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Prospects and Challenges of Artificial Intelligence for Effective Teaching and Learning in Early Childhood Education Centres in Rivers East Senatorial District

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Abstract

The study investigated the prospects and challenges of artificial intelligence for effective teaching and learning in early childhood education centres in Rivers East Senatorial District. A descriptive survey design was adopted just as two research objectives and corresponding research questions guided the study. The population for the study comprised all the head teachers in the study area numbering 731, both the stratified and purposive sampling techniques were used to select 183 head teachers representing 25% of the population. The instrument used for data collection was a self-structured questionnaire titled “Prospects and Challenges of Artificial Intelligence for Effective Teaching and Learning in Early Childhood Education Centres Questionnaire (PCAIETLECECQ)”. Face and content validation of the instrument were carried out by two experts in test, measurement and evaluation department in order to ensure proper evaluation. The reliability coefficient obtained was 0.86 which was high enough. Likewise, the researchers subjected the data generated to percentage analysis in order to answer the research questions. The findings of the research revealed that personalised learning was the highest prospect of artificial intelligence in effective teaching and learning in early childhood education centres in Rivers East Senatorial District while inadequate preparedness of teachers was the major challenge of artificial intelligence in teaching and learning in the study centres. The study concluded that by leveraging AI-powered tools and platforms, caregivers can personalise learning experiences, enhance learners' engagement and optimise teaching methodologies to meet diverse learning styles. It was thus recommended among others that there should be professional development and training programmes organized by both government and head

teachers of early childhood education centres for caregivers to build their capacity for effectively integrating AI tools and resources into the early childhood curriculum.

Keywords: Artificial Intelligence, Effective Teaching, Prospect and Challenges

Introduction

Early Childhood Education (ECE), also referred to as early child care evolves in Nigeria as a special field of focus for development intervention. It attempts to create an enabling environment for the Nigerian child to thrive and develop to the fullest potential in line with the national goal and aspiration of building a land of bright and full opportunities for all citizens. Consequently, the care and support received by a child in terms of nutrition, psychological care and protection are crucial in his formation and development with regard to intelligence, personality and social behaviour.

Early Childhood Education (ECE) as a concept is used for children of different age bracket who are yet to attain the school-going age (preschoolers). ECE also known as pre-primary, pre-school or nursery school education, among others, encompasses the overall social, physical and intellectual development and education of children below the age of six years (Maduewesi, 2005). The Federal Government of Nigeria (FGN, 2014), in the National Policy on Education document defined ECE as the education given in an educational institution to children prior to their entering into primary school. It includes the crèche, nursery and kindergarten. It shows that younger children are to be taught in informal settings as in the crèche starting from birth to two years, the nursery, two to three years, and kindergarten, three to five years. Therefore, ECE in this study refers to any formal education provided for children from birth to five years before primary school age, during which the curriculum enables them to acquire social skills and develop physically and intellectually as a foundation for life and transition into primary school.

The essence of ECE as outlined in the National Policy on Education shall be to ensure a smooth transition from home to school, prepares the child for the primary level of education and provides adequate care and supervision for the children while their parents are at work. Other reasons include to inculcate social norms in the children, inculcate in children the spirit of enquiry and creativity through the exploration of nature, the environment, art, music and playing with toys, among others as well as develop a sense of co-operation and team- spirit with people (Eddy, 2010). In contemporary times, Artificial intelligence can be utilized in facilitating early childhood education in the society.

The emergence of artificial intelligence (AI) in today's world brings new possibilities and challenges to the teaching-learning process in schools. AI is a promising new tool that can be utilised to improve teaching and learning processes at the various level of education, including that of early childhood and is construed as 'man-made thinking power', where artificial means 'man-made' and intelligence means 'thinking power' (Choudhury, 2022).

With its ability to customise lessons, enhance learning opportunities and provide caregivers and preschoolers with cutting-edge tools and resources, AI has the potential to completely transform the educational landscape in terms of both teaching and learning effectiveness. Its applications

have the potential to significantly alter the field of early childhood education by providing learners with more accessible, efficient and interesting learning opportunities. Also, the natural language processing (NLP) in education has the promise of utilising AI to improve teaching and learning in early childhood centres in Rivers East Senatorial District. AI systems can comprehend, interpret and produce human language by utilising natural language processing (NLP) methods in research (Bassey & Owushi, 2023).

