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# LEVERAGING ARTIFICIAL INTELLIGENCE (AI) FOR COGNITIVE DEVELOPMENT OF PRIMARY SCHOOL PUPILS IN LEARNING HOME ECONOMICS SKILLS: PERCEPTION OF HOME ECONOMICS TEACHERS

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**Abstract**
*This study examined the perceived impact of teaching with artificial intelligence on the cognitive development of primary school pupils in learning Home Economics skills. The study was carried out among teachers in primary schools in the Epe Local Government Area, Lagos State. Quantitative methods were used to conduct a descriptive survey. Data were collected using a structured questionnaire. The population of the study was 833, from which a sample size of 265 was drawn using a multi-stage sampling procedure. A validated questionnaire was utilized to obtain data from the participants. Mean and standard deviation were used to analyze data. The study revealed that the primary school teachers are not aware of most of the listed AI gadgets necessary for learning Home Economics skills (Grand X= 2.30: Grand SD=0.92). The study revealed that the teachers have the right perceptions on the use of artificial intelligence in facilitating children's intellectual development in learning Home Economics skills (Grand X = 2.96; SD: 0.91). The study concluded that the primary school teachers are aware of some of the AI technologies that can enhance learning and cognitive development in Home Economics skills, such as home management and organization, child care, and food preparation. The study suggested that the Ministry of Education should consider the integration of teaching and learning with AI in the primary school curriculum as a matter of genuine interest, to enable pupils to compete cognitively with their counterparts in the advanced world. Additionally, there is a need for regular in-service training for teachers on the use of AI in teaching and learning exercises. Familiarization with AI gadgets and their application in teaching will enable teachers to promote an adaptive learning environment.*

**Keywords:** AI, Cognitive Development, Primary School Pupils, Home Economics Skills

## INTRODUCTION

Artificial intelligence refers to the simulation of human intelligence in machines that are programmed to think and learn like humans. It encompasses various technologies such as machine learning, natural language processing, and computer vision, among others. Wang (2020) defined AI as the science and engineering of problem-solving with technological innovations such as machine learning and neural networks. Artificial intelligence, as described by Barabas et al. (2018) and Berendt et al. (2020), is the capacity

of a digital computer or computer-controlled robot to carry out tasks that are frequently associated with intelligent individuals. It is the study of using contemporary technology, such as machine learning and neural networks, to solve problems. The broad definition of artificial intelligence encompasses a wide range of technologies and algorithms (Baker and Smith, 2019; Jantakun et al., 2021). It represents the integration of science, technology, engineering, and mathematics (STEM), which has been highlighted in the current technology-empowered society. Artificial Intelligence (AI) can help children grow up in a rapidly changing digital world, with the proliferation of virtual assistants such as Siri and Google Assistant, and many other AI-enabled applications in areas such as education, healthcare, automobile, social media, entertainment, and robotics (Druga et al., 2018; Su & Yang, 2022).

In primary school education, artificial intelligence (AI) tools can be employed to improve the learning and cognitive development of young children (Su and Yang, 2022). Foreign studies have demonstrated how AI has improved children's understanding of robotics, computer science, machine learning, and related fields dramatically. Yahya and Muhammed (2024) asserted that Artificial intelligence (AI) offers unique opportunities in early childhood education to help young children develop skills. The authors stressed that while artificial intelligence is commonly linked to technology, there is increasing acknowledgment that AI can improve children's abilities in communication, critical thinking, teamwork, and adaptability. Through interactive platforms and customized learning experiences, artificial intelligence (AI) has the ability to enhance creativity, strengthen social relationships, and sharpen problem-solving abilities. Artificial intelligence (AI) can enhance the development of a wide range of soft skills and suit individual learning styles through the use of customized approaches and flexible algorithms (Chen et al, 2020).

In the view of Anmad et al. (2023), artificial intelligence (AI) presents a viable solution to assist teachers in honing their trade on a large scale through useful insights and tools for professional development. Intelligent tutoring systems that can provide personalized learning experiences for students can adapt to individual student needs and provide targeted feedback and guidance. Similarly, automated grading systems that can save instructors time and effort by automatically grading assignments and providing feedback to students can help instructors focus on other aspects of teaching and provide more timely feedback to students. Data analytical algorithms designed to assess collective student performance involve the use of AI to analyze large datasets of student information. By doing so, patterns and trends in student performance can be identified. This data-driven approach enables teachers to spot at-risk students (Anmad et al., 2023). Su and Yang (2022) confirmed that AI can improve children's abilities in skill development, reading, creativity, emotional regulation, cooperative learning, and computational thinking. Teaching and learning with AI can integrate knowledge of different disciplines and multiple technologies simultaneously and has a great potential to enrich children’s learning in every subject, including Home Economics (Teach flow, 2024).

