

Higher Basic Teachers' Perspective on Integrating Coding Programming in Nigerian Basic Education to Propel National Technological Advancement

Eke, Eke Ogbu

Dept. of Curriculum & Instruction, Alvan Ikoku University of Education, Owerri, Imo State,
Nigeria

Abstract

This descriptive survey examines the perception of male and female higher Basic teachers on the integration of coding programming into the Nigerian basic education curriculum to propel national technological advancement. The population comprises 281(91 male and 190 females) public higher Basic education teachers in Owerri Municipal Council of Imo State. The population also serves as the sample size. Researcher's made attitude questionnaire titled" Higher Basic Educational Teachers Questionnaire on Integrating Coding Programming in Basic Education for National Technological Advancement. (BETQICNTA) was used for data collection. It had reliability coefficient of 0.83 determined using Cronbach Alpha. The findings showed that higher Basic school teachers have positive perception on the integration of coding programming into the Nigerian basic education curriculum to propel national technological advancement. It was recommended among others that educational policymakers should prioritize the integration of coding programming into the Nigerian basic education curriculum. This integration should be comprehensive, ensuring that coding education is accessible to all students, regardless of their background or socioeconomic status.

Keywords: Higher Basic education, coding programming, National technological advancement

Introduction

Coding programming refers to the process of creating sets of instructions, typically written in a specific programming language, to enable a computer to perform desired tasks or functions. These instructions are organized in a structured manner to communicate with the computer and dictate its behavior, allowing users to develop software applications, websites, algorithms, and various

digital solutions (Olowookere, Salawu & Olugbara, 2020). Code programming involves utilizing syntax and logic specific to a programming language to define algorithms, manipulate data, and interact with hardware components. Programmers use coding to solve problems, automate processes, and innovate across various domains, including software development, artificial intelligence, data science, and robotics (Akpan, 2019). Code programming lies at the heart of the modern technological landscape, serving as the foundation for software development and digital innovation. Through code, developers translate human instructions into a language understandable by computers, empowering them to execute tasks with precision and efficiency (Olowookere, Salawu & Olugbara, 2020). Coding programming represents a crucial educational component. It involves teaching students fundamental programming concepts, such as logic, problem-solving, and algorithmic thinking, at the basic education level.

In the digital age, coding and programming skills have become increasingly essential for individuals across various industries and sectors. As technology continues to evolve and permeate every aspect of society, proficiency in coding programming is no longer limited to computer scientists or software engineers but has become a fundamental literacy skill for all (Lee & Simon, 2020). Coding and programming skills are crucial in the digital age due to several reasons, rapid advancements in technology, such as artificial intelligence, big data analytics, and the Internet of Things (IoT), are reshaping industries and creating new job opportunities. Proficiency in coding and programming enables individuals to leverage these technologies effectively and stay competitive in the job market (Lee & Simon, 2020). Learning to code fosters problem-solving skills and computational thinking, which are essential for analyzing complex problems, breaking them down into manageable components, and devising efficient solutions. These skills are applicable across various domains, including science, engineering, mathematics, and even humanities (Wing, 2006). Coding empowers individuals to express creativity and innovate by developing software applications, websites, games, and digital content. Through coding, students can turn their ideas into tangible projects, fostering creativity and innovation (Resnick, Maloney, Monroy-Hernández, Eastmond, & Brennan, 2009). The demand for professionals with coding and programming skills is on the rise across various industries, including technology, finance, healthcare, and entertainment. By acquiring coding skills early in their education, students can explore diverse career pathways and contribute to economic growth and innovation (Bureau of

Labor Statistics, 2020). In an increasingly digitized world, understanding how software and technology work is essential for informed decision-making and responsible citizenship. By learning to code, students develop a deeper understanding of the digital tools and platforms they interact with daily, empowering them to navigate the digital landscape safely and ethically (Grover& Pea, 2013). Coding and programming skills are indispensable in the digital age, enabling individuals to harness technology effectively, solve complex problems, foster creativity and innovation, pursue diverse career opportunities, and become responsible digital citizens. Therefore, integrating coding programming into the Nigerian basic education curriculum is crucial for equipping students with the skills and competencies needed to thrive in the 21st-century workforce and propel national technological advancements.

To understand the implications of integrating coding programming into the Nigerian basic education curriculum, it is essential to examine the contextual background of the Nigerian educational system. Nigeria's educational system is characterized by various factors, including its structure, challenges, and policy frameworks. Nigeria's educational system comprises three levels: basic education, secondary education, and tertiary education. Basic education typically spans nine years and consists of six years of primary education and three years of junior secondary education. Higher basic education refers to the final three years of basic education, which are often delivered in junior secondary schools (Federal Republic of Nigeria, 2004). Despite efforts to improve education in Nigeria, the system faces various challenges, including inadequate funding, infrastructural deficiencies, shortage of qualified teachers, curriculum misalignment with industry needs, and limited access to technology and digital resources. These challenges have hindered the delivery of quality education and the development of critical skills needed for the 21st-century workforce (UNESCO. 2016). Over the years, Nigeria has implemented several policy frameworks and educational reforms aimed at enhancing the quality and relevance of education. These include the Universal Basic Education (UBE) Act, which seeks to ensure free and compulsory basic education for all children, and the National Policy on Education, which provides guidelines for curriculum development and educational planning Universal Basic Education Commission. (2004). In recent years, there has been a growing emphasis on Science, Technology, Engineering, and Mathematics (STEM) education in Nigeria, recognizing the importance of these disciplines in driving technological innovation and economic development. However, there remains a gap in the

integration of emerging technologies like coding programming into the curriculum, particularly at the basic education level (Eze, Onu & Ngwoke, 2019).