However, together with its educational potentials comes certain challenges which need to be carefully addressed. These include teacher preparedness, ethical considerations and equity as schools consider integrating AI into their pedagogical methods. The study thus attempts to offer insights and suggestions for utilising AI to improve educational outcomes in early childhood education centres while managing its complexities and subtleties inherent in its deployment, within the framework of early childhood education mission and goals.

Objectives

The objectives of the paper are to:

1. discuss the prospects of artificial intelligence in effective teaching and learning in early childhood education centres in Rivers East Senatorial District.
2. examine the challenges of artificial intelligence in teaching and learning in early childhood education centres in Rivers East Senatorial District.

Research Questions

The research questions are:

1. What are the prospects of artificial intelligence in effective teaching and learning in early childhood education centres in Rivers East Senatorial District.
2. What are the challenges of artificial intelligence in teaching and learning early childhood education centres in Rivers East Senatorial District.

Artificial Intelligence

Artificial Intelligence (AI) connotes a broad range of technologies that under-pines many products and services which people use on daily basis. It includes chatbots that offer real-time customer care and applications that suggest TV series. AI is a technology that, when applied alone or in conjunction with other technologies, allows computers and other machines to mimic human intelligence and problem-solving abilities. Hence, tasks that would normally require human intelligence or intervention can now be completed by it (Coursera Staff, 2024) .

According to Copeland (2024), artificial intelligence is the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings. It is frequently applied to the task of developing systems endowed with the intellectual processes that are characteristic of humans, such as the ability to reason, discover meaning, generalise or learn from previous experience. It is equally the production of computer systems that can render tasks that typically require human intelligence.

Likewise, Glover (2024) viewed artificial intelligence as the theory and development of computer systems capable of performing tasks that historically required human intelligence, such as recognizing speech, making decisions and identifying patterns. It is an umbrella term that covers a wide variety of technologies, including machine learning, deep learning and natural language processing (NLP) as well as enables machines to match, or even improve upon, the capabilities of the human mind.

Artificial intelligence helps in the simulation of human intelligence processes through machines, especially computer systems (Laskowski, 2024). Specific applications of AI include expert systems, natural language processing, speech recognition and machine vision. In certain areas, AI can perform tasks much better than humans. It uses multiple technologies that equip machines to sense, comprehend, plan, act and learn with human-like levels of intelligence. Fundamentally, AI systems perceive environments, recognise objects, contribute to decision-making, solve complex problems, learn from past experiences and imitate patterns.

Teaching Effectiveness

Teaching effectiveness shows the capability of caregivers to teach in such a manner that they attain success and bring about the desired change in the learners' behaviour. Hawthorne (2022) averred that teaching effectiveness shows the knowledge, strategies, processes and behaviours of caregivers that lead to good learning outcomes; which further demonstrates both the quality of teaching and the capability of caregivers. Consequently, teaching effectiveness requires caregivers to continually enhance practice by adopting an evaluative mindset. It is informed by the growth-focused evaluations of teaching practice, indicators of learning and wellbeing and a positive school culture (Goel, 2023).

According to Jupp (2009), teaching effectiveness assists a teacher to produce gains on learners' achievement scores, taking account the baseline measure of learners' prior attainment and other characteristics of their intake. It also demonstrates the practical outputs (qualitative and quantitative preschooler learning) of teaching. These outputs are calculated by value-added assessments, which measure how much a caregiver improves a preschooler's learning) or other rigorous measures. Likewise, they are qualitative observations of a caregiver's classroom performance by a head teacher or peer who understands the classroom practices that improve learner's achievement (Little et al, 2009).

Teaching effectiveness shows how preschoolers are able to replicate what they have been thought. Where they are able to do this, one can say that the teaching has been effective. With this, learners are able to practice on their own and become better in their studies. At the early childhood education level, this is very important in order to develop the cognitive, affective and psychomotor aspects of preschoolers.

