

ARTIFICIAL INTELLIGENT (AI) ASSISTED INSTRUCTIONAL LEARNING TOOLS FOR PRE-SCHOOLERS IN ENHANCING NUMERACY AND LITERACY SKILLS IN ADEYEMI FEDERAL UNIVERSITY OF EDUCATION EARLY CHILDHOOD EDUCATION CENTER

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Abstract

The study investigated the effectiveness of AI-assisted instructional tools in enhancing numeracy, literacy, and combined nume-literacy skills among preschoolers adopted at Adeyemi Federal University of Education, ECE Centre. This research adopted a descriptive survey design. The population for this study is all the children in the centre. The sample consisted of twenty-five (25) participants to assess skill development. The study employed artificial intelligence tools, which include AI-driven phonics programs for the literacy part and interactive number games for their numeracy skills, to gather information on using number games. Findings revealed that AI-powered tools significantly improved numeracy through interactive number recognition and adaptive learning, while literacy skills benefited from AI-driven phonics, speech recognition, and personalised feedback. The integration of AI strengthened interdisciplinary connections between numbers and words, fostering holistic cognitive growth. Challenges such as unequal access to technology and ethical concerns were noted, emphasising the need for balanced AI implementation alongside traditional teaching methods. Recommendations include policy integration of AI numeracy/literacy programs, equitable resource distribution, and teacher training to ensure ethical and effective AI use in early education.

Keywords: Artificial Intelligence Tools (AIT), Numeracy, Literacy, Adaptive Learning

Introduction

Early childhood is a period that spans from birth to age 8. The period of early childhood education is crucial for children's brain development; this is a period during which the intelligence quotient (IQ) develops. Therefore, they become sensitive to their environment, develop essential skills and are imbued with foundational concepts that enable them for adulthood, which is a key part of the Nigerian educational system. It involves physical, cognitive, socio-emotional and language development of children, which is foundational for a child's future development. Alhosani (2022) stated that ECE is a foundational pillar in the development of any society. Adewusi *et al.* (2024) opined that early childhood education is globally recognised as a part of a nation's educational landscape. It is a bedrock upon which prospective educational attainment and societal contributions

are established. It is agreed that a high standard of early childhood educational programs enhances school readiness, lessens achievement gaps, and improves long term effect in terms of employment, health and other social integration.

Children are groomed from a tender age to the time when they are ready for proper school life with ease. These days, many children may have picked up one or two numbers and words from home before they eventually start school. Artificial intelligence is used in various places, including the home and school. At home, Many parents have iPads, tabs, and phones, with educational games and activities. With these, many children are introduced to numbers and reading activities; these AI tools are, in turn, brought into the crèche and playgroups in schools where children engage in AI learning activities. These activities introduce children to number-literacy skills, which prepare them for proper school life. Adrienne (2024) asserted that the introduction of AI in ECCE helps young children develop language and speech skills because it offers accurate and instant feedback and assessment on pronunciation, vocabulary, comprehension, fluency and accurate numeracy, which are crucial for a child's transition to proper school life.

Early childhood education enables care and thorough supervision while parents are away. With the introduction of AI in ECCE, monitoring systems such as AI-powered sensors and cameras can help monitor classrooms, playgrounds and detect potential hazards or accidents. Early childhood education imbues social norms in children. Through the use of AI, interacting with other children, their environment, material and other facilities becomes easy. Adrienne (2024) added that AI helps children gain confidence to express themselves, learn manners like, please and thank you for easy interaction among their peers.

Early childhood education gives room for creativity and enquiry through art, music, nature and play, which is where the use of AI comes into play. Some tools, like digital painting tools, provide children with avenues to express their creative minds. AI helps in composing, generating and exploring the world of music. AI-powered virtual reality tools provide children with immersive nature experiences that promote exploration and discovery. AI provides game-based learning platforms, which provide children with an interactive learning experience, early childhood education cooperation and team spirit in the sense that when children are interacting with one another when they engage in the use of AI tools learn how to work in oneness and cooperate together to get their work done. AI-powered collaborative tools such as shared digital workspaces enable children to work together on projects, which promotes teamwork and cooperation. Fikri and Rhalma (2024) opined that AI could be used in early childhood education to become inquiry literate. It has the power to stimulate creativity in children, by giving them access to design, music and art resources. It builds children into future social being, offers emotional support and values that transcends technology.

Early childhood education imbibes the rudiments of numbers, letters and colours. AI tools are programmed into activities that teaches and at the same time fun. AI interactive counting games engage children in counting activities, number recognition and other mathematical patterns such as shapes and colours. It exposes them to phonics and phonemic awareness, letter recognition, word building, colour recognition, colour mixing and matching and colourful patterns and shapes. Early childhood education enhances physical activities, which brings some part of the body into action. AI powered physical education tools, such as virtual fitness coaches, interactive dance mats, and smart playground equipment, can help engage children in physical activities while teaching them about rhythm, tempo and movement. Wilhelmina and Ohaka (2024) stated that integrating AI in early childhood education enhances language acquisition through learning of letters and boosts problem-solving skills through the rudiments of numbers.