In the context of Home Economics, AI offers immense potential to enhance the teaching and learning experience in the subject. Home Economics is a skill-based subject. It is one of the primary school subjects that requires special teachers because of the special skills required. Skills to be learned at this level include body grooming, home management, food preparation, and childcare skills, among others

(Okoh, 2019). The practical application of Home Economics skills is an essential aspect of the subject, equipping learners with the ability to apply their knowledge in real-life situations. Artificial Intelligence can play a significant role in enhancing the practical aspect of Home Economics by streamlining processes, providing valuable insights, and empowering individuals to make informed decisions. AI-driven technologies have the potential to revolutionize the process of skill acquisition in Home Economics. Hence, its proper integration in the educational process should be a priority. The integration of AI in teaching and learning Home Economics can transform traditional instructional methods, enhance cognitive development, and open up new avenues for engaging and effective education at all levels of education (Teach flow, 2024).

Ilesanmi (2021) defined cognition as the mental processes by which knowledge is acquired, elaborated, stored, retrieved, and used to solve problems. It is a child's ability to think more complexly and to reason and solve problems. Cognitive development, on the other hand, refers to the changes that occur in children's mental skills and abilities over time (Nur and Fitri, 2023). The most important indicator of the socio-economic well-being of a society is the state of cognitive development of the younger generation, as the children constitute an important reserve of the country, which will determine the level of its economic development, the state of science, and culture. The capacity of an individual to be productive and engage in creative activities depends on the level of their cognitive development (Mira, 2019). Accordingly, the requirement of the twenty-first century for the school, its graduates, and the educational process is fundamentally changing the main strategic guidelines of the school. The modern school is gradually introducing innovative programs and implementing the concept of developing education as a priority goal.

This includes the development of intelligence, creativity, and the culture of thinking of learners in the context of the general education (Mira, 2019). The early years of human life provide a unique opportunity for social and cognitive investment, but at the same time, this is the most vulnerable period for all forms of setbacks in academic performance (Leah, 2024). The teacher is the central factor in the failure or success of teaching and learning. Ezeocha (2014) described the teacher as a model, moulder, motivator, director, and a catalyst whom children seek for guidance. In the same vein, Lassa (2016) observed that the teacher is the initiator of learning processes, the learning skills, the coordinator of the learning sequence, the assessor of the learning efficiency, and indeed the pivotal element in the entire educational development. Hence, teachers of young children must be willing to learn, resourceful, and digitally sound to have an appropriate impact on children's exploration and learning, as well as provide appropriate guidance to children that will enable them to develop cognitively.

Foreign studies have shown that AI-enabled interfaces support young children's access to digital content and services via child-computer interactions such as gesture, touch, and speech (Williams et al., 2019) and can improve their creativity, emotion, collaborative inquiry, and related literacy skills (Kewalramani et al., 2021; Su & Yang, 2022). However, not much is known about how well primary school teachers could support children's learning with AI technologies. The review of literature showed that most studies on AI are foreign, and there is a paucity of empirical research on the impact of teaching with AI on the cognitive development of primary school children in learning Home

Economics skills. The present study filled the identified gap.

**Research Questions**

The following research questions guided the study:

1. Are primary school teachers aware of the different AI gadgets for learning Home Economics skills?
2. What is the perception of the teachers on the impacts of teaching with AI gadgets on children's cognitive development in Home Economics Skills?

## METHODOLOGY

The study adopted a descriptive cross-sectional survey research design. The population for this study was 833. This consisted of all teachers in the 49 primary schools in Epe LGA, Lagos (office of the secretary, Local Government Education Authority, Epe). Two hundred and sixty-five (265) primary school teachers were included in the research. The Krejcie and Morgan table for estimating sample size was used to determine the population sample size. The samples for the research were chosen using a multistage sampling process. At the first stage, Epe LGA was purposefully chosen for the research because it is a semi-urban locality located close to the Lekki peninsula. At the second stage, five towns were chosen from the Local Government area. The five towns selected were Igbo-Oye, Odo-Irangushi, Eredo, Noforija, and Mojoda. At the third stage, 275 teachers were chosen from five primary schools available in each of the selected towns. The schools were chosen using a systematic random sampling approach. As a result, eleven teachers were chosen from each of the schools for questionnaire administration, making a total of twenty-five schools.