Learning Effectiveness

In the course of designing learning programmes, their effectiveness is very crucial. When learners can retain and access information over long periods of time, it is an indication of an effective learning process. Learning effectiveness thus implies the ability of a learning programme to achieve its intended learning outcomes and produce the desired results. It focuses on the quality of learning and the application of that learning to impact performance. An effective programme does that by keeping learners engaged, motivated and participative (Goel, 2023).

The emphasis on learning as an ongoing continuum is vital for setting expectations around learning outcomes and designing learning experiences that build on one another (Davey, 2023). On several occasions, learning effectiveness shows up as a change in behaviour, critical thinking abilities and the application of new knowledge to new situations. It enables preschoolers to completely understand what they have learnt and apply them in live situations.

Furthermore, effective learning emphasises the understanding, intelligence, perseverance and quality of learning. It involves creating a comfortable and conducive learning environment, providing necessary facilities and resources and incorporating research components into the educational curriculum. It is equally characterised by the ability to generate positive feelings and favourable attitudes towards learning, which in turn facilitates active engagement and proactive behaviour in the learning situation (Adams et al, 2020).

Public Early Childcare Centres (ECCCs)

Public ECCCs in Nigeria started in 2004 when the Federal government decided to fund a one-year pre-primary education across the country. In order to be a feeder centre to the public primary school, which was experiencing low enrolment, the preschool centres were created as a section in all the public primary schools (Undiyaundeye, 2013). It is expected that all government policies concerning ECE will be implemented in the public centres in order to make them models to other centres. Salami (2016: 5) highlighted the characteristics of preschool sections in the public primary schools in Nigeria as of November, 2015 thus:

1. The centres had no curriculum that guided their activities. Most of the time, the teachers either borrowed from the nearest private school (the curriculum used by the private schools is foreign based) or relied on the experience of the teachers to decide what to teach.
2. About 75% of the public schools in southwest part of Nigeria did not have any of the policy documents. Therefore, the teachers were not aware of the policies guiding the implementation of ECE in the country.
3. Children of different ages were given admission and were put into the same class in most cases. The age ranged from 2 years plus to 5 years plus. All the children were exposed to the same activities in the learning area.
4. 'Experienced' primary school teachers were redeployed to teach at the pre-primary section. These 'experienced' teachers were those that had at least National Certificate in Education (NCE), who studied Primary Education Studies (PES) and had been teaching for many years. Government failed to employ teachers that studied ECE to handle the children.
5. The major teaching strategy was direct instruction (teacher-centred) and the children were taught using *say-after-me*, *songs* and at times, *rhymes* methods to commit the content into the memory of the children. The children were only allowed to play (unguided and unplanned for) during short break (10mins), long break (30mins) and closing hour when going home.
6. The language of instruction was the English Language which was interchangeably used with the Language of the Immediate Community (LIC) occasionally. Teaching LIC to the children was by choice; while some centres do, some do not at all.
7. The only resources in the learning centres were chairs and tables for the children and caregivers, and chalkboard. Learning resources were either not supplied at all or grossly

inadequate. Those that were supplied were kept out of reach of children in the name of protection from being getting spoilt.

8. The activities were mainly academic and the focus was to develop the intellectual ability of the children. The social, emotional and physical development domains of the children were ignored by the centre.
9. About 70% of the centres visited had a single teacher working with the children. There were situations in which a teacher was meant to teach the children and one other primary class at the same time.
10. The learning environment was generally unattractive and lacks both indoor and outdoor playing materials. There were playing grounds for the children but none of the centres had play materials; the playgrounds were not well-kept and safe for the children.

Going further, the UNESCO International Bureau of Education (2006) identifies ECC as a crucial process for optimal care, early stimulation and a fulcrum upon which the attainment of the child's fullest potential development depends. Likewise, Eva (2003) ascribed ECC as the care for children while their parents/guardians are at work; implying a supplementary service. This is so since parents delegate their duties and responsibilities of providing care and adequate experiences to their children to those caregivers in their absence. Thus, the programme of any quality childcare must include educational learning activities as part of its curriculum.

Among the roles of ECCC centers in the lives of children, is that their staff partner with parents to help them learn how to support children's learning at home; in order to facilitating optimal development of the child. This led to the reason that ECC is a careful and appropriate arrangement done to ensure that children are physically healthy, emotionally secure, mentally alert, socially capable and intellectually able to learn, when sent to learning centres such as school.