Having gone through the concept of early childhood education, it has been proven evident that the use of artificial intelligence in children will help enhance the basic features of early childhood education and that the use of AI will aid nume-literacy skills in children.

LiteratureReview

Artificial Intelligence (AI) is a system that gives insight into problems for easy solutions. AI has emerged as a transformative force across various sectors, including education. Defined as the development of computer systems capable of performing tasks that typically require human intelligence, AI encompasses learning, reasoning, problem-solving, perception, and natural language processing (Russell &Norvig, 2020). It allows the

caregiver to have access to various ways of solving the child's problem with less difficulty.

AI refers to the simulation of human cognitive processes by machines, particularly computer systems. These systems are designed to analyse data, recognise patterns, and make autonomous decisions with minimal human intervention. AI encompasses several subfields, including machine learning, natural language processing, robotics, and computer vision, all of which contribute to its ability to perform complex tasks traditionally associated with human intelligence (Goodfellow *et. al.*, 2016).

The benefits of AI in Early Childhood Education include the integration of AI in ECE. This presents numerous benefits, such as enhancing both teaching methodologies and learning experiences by personalising learning, teachers' support, inclusive education, and engagement and motivation. AI-powered educational platforms can tailor learning experiences to meet individual developmental needs. Adaptive learning systems adjust content complexity based on a child's progress, promoting engagement and cognitive growth (Holmes *et. al.*, 2019). This implies that AI can foster personalised learning.

AI-driven educational games and interactive tools foster an engaging learning environment, motivating young learners through interactive and playful experiences (Holmes *et al.*, 2019). AI holds significant potential to revolutionise Early Childhood Education by offering personalised learning experiences, enhancing teacher effectiveness, and fostering inclusive educational environments. As AI technologies continue to evolve, their thoughtful integration into ECE can support the cognitive, emotional, and social development of young learners, paving the way for more effective and equitable educational practices.

Objectives of the Study

The general objective of this study is to investigate AI Assisted Instructional Learning Tools for Pre-schoolers in Enhancing Numeracy and Literacy Skills in Adeyemi Federal University of Education, ECE Centre, while the specific objective is to:

1. How AI instructional learning tools enhance pre-schoolers' numeracy skills
2. How AI instructional learning tools enhance pre-schoolers' literacy skills
3. How AI instructional learning tools enhance pre-schoolers' numeracy-literacy skills

Research Questions

1. Do AI-assisted instructional learning tools enhance pre-schoolers' numeracy skills?
2. Do AI-assisted instructional learning tools enhance pre-schoolers' literacy skills?
3. Do AI-assisted instructional learning tools enhance pre-schoolers' numeracy-literacy skills?

Methodology

The study employed a descriptive survey design. The pupils used in the study were the pupils in the Nursery Public Schools in Ondo State. A simple random sampling technique was used to select 25 pupils for the study. The instrument used consists of questions asked to see if it is right or wrong (Yes/No) and AI instructional learning tools, which include AI-driven phonics programs for the literacy part and interactive number games for the numeracy skills. Descriptive statistics such as frequency and simple percentage were used to answer the research questions.

Results

Research Question 1: Do AI-assisted instructional learning tools enhance pre-schoolers' numeracy skills?

Questions	Right %	Wrong%
1. Recite number 1-50	20 (80%).	5(20%)
2. Can you tell me which number comes before 9	23 (92%)	2(8%)
3. From the number placed on the floor, Select numbers from 21-40	13(52%)	12(48%)
4. Number 1 plus 2 is what?	25(100%)	0.(0%)

Both the intact and control group were able to answer the questions during observation. It shows that numbers of pupils that answered the question rightly is more than those who were wrong.

From the study, the tools being presented to the pupils to use, the pupils were able to recite numbers-1-50, it revealed that the pupils have developed the numeracy skills; In the control group, the tools (games) were not administered, but the pupils were able to recite the numbers without any difficulties. From the table 1 above, items 1, 2, 3, 4 showed that questions were answered rightly, 80%, 92%, 52% and 100% respectively. This showed respectively that the number games developed pupils' numeracy skills, while the wrongly answered items were 20%, 8%, 48% and 0% respectively.

Research Question 2: Does AI assisted instructional learning tools enhance pre-schoolers literacy skills?

Questions	Right %	Wrong%
1. What is the corresponding word of number 1 and 2	24 (9%)	1(4%)
2. Recite one 1 to ten	19 (76%)	6(24%)
3. Spell two letter words	16 (64%)	9 (36%)
4. Identification of alphabets	15 (60%)	10(40%)

When the endless number numeracy tools were given to pupils, the children were able to identify, pronounce and spell the numbers. Numbers 1-50 were placed on the table at the corner of the class, each child was asked to pick different numbers and were also asked to spell the figure picked. Also, when the tools were not administered to the control group, the pupils were able to read / recite and spell. This shows that the pupils are familiar with the tools and the use of it. The table above shows that items 1,2,3,4 shows rightly responded and high percentage 96%, 76%, 64% and 60% while the wrongly answered items are 4%, 24%, 36% and 40%. Which significantly shows that number game teaches numeral and literacy which develops children's skills.