A structured questionnaire titled "Artificial Intelligence and Cognitive Development of Primary School Children" (AIIDPSC) was developed by the researchers. The questionnaire items were derived from the research questions. The instrument obtained data on the respondents' awareness of AI gadgets available for teaching Home Economics skills and the teachers' perceived impacts of teaching with AI on the cognitive development of primary school children. The instrument was validated by experts in measurement and evaluation. The final draft of the instrument was constructed based on their criticisms and suggestions. The Cronbach Alpha method was employed to ascertain the reliability of the study instrument. The researchers conducted a pilot study by administering the instrument twice to forty (40) primary school teachers of Ibeju-Lekki LGA of Lagos State, and again after an interval of two weeks to the same set of persons who took the test previously. Primary school teachers in Ibeju-Lekki LGA share similar characteristics with the study population. The scores were correlated using the Cronbach's Alpha method to determine the instrument's reliability coefficient. A reliability coefficient of 0.77 was obtained.

Two hundred and seventy-five (275) copies of the questionnaire were administered to the primary school teachers. The questionnaire was written in English language since the subjects are literate. Efforts were made to ensure that the items were filled correctly without omitting any of the needed information. The questionnaires were retrieved on the spot. Two hundred and sixty-three (263) questionnaires were returned, showing 95% return rate. The duration of time for the distribution of the questionnaire for the study was two (2) weeks. Data was analyzed using mean and standard deviation. The decision rule for the mean was 2.50. Items with a mean of 2.50 and above were regarded as agreed upon, while items below 2.49 were

disagreed upon. All computations were done using SPSS software version 20.

## RESULTS AND DISCUSSION

### Results of the Study

**Research Question 1:** Are primary school teachers aware of the different AI gadgets for learning Home Economics skills?

**Table 1:** Mean and Standard Deviation on Awareness of Teachers on the Different AI Technologies for Learning Home Economics skills

| AI Technologies for Teaching & Learning Home Economics Skills | X | SD | Decision |
|---|---|---|---|
| **AI in virtual and augmented reality for the home Economics** | | | |
| Immersive Home Economics simulations | 2.00 | 1.15 | Not Aware |
| Virtual field trips and experiential learning | 2.71 | 0.88 | Aware |
| Collaboration and remote learning | 2.71 | 0.88 | Aware |
| **AI in Educational Games for Home Economics** | | | |
| Virtual mentors and tutors | 2.86 | 0.79 | Aware |
| Gamified learning experiences | 2.91 | 0.75 | Aware |
| Data-driven learning analytics | 2.04 | 1.16 | Not Aware |
| **AI in Learning Home Management and Organization Skills** | | | |
| Robotic vacuum cleaners | 2.57 | 0.96 | Aware |
| Robo-advisors | 2.54 | 0.97 | Aware |
| Smart home systems | 2.59 | 0.96 | Aware |
| Smart inventory management | 2. 07 | 1.19 | Not Aware |
| Energy monitoring and optimization | 2.06 | 1.19 | Not Aware |
| **AI in Learning Clothing and Textile Maintenance Skills** | | | |
| Stain removal assistance | 2.57 | 0.96 | Aware |
| Wardrobe assistance | 2.69 | 0.87 | Aware |
| Fabric care assistance | 2.73 | 0.85 | Aware |
| **AI in Food Preparation Skills** | | | |
| Smart ovens | 2.57 | 0.96 | Aware |
| Smart fridge | 2.72 | 0.85 | Aware |
| Smart recipe suggestions | 2.91 | 0.76 | Aware |
| Nutritional analysis | 2.86 | 0.79 | Aware |
| Allergen detection | 2.01 | 0.17 | Not Aware |
| **AI in Childcare Skills** | | | |

| | | | |
|---|---|---|---|
| Khan Academy Kids | 2.55 | 0.95 | Aware |
| Duolingo | 2.15 | 1.21 | Not Aware |
| Smart baby monitors | 2.21 | 1.13 | Not Aware |
| Grand Mean | 2.51 | 0.92 | Aware |

Inferring from Table 1, the teachers are aware of some of the listed AI gadgets necessary for learning Home Economics skills (Grand X= 2.51: Grand SD=0.92). Results showed that primary school teachers are aware of some of the AI technologies that can enhance learning and cognitive performance. Though the grand mean of 2.51 is slightly above the benchmark of 2.50, this suggests that the level of awareness is low.

**Research Question 2:** What are the perceived impacts of teaching with AI gadgets on children's cognitive development in Home Economics Skills?

