactive media—can lead to emotional and behavioural problems. According to Vandewater, Bickham, and Lee (2006), children who watched more television were more likely to act aggressively and have shorter attention spans.

### **Practices in Education**

#### **Technology Integration in Early Childhood Education**

It takes careful preparation and execution to include technology into early childhood education. Teachers must make sure that technology enhances rather than replaces conventional teaching strategies. Technology should be utilized as a tool to promote learning objectives, according to the National Association for the Education of Young Children (2012), which highlights the need of developmentally appropriate activities.

### **Support and Training for Teachers**

Training and support for teachers are also essential for the successful use of technology in early childhood education. Teachers who receive professional development in the use of educational technology are more likely to successfully incorporate it into their classes, according to research by Blackwell, Lauricella, and Wartella (2014).

### **Health-Related Issues**

#### **Effects on Physical Health**

Long-term usage of technology can affect young children's physical health. Concerns include things like eye strain, bad posture, and decreased physical activity. In order to support healthy development, the World Health Organization (2019) advises children ages one to four to engage in physical activity for at least three hours each day.

### **Sleep Interruptions**

Young children's sleep cycles might be disturbed by screen time, particularly right before bed. The hormone that controls sleep, melatonin, may be disrupted by the blue light that screens emit. Hale and Guan (2015) discovered a strong correlation between children's screen usage and lower sleep duration.

### **Equity and Access**

#### **Digital Divide**

Not all socioeconomic classes have equal access to technology. Low-income children frequently lack access to high-quality digital tools, which can make educational disparities worse. To guarantee that every youngster benefits from technology breakthroughs, it is imperative to address the digital divide.

### **Design Inclusive Technology**

All children, including those with impairments, should be able to use technology in an inclusive manner. Children with a range of requirements can benefit from features like interactive elements, voice descriptions, and text size adjustments in digital content.

There are benefits and drawbacks to incorporating technology into early childhood education. Technology can improve social, emotional, and cognitive growth when used properly.

Nonetheless, it is essential to maintain a balance in screen time, guarantee fair access, and assist teachers with appropriate training. **Maximizing** the positive effects of technology while minimizing any potential negative effects requires constant research and careful application.

### **Challenges and concerns of fostering technology and AI in Early years**

Technology is appropriate, but it also has drawbacks. In contrast, Berson & Berson (2019) view children's data privacy as a major concern because AI systems may collect and store personal information without proper consent or security measures in place. Hutton Dudley, Hurwitz Karly, and Dewitt Holland (2020) claim that excessive screen time can have negative effects on young children's development, including language delays, decreased attention span, and poor sleep quality.

Preventing biases and prejudice requires that early childhood education tools and technology be developed and utilized ethically (Yellad, 2019). According to Brookings, there is a chance that children from lower-income families won't have equal access to technology and artificial intelligence tools, which would exacerbate already-existing educational disparities.

Furthermore, a reliance on AI and technology may impede children's ability to think critically, solve problems, and be creative (Papadakos, Bertone & Christodoulou, 2019).

Not all AI-powered platforms or educational applications are made equal, so it's important to make sure the material is age-appropriate, supported by research, and in line with learning objectives. The requirement for sufficient training and continuous assistance for educators to successfully incorporate technology and artificial intelligence into early childhood education is another significant issue that the International Society for Technology in Education has addressed (Plowman, MC Pake & Stephen 2012). A multidisciplinary strategy combining educators, legislators, engineers, and families is necessary to address these issues and guarantee that



AI and technology are utilized in an ethical and responsible manner to promote children's learning and development throughout their years.

### **Techniques for promoting AI and technology in the early years.**

Learning is improved when young children are engaged in play-based activities that include technology and AI principles. Curiosity and investigation can be encouraged by resources such as interactive applications, instructive games, and programmable robots (Bers, 2018). Additionally, incorporating STEM ideas into early childhood education promotes experimentation, critical thinking, and problem-solving through robotics, coding, and fundamental engineering concepts (Clements & Sarama, 2018). Giving teachers chances for professional development to improve their knowledge of technology and artificial intelligence in early childhood enables them to assist integrating digital tools into the curriculum and creating engaging learning experiences (NAYEC, 2012).