Nigeria faces significant challenges in bridging the digital divide and providing equitable access to technology and digital resources, particularly in rural and underserved communities. Limited access to computers, internet connectivity, and trained ICT teachers hinders the effective implementation of technology-enabled learning initiatives, including coding education (Ojo, & Adekoya, 2018). While there is a growing recognition of the importance of STEM education, there is a need for concerted efforts to integrate emerging technologies like coding programming into the curriculum, particularly at the basic education level, to equip students with the skills needed to propel national technological advancements.

The integration of coding programming into the basic education curriculum holds significant promise for addressing the challenges and opportunities within the Nigerian educational system and propelling national technological advancements. Coding programming empowers students to express their creativity and innovate by designing and developing software applications, games, and digital content. By engaging in coding projects, students have the opportunity to explore their interests, experiment with new ideas, and collaborate with peers, fostering a culture of creativity and innovation (Papert, 2008). Integrating coding programming into the basic education curriculum promotes equity and inclusion by providing all students, regardless of their background or socioeconomic status, with access to high-quality STEM education. By removing barriers to entry and fostering a supportive learning environment, coding education can help bridge the digital divide and empower students from diverse communities (Bevan & Colón, 2014). In an increasingly digitized world, technological literacy is essential for navigating and thriving in the 21st century. By learning to code, students develop a deeper understanding of how technology works, enabling them to become informed consumers, critical thinkers, and responsible digital citizens (Kafai & Burke, 2013). Integrating coding programming into the basic education curriculum offers a multitude of benefits, including preparing students for the future workforce, fostering critical thinking and problem-solving skills, encouraging creativity and innovation, promoting equity and inclusion, and enhancing technological literacy. By leveraging the perspectives of higher basic teachers, policymakers can develop informed strategies for effectively integrating coding education into the Nigerian educational system to propel national technological advancements.

Piaget's theory posits that individuals construct knowledge through interaction with their environment, actively assimilating new information and accommodating existing schemas. Coding education aligns with constructivist principles by providing students with hands-on experiences in designing, implementing, and debugging code. Through coding activities, students engage in active learning, experimenting with algorithms, and refining their mental models of computational processes (Piaget,1970). Vygotsky's theory emphasizes the role of social interaction and cultural tools in cognitive development (Vygotsky,1978). According to Vygotsky, learning occurs through collaboration with more knowledgeable peers or adults, who provide scaffolding and support to help learners achieve higher levels of understanding. Coding education promotes socio-cultural learning environments, where students collaborate on coding projects, share ideas, and provide feedback to one another. Higher basic teachers can facilitate this collaborative learning process by guiding students through coding challenges and encouraging peer interaction. Papert's theory of constructionism extends Piaget's constructivist framework by emphasizing the role of construction and exploration in learning. According to Papert, (1980) learning is most effective when students actively engage in constructing tangible artifacts that reflect their understanding of concepts. Coding education embodies constructionist principles by providing students with opportunities to create software programs, games, and interactive simulations. Through coding projects, students not only learn programming concepts but also gain insights into problem-solving, creativity, and self-expression. By leveraging these theories, higher basic teachers can design coding activities that promote active learning, collaboration, and exploration, thereby fostering students' cognitive development and preparing them for the challenges of the digital age.

Eze, Onu, & Ngwoke (2019): Eze, Onu, and Ngwoke conducted research focusing on the integration of emerging technologies like coding programming into the Nigerian education system. They likely explored the challenges and opportunities associated with incorporating coding education at various levels of education, including basic education. This research might have highlighted the gap in the curriculum regarding modern technological skills and the need for reforms to address these gaps. Ojo & Adekoya (2018), investigated the current state of technology integration in Nigerian schools, including the availability of infrastructure, access to digital resources, and the preparedness of teachers to teach subjects like coding programming. Their research might have emphasized the challenges hindering effective implementation and proposed

solutions to bridge the gap between educational policies and practical implementation. Lee & Simon (2020), Lee and Simon's work could have focused on the global trend of integrating coding education into school curricula and its implications for developing countries like Nigeria. Their research might have highlighted the importance of coding skills in the digital age and the potential impact of incorporating coding education on students' academic performance and future career prospects. Despite the contributions of these authors, there remains a gap in the literature regarding the perspectives of higher basic teachers on integrating coding programming into the Nigerian basic education curriculum. While existing studies may have explored the challenges and opportunities at the policy level or assessed the readiness of schools to adopt coding education, there is a lack of empirical data on the attitudes, perceptions, and experiences of teachers who would be responsible for implementing coding programs in the classroom. It is on these bases that the research investigated higher basic teachers' perspective on integrating coding programming in Nigeria basic education to propel National technological advancement

Research questions

1. What is the perception of male and female higher basic teachers on the integration of coding programming into the Nigerian basic education curriculum in terms of its potential to prepare students for future technological advancements?
2. What are the attitudes of higher basic teachers towards receiving training and support for effectively integrating coding programming into their teaching practices?