Equally, the ECCC is where children aged birth – 5 years are taken care of in the absence of their parents. According to Undiyaundeye (2013), it is an institution where children are cared for, by a person other than their parents while their parents are out working for a livelihood. Similarly, Ibiam (2012) considered ECCC as a product of deliberate efforts made by individuals or group of persons or organizations to help infants and children live well, cope better in the absence of parents and in this process, have a drill on skills to achieve positive progress in development tasks. Actually, the ECCC has a variety of meanings to different scholars. For instance, Undiyaundeye (2013) considered ECCC as highlighting a social network provided for children and infants meant for developing insight into possible ways of identifying and solving recognized developmental problems of children and turning them into useful products for the society.

The ECCC is presently administered by individuals and agencies that provide varieties of care and services and are observed in many places. No matter the nature of child care provided, major factors to consider are the centre, the ability to afford the cost as well as accessibility. In support of these facts, both NERDC and UNICEF (2005) as well as Ukeje(1992), stated that ECCC could be established in different places such as families, halls, churches mosques, existing schools, purposes-built structures, among others. However, such centres should be of reputable quality and should be of a walking distance of not more than two kilometers from the child's home.

The Prospects of Artificial Intelligence for Effective Teaching and Learning in Early Childhood Education Centres

The prospects of artificial intelligence (AI) enhancing the effectiveness of teaching and learning in early childhood education centres include:

1. Personalised Learning

AI-powered adaptive learning systems can direct educational experiences to the individual needs and learning styles of preschoolers. In the context of early childhood education, AI algorithms can analyse preschoolers' strengths, weaknesses and learning patterns to provide personalised learning pathways. For example, AI- driven platforms can offer customised quizzes, simulations, and interactive exercises based on preschoolers' proficiency levels and learning objectives. By meeting each preschooler's pace and learning preferences, AI enhances a deeper understanding and retention of education concepts (Okeke, 2017).

2. Intelligent Tutoring Systems (ITS)

Intelligent Tutoring Systems (ITS) are AI-based platforms designed to offer personalised guidance and feedback to preschoolers, mimicking the role of human tutors. ITS can offer real-time assistance and explanations, identify misconceptions and suggest relevant resources for further study (Adams et al, 2020). These systems can engage preschoolers in interactive problem-solving activities, simulations, and virtual experiments, fostering active learning and critical thinking skills. Also, ITS can track preschoolers' progress over time, enabling caregivers to intervene when necessary and adjust instructional strategies appropriately.

3. Natural Language Processing (NLP) in Early Childhood Education

Natural Language Processing (NLP) technologies enable AI systems to understand, interpret and generate human language wonderfully. For instance, NLP powered chatbots and virtual assistants can interact with learners in natural language, answering questions, explaining concepts and providing further resources. They can equally offer on-demand support outside the classroom, serving as personalised tutors accessible anytime and anywhere (Aina, 2023). Moreover, NLP algorithms can analyse learners' written responses to open-ended questions, providing automated feedback on their reasoning and communication skills. This advancement has the potential to promote communication between AI-powered systems and learners, resulting to better authentic and engaging interactions.

Challenges of Artificial Intelligence to Teaching and Learning in Early Childhood Education Centres

Some of the challenges of artificial intelligence to teaching and learning in Early Childhood Education Centres include:

- Limited Ease of Accessibility:**

Despite the many benefits AI has to offer, the permanent integration of artificial intelligence in education may lead to limitations for some learners. In developed countries, issues such as smartphones, other forms of gadgets and internet connections which help the activities of artificial intelligence are easily accessible. However, in developing countries,

this certainly is not the case. Socio-economic status and geographical location can serve as limitations in the adoption of artificial intelligence in education (Awofiranye, 2024).

- Inadequate Preparedness of Caregivers

The integration of AI into the educational system will mean that caregivers will need to be adequately trained and prepared for its purpose to be actualised. Providing adequate training and support for teachers is essential for the successful implementation of AI in education. Sadly, this may require some funds which are hardly available. Due to the high technology that AI carries, continual practice is required to help the caregivers understand how it works as well as its application in classroom setting. Presently, many caregivers lack training in this regard.