**Table 2:** Mean and Standard Deviation on Teachers' Responses on Perceived Impacts of Teaching with AI Gadgets on Children's Cognitive Development in Learning Home Economics skills

| S/N | Teaching with AI Gadgets & Children's Cognitive Development | X | SD | Decision |
|---|---|---|---|---|
| 1. | Teaching with AI promotes creativity and critical thinking | 3.00 | 0.99 | Agreed |
| 2. | Teaching with AI facilitates the development of skills in meal planning and household management | 3.01 | 0.99 | Agreed |
| 3. | AI provides immediate feedback and support to students which helps refine their skills and promote confidence | 2.96 | 0.76 | Agreed |
| 4. | Teaching with AI promotes personalized learning and help students develop skills | 3.23 | 1.03 | Agreed |
| 5. | AI can promote motivation in skill acquisition | 3.15 | 1.01 | Agreed |
| 6. | Teaching with AI facilitates better learning outcomes in skill acquisition | 3.00 | 0.99 | Agreed |
| 7. | Teaching with AI can supplement children's innate abilities and potentials | 2.98 | 0.74 | Agreed |
| 8. | Teaching with AI has the potential to significantly change how young children learn | 2.76 | 0.85 | Agreed |
| 9. | Teaching with AI enables children to be more inquiry-literate | 2.75 | 0.85 | Agreed |
| 10. | Teaching with AI can help students to acquire soft skills such as time management, teamwork, adaptability, leadership, emotional intelligence, and so on. | 2.75 | 0.85 | Agreed |
| | **Grand Mean** | **2.96** | **0.91** | |

Results in Table 2 showed that all the items were perceived as impacts of AI on the cognitive development of primary children in learning Home Economics skills. All the items have mean values ranging from 2.75 to 3.23 with standard deviation values of 0.74 to 1.03, which indicates that their responses are close.

**Discussion of the Findings**

Findings from research question 1showed that primary school teachers are aware of some of the AI technologies that can enhance learning and cognitive performance. Our findings confirmed Kewalramani et al. (2021), who reported in their study that teachers' awareness level on AI teaching gadgets is low and that they require robust in-service training on the place of AI in teaching and learning. Teachers' awareness and mastery of AI teaching and learning tools are critical for effective teaching and learning and cognitive development. Results of findings from our study also corroborated Anmad et al (2023), who postulated that effective learning is fundamentally dependent on excellent teachers. Teachers are prime determinants of the teaching and learning exercise. Teachers are responsible for creating meaningful learning environments and experiences for the learners. Teachers are expected to possess a unique set of skills and qualities that will enable them to create a conducive learning environment. The authors asserted that excellent teachers have a deep understanding of their subject matter and can convey complex concepts clearly and concisely. Additionally, they are skilled in differentiating instruction to meet the diverse needs of their student.

Findings from research question 2 indicated that all the listed items were perceived as impacts of AI on the cognitive development of primary school children in learning Home Economics skills. Although the teachers have the right perception of the impacts of teaching with AI on children's cognitive development, and are aware of some AI gadgets for teaching and learning Home Economics skills, they may lack the practical application of these AI tools in enhancing the skills and cognitive development of learners. The practical application of Home Economics skills is an essential aspect of the subject, equipping students with the ability to apply their knowledge in real-life situations. Hence, teachers require training on instructional technologies that facilitate development in cognition and learning outcomes. This corroborates Drugal et al. (2018) that teachers need to be empowered with the requisite training and skills that will aid them in guiding the children, which in turn would promote their interdisciplinary learning. Children cannot acquire AI literacy through their own aimless exploration or free interaction with AI-enabled technologies or toys. Children will understand how AI-enabled devices work with effective guidance from the teacher (Williams, Park, & Breazeal, 2019).

## CONCLUSIONS AND RECOMMENDATIONS

**Conclusions**

The study concluded that the primary school teachers are aware of some of the AI technologies that can enhance learning and cognitive development in Home Economics skills, such as home management and organization, child care, and food preparation. While some teachers are not aware of the AI technologies for cognitive development, others have the right perception of the impact of teaching with AI technologies on the cognitive development of children in learning Home Economics skills.

**Recommendations**

1. There is a need for increased awareness of AI technologies that can be used in acquiring Home Economics skills and other vocational subjects through regular in-service training for teachers. Familiarization with AI gadgets and their application in teaching will enable them to promote an adaptive learning environment.

2. The Ministry of Education should consider the use of AI in teaching and learning in the primary school curriculum as a matter of genuine interest, for the learners to be able to compete cognitively with their counterparts in the advanced world.
3. Children should be well guided by teachers during their interaction with AI gadgets.

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