Research Question 3: Does AI assisted instructional learning tools enhance pre-schoolers numeracy skills?

Questions	Right %	Wrong%
1. Recite number 1-10 and spell	21 (84%)	4(16%)
2. Two letters words and three letter words is equal to what	24 (96%)	1(4%)
3. How many colours are there on the floor, separate and calculate	19(76%)	6 (24%)

The table above demonstrated that those pupils have knowledge about nume-literacy skill in the game provided. The same game that tested nume-literacy skills showed that 84% of the pupils rightly answered the questions while 16% answered wrongly. Item 2 and 3 showed that 96% and 76% were right while 4% and 24% answered wrongly. The outcome of the study shows holistically that the pupils have nume-literacy skills.

Discussion of Findings

The study investigated the impact of AI-assisted instructional learning tools on preschoolers' numeracy and literacy skills, yielding significant results. The findings exposed that these AI-driven tools led to notable enhancements in numeracy skills. For example, children demonstrated a remarkable ability to answer basic addition questions, with 100% success in one instance. This indicates that interactive number games foster engagement and a strong understanding of fundamental concepts. Even in the control group, where no AI tools were used, pupils showed proficiency in basic numeracy, yet the experimental group benefited clearly from the engaging activities provided by AI.

Similarly, the tools significantly improved literacy skills. The high percentage of correct responses in literacy tasks, such as identifying letters and spelling words, shows the effectiveness of AI in promoting familiarity with language. Immediate feedback from the AI systems helped reinforce learning, ensuring that children corrected mistakes in real-time.

Furthermore, the study dug out the development of 'nume-literacy' skills, which is an integrated approach combining numeracy and literacy. This showed that children were able to learn collaboratively and apply their skills, leading to holistic cognitive development.

Conclusion

This study investigated the impact of AI-assisted instructional learning tools on pre-schoolers' numeracy and literacy (nume-literacy) skills at AFUED ECE Centre.

The study revealed that AI-powered tools significantly improved pre-schoolers' numeracy skills by engaging them in interactive number recognition, counting activities, and pattern identification. AI-driven adaptive learning systems provided real-time feedback and personalised learning experiences, leading to better mathematical understanding compared to traditional methods.

AI tools were found to be highly effective in promoting literacy skills among preschoolers. The use of AI-supported phonics, letter recognition exercises, and interactive storytelling activities improved children's vocabulary, pronunciation, comprehension, and fluency. AI provided immediate corrections and reinforcement, enabling better retention of literacy concepts.

The integration of AI in early childhood education strengthened both numeracy and literacy skills, demonstrating that nume-literacy can be effectively developed through AI-assisted instruction. AI facilitated interdisciplinary learning, allowing children to make connections between numbers, words, and real-life problem-solving, thereby fostering a holistic cognitive development approach.

Despite these positive outcomes, challenges such as unequal access to AI technology, ethical concerns regarding data privacy, and the need for teacher training in AI utilisation were identified. The study underscores the necessity of balancing AI-assisted instruction with traditional teaching methods to maximise learning benefits while maintaining human interaction. The study promoted critical thinking skills and logical thinking skills. It promoted social emotional interaction. It also promoted language development and word formation.

Recommendations

Enhancing Preschoolers' Numeracy Skills through AI. Educational policymakers should integrate AI-powered numeracy programs into early childhood curricula to strengthen foundational math skills. AI-driven games and virtual simulations should be further developed to reinforce mathematical concepts in an engaging and age-appropriate manner. Schools should incorporate AI-assisted phonics and language development tools into early learning environments to enhance preschoolers' reading and communication abilities.

AI-based speech recognition and interactive storytelling applications should be leveraged to provide personalised reading experiences that cater to each child's learning pace. Educators should adopt AI-assisted

interdisciplinary learning approaches that seamlessly integrate numeracy and literacy instruction, allowing preschoolers to develop both skills simultaneously. AI-enhanced collaborative learning activities should be introduced to encourage problem-solving, critical thinking, and logical reasoning in early learners.

Government and educational institutions should ensure equitable access to AI learning tools, especially in underprivileged communities, to prevent a digital divide. Public-private partnerships should be encouraged to provide affordable AI-powered educational resources to early childhood centres. AI-assisted learning should complement—not replace—teacher-led instruction to preserve essential human interaction in early childhood education. Teachers should be trained in using AI as a supportive tool while maintaining their role in fostering social and emotional learning. Strict regulations should be established to protect preschoolers' data privacy and ensure ethical AI implementation in early learning environments. AI tools should be designed with transparency and inclusivity to prevent algorithmic biases that may disadvantage certain learners.

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