- Ethical Issues:

Another major challenge in adopting AI in the educational system concerns ethics and transparency in the collection and use of information. The integration of artificial intelligence in education raises ethical concerns as it relies on data to function effectively (Holmes et al, 2019). Hence, issues such as personal data, data privacy and ownership as well as confidentiality require transparency, and ethics. These factors have to be considered carefully to avoid breach of trust or an innocuous damage / disdain to one's right or belief.

Cognitive Developmental Theory

The cognitive theory was postulated by Jean Piaget in 1954. It explains that children go through four stages of cognitive development as they actively construct their knowledge and understanding of the world around them (Onoh & Onu, 1999; Omotayo, 2006). Two processes underline the way the child constructs knowledge of his environment: organization and adaptation. To make sense of the world, an individual organises his experiences; he separates essential ideas from less relevant ones and connects one idea to another. In addition to organising observations and experiences, the individual adapts and adjusts to new environmental demands.

Piaget also asserted that the child undergoes four stages of cognitive development and in his construction of knowledge. Interestingly, each stage is related to age and consists of a peculiar way of thinking and a distinct way of understanding the world. To him, the child's cognition is qualitatively different in the different stages. However, present study is interested in the first two stages: sensorimotor and preoperational stages. The sensorimotor stage, lasts from birth to about two years of age; it is the first stage of cognitive development of the child. Children at this stage have a cognitive system that is limited to the motor reflexes. They learn from their parents and care-givers and imitate what they see and hear; and experiment with muscle movements and sounds that the mouth makes. At this stage, infants construct an understanding of the world by coordinating sensory experiences such as seeing, hearing and touching. The Sensorimotor stage is further classified into six sub-stages which explain the stage by stage development of the infant from birth to 2 years when the child gains the mental ability to represent reality. From here, the child then progresses to the preoperational stage (Wopara, 2020).

The preoperational stage connotes the second stage. It commences at about age two and lasts until the child is about six or seven years old. According to Piaget, during this stage,

children start to use mental imagery, language (word) and drawings. These children are very egocentric and view things that are happening around them only through their point of view. Piaget probably discovered that his own children at this age could not understand why their parents felt the way they did but only reasoned from what the children knew. Children at this stage reason in a non-logical and non-reversible pattern (Oshungbohum, 2005).

In his early work, before he had constructed his structuralism theory of cognition, Piaget described the child's thought during this period as being governed by principles such as egocentrism, animism and other similar constructs. Egocentrism is when a child can only see a certain situation his way. One cannot comprehend that other people have other views and perceptions of scenarios. Animism is when an individual gives lifeless object human-like qualities. Such an individual believes that this object has human emotions, thoughts and intentions. Once he had proposed his structuralism theory, Piaget characterized the preoperational child as lacking the cognitive structures possessed by the concrete operational child. The absence of these structures explains, in part, the behaviours Piaget had previously described as egocentric and animistic; for instance, an inability to comprehend that another individual may have different emotional responses to similar experiences. During this stage, children become increasingly adept at using symbols as shown by the increase in playing and pretending (Wopara, 2020).

The relevance of Piaget's theory of cognitive development to this study is that the theory described the process of cognitive development of the child in four stages and the preschooler happens to fall into the second stage and the preoperational stage which is ages 2 to 7 and the preschooler is ages 3 to 4. At this stage, the child is not yet able to conceptualize abstractly and needs concrete, physical situation which instructional facilities such as alphabet games, electronic games, puzzles, smart boards, work sheets, etc. provide. When they see physical objects, they will be able to concretize their learning. Interestingly, these things are now provided by artificial intelligence.

This theory is also relevant as it guides the selection of activities, methods of instruction and materials at different stages; considering the child's ability. For instance, a child at preoperational stage cannot be asked logical questions concerning concrete events or to arrange objects in different sets. The question has to be asked within the age range of the child. Another essential aspect of this theory is how Piaget explained organisation and adaptation as a systematic pattern of information that enables the child's cognitive structure to become more articulate and sophisticated, enabling the child to adapt to the new environment. Consequently, the child is prepared for growth, development and greatness.