Research has demonstrated that parents should be informed about the advantages of introducing technology and artificial intelligence (AI) to young children, as well as tools for fostering learning at home (Takeuchi & Stevens, 2011). Parents should be encouraged to participate in activities that foster their children's computational thinking and digital literacy. Talking with educators and kids about ethical issues related to technology and AI, such as privacy, online safety, and responsible tool usage, is another crucial part of promoting technology in the early years (NAYEC 2012). By providing devices, internet connectivity, and customized materials, it is also necessary to guarantee that all children, regardless of background or ability, may access technology and AI resources (Bers, 2018).

Collaborative endeavors may equally boost technology. Encourage cooperation and teamwork through technology and AI-related initiatives like cooperative coding exercises, robotics contests, or multimedia presentations (Clements & Sarama, 2018). It is necessary to establish assessment evaluation. Children's comprehension of technology and AI ideas should be evaluated using age-appropriate techniques, such as observation, recording, and reflection on their use of digital tools (NAYEC 2012).

### **Best practices of fostering technology and AI in Early years**

The best ways to promote AI and technology in early **childhood**

In order to make play-based learning activities interesting and fun, integrate technology and artificial intelligence. Educational applications such as "Sago Mini," for instance, provide interactive experiences that help children learn fundamental ideas via play (Sago Mini).

Give young children age-appropriate electronic tools, such as programmable robots, to facilitate hands-on activities. A physical programming device called "Cubetto" teaches kids as early as three years old about coding fundamentals.

Use AI and technology to improve learning results in the early childhood curriculum. Interactive games are available through tools like "OSMO" that enhance courses like reading and numeracy.

Children should be encouraged to use AI and technology as creative tools. Through digital narrative and character development, apps such as "Toca Boca" enable kids to explore their imagination (Toca Boca). To protect kids' general wellbeing, strike a balance between screen time and other activities. Guidelines for screen time based on age are provided by the American Academy of Pediatrics, which emphasizes the value of moderation.

Inform parents about the advantages and disadvantages of AI and technology on young children's development. Encourage them to be involved in their kids' technology use and offer advice on how to choose age-appropriate material.

Discuss ideas like algorithms and biases with kids to help them learn how to critically assess technology and AI technologies. With the help of the programming language "Scratch Jr," young children may make their own interactive stories and games that promote computational thinking.

Discuss ethical issues like online safety and digital citizenship that are related to technology and artificial intelligence. Common sense education is a resource that provides lesson plans and tools for teaching young children digital literacy abilities.

Teachers and caregivers may successfully support the constructive integration of technology and AI in the early years by putting these best practices into practice, laying a solid basis for the learning and development of young children. Ethical issues and duties are crucial while promoting technology and AI in the early years.

According to Jones Issross, S. Canion Clough, and MC Andrew (2020), it is crucial to put children's welfare first and make sure that technology improves their educational experiences without endangering their privacy or safety. By using existing relevant experience, such as putting strong parental controls in place (Smith, 2021) and encouraging digital literacy through material that is age-appropriate and in line with ethical guidelines (Garcia & Johnson, 2023), these concerns may be successfully navigated.

Technology integration in early childhood education may be made more responsible and moral by encouraging open contact with parents and teachers to discuss issues and get their opinions (Robinson & Patel, 2024).

## Conclusion

Technology and artificial intelligence (AI) are essential to education, cognitive development, and providing children with individualized learning experiences. They support dynamic learning settings, flexible curricula, and customized feedback to satisfy each student's requirements, encouraging creativity and critical thinking abilities from an early age. Furthermore, AI-powered solutions may help teachers evaluate students' development and pinpoint areas for growth, thereby raising the standard of instruction. Additionally, exposing kids to technology and artificial intelligence at a young age gives them the tools they need to succeed in the increasingly digital world they will live in. There is a lot of promise for improving learning experiences in early childhood education via the use of AI and evolving technologies. It highlights a few upcoming possibilities.

AI can provide individualized learning experiences by adjusting instructional content to each child's unique requirements and learning style.

Therefore, the following is a clear call to action for all parties involved: educators, parents, and policymakers: Encourage research on the effects of technology on early childhood development, give educators professional development on tech integration, include age-appropriate tech tools into early education curricula, and guarantee that all children have fair access to digital resources.

In addition, stakeholders should investigate innovative tech solutions specifically designed for early childhood education, work with tech companies to create child-friendly and privacy-conscious products, advocate for policies that promote responsible tech integration in early education, and encourage interdisciplinary collaboration among stakeholders to advance tech in early childhood education. They should also develop guidelines for responsible tech use in early childhood settings, engage parents in conversations about tech use, and provide resources for at-home learning.

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