Methodology

The researcher made use of a descriptive survey design in carrying out the study. The population for the study comprised all the head teachers in the study area numbering 731, both the stratified and purposive sampling techniques were used to select 183 head teachers representing 25% of the population. The instrument used for data collection was a self-structured questionnaire titled "Prospects and Challenges of Artificial Intelligence for Effective Teaching and Learning in Early Childhood Education Centres Questionnaire (PCAIETLECECQ)". Face and content validation of the instrument were carried out by two experts in test, measurement and evaluation department in order to ensure proper evaluation. The

reliability coefficient obtained was 0.86 which was high enough. Likewise, the researchers subjected the data generated to percentage analysis in order to answer the research questions.

Research Questions 1: What are the prospects of artificial intelligence in effective teaching and learning in early childhood education centres in Rivers East Senatorial District.

Table 1: Percentage Analysis of the prospects of artificial intelligence in effective teaching and learning in early childhood education centres in Rivers East Senatorial District.

Prospects	Frequen cy	Percentage (%)
Personalised Learning	69	37.71**
Intelligent Tutoring Systems	63	34.43
Natural Language Processing (NLP)	51	27.89
TOTAL	183	100%

The highest percentage frequency

Source: Field Survey

Table 1 presents the percentage analysis of the prospects of artificial intelligence in effective teaching and learning in early childhood education centres in Rivers East Senatorial District. From the result of the data analysis, it was observed that Personalized Learning 69 (37.71%) was rated as the highest prospect of artificial intelligence in effective teaching and learning in early childhood education centres in Rivers East Senatorial District while Natural Language Processing (NLP) 51 (27.89) was rated the least. The result therefore is in agreement with the opinion of Holmes et al (2019) who posited that AI-driven platforms can offer customised quizzes, simulations and interactive exercises based on learners' proficiency levels and learning objectives. By meeting each learner; space and learning preferences, AI facilitates a better understanding and retention of early childhood education concepts.

Research Questions 2: What are the challenges of artificial intelligence in teaching and learning early childhood education centres in Rivers East Senatorial District.

Table 2: Percentage analysis of the challenges of artificial intelligence in teaching and learning in early childhood education centres in Rivers East Senatorial District.

Challenges Frequency	Percentage (%)
Limited Ease of Accessibility	61
Inadequate Preparedness of Teachers	70
Ethical Issues	52
TOTAL	183
	100%

The highest percentage frequency

Source: Field Survey

Table 2 presents the percentage analysis of the challenges of artificial intelligence in teaching and learning in early childhood education centres in Rivers East Senatorial District. From the result of the data analysis, it was observed that Inadequate Preparedness of Teachers 70(38.25%) was rated the highest challenges of artificial intelligence in teaching and learning in early childhood education centres in Rivers East Senatorial District while Ethical Issues 5228.42%) was rated the least challenge. The result thus is in agreement with the research findings of Awofiranye (2024) who stated that the integration of AI into the educational system will mean that caregivers will need to be adequately trained and well-prepared for the purpose to be actualized, which also requires proper funding.

Conclusion

The integration of artificial intelligence in early childhood education holds immense promise for revolutionising teaching and learning processes. By leveraging AI powered tools and platforms, educators can personalise learning experiences, enhance learners' engagement and teaching methodologies for better teaching and learning outcomes. As much as there are prospects and challenges connected with the integration of AI in teaching and learning in early childhood education, the benefits outweigh the risks. By responsibly embracing AI technologies and proactively addressing challenges, educators can unlock new possibilities for facilitating the quality and effectiveness of early childhood education in their centres, ultimately empowering learners to thrive in an increasingly digital and technologically interconnected world. Among the prospects of AI in early childhood education, is Personalised Learning while one of its challenges is Inadequate Preparedness of Teachers.

Recommendations

Professional development and training programmes should be provided for educators to build their capacity for effectively integrating AI tools and resources into early childhood instruction, assessment, and curriculum development.

There should be development of a comprehensive AI integration strategy by government, aligned with the goals and priorities of early childhood education centres in Rivers East Senatorial District, encompassing infrastructure development, capacity building and stakeholder engagement.

Early childhood education centres in Rivers East Senatorial District should establish partnerships with AI technology providers, educational institutions and government agencies to access funds, technical expertise and support for implementing AI initiatives.

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