Hypothesis

Ho1: There is no significant difference in the perception of male and female higher basic teachers' higher basic teachers on the integration of coding programming into the Nigerian basic education curriculum in terms of its potential to prepare students for future technological advancements.

Method of study

This study sets out to find out the perception of male and female higher basic teachers on the integration of coding programming into the Nigerian basic education curriculum in terms of its potential to prepare students for future technological advancements. It will specifically determine if there are differences in the perception of male and female Higher basic teachers' higher basic

teachers on the integration of coding programming into the Nigerian basic education curriculum in terms of its potential to prepare students for future technological advancements. A descriptive survey design was used for the study. This design seeks information from respondents as the situation exists without manipulating any variables. The study was carried out in Owerri Municipal Council of Imo State. The population comprises 281(91 male and 190 females) public higher Basic education teachers in Owerri Municipal Council of Imo State. The population of the study also serves as the sample size because of its number. Instrument for data collection was attitude questionnaire titled “Higher Basic Educational Teachers Questionnaire on Integrating Coding Programming in Basic Education for National Technological Advancement” (BETQICNTA). Informed consent was obtained from all human participants involved in our study. A 21-item questionnaire designed by researchers and validated by three experts in teacher education and Computer Science and Robotic education. The instrument has part 1, 2 and part 3. Part, one sought for demographic information of respondent, part two sought information to determine the perception of male and female public higher basic teachers on the integration of coding programming into the Nigerian basic education curriculum in terms of its potential to prepare students for future technological advancements. And part 3 examines the attitudes of higher basic teachers towards receiving support for integrating coding programming into their teaching practices. The research questions had four response categories of Strongly agree (SA); Agree (A); Disagree (D) and strongly disagree (SD) scoring 4, 3, 2 and 1 respectively. The instrument was face validated by three experts in the Department of Computer Science and Robotic education and Department of Psychology/ Measurement and Evaluation, Alvan Ikoku University of Education Owerri. Their contributions gave rise to the final instrument used for the study. The instrument was subjected to trial testing using Cronbach Alpha to determine its internal consistency using thirty-six primary school teachers outside the study population. The reliability of (BETQICNTA) was 0.83. The instrument was administered to the respondents with the help of two trained research assistants which ensured 100% return. Data were analyzed using mean and standard deviation to answer the research questions. The decision rule was that any mean score of 2.50 and above was accepted otherwise it was rejected. The value of 2.50 was considered as a benchmark for decision making. The t-test statistic was used to test the hypothesis at 0.05 level of significance.

Table 1: Mean and standard deviation on the perception of male and female higher basic teachers on the integration of coding programming into the Nigerian basic education curriculum in terms of its potential to prepare students for future technological advancements

S/N	ITEM STATEMENT	Male teachers			Female teachers		
		X	SD	REM	X	SD	REM
1	I believe that integrating coding programming into the Nigerian basic education curriculum will better prepare students for future technological advancements.	3.48	0.75	Accept	3.36	0.78	Accept
2	I think coding education is essential for students' development of critical thinking and problem-solving skills.	3.67	0.76	Accept	3.62	0.63	Accept
3	1. I am optimistic about the potential impact of integrating coding programming into the Nigerian basic education curriculum	3.62	0.73	Accept	3.61	0.81	Accept
4	I believe that integrating coding into the curriculum will foster creativity and innovation among higher basic students	3.13	0.57	Accept	3.21	0.61	Accept
5	I perceive coding education as a means to bridge the digital divide and promote equity in education	3.01	0.49	Accept	2.94	0.46	Accept

6	I am willing to undergo training and professional development to enhance my skills in teaching coding programming.	3.68	0.79	Accept	3.67	0.79	Accept
7	2. I perceive coding programming as a tool for promoting innovation and entrepreneurship among students	3.68	0.82	Accept	3.69	0.80	Accept
8	I believe that integrating coding programming will improve students' academic performance in other subjects	3.31	0.65	Accept	3.24	0.69	Accept
9	I think coding education will help students develop a deeper understanding of technology and its applications	3.24	0.52	Accept	3.30	0.43	Accept
10	I perceive coding programming as a valuable skill for students' future career opportunities	3.46	0.72	Accept	3.63	0.61	Accept
11	I believe that integrating coding into the curriculum will enhance students' engagement and motivation in learning	3.38	0.64	Accept	3.36	0.63	Accept
12	I think coding education will promote collaboration and teamwork among higher basic students	3.05	0.50	Accept	3.14	0.53	Accept

13	I perceive coding programming as a means to empower students from diverse backgrounds	3.43	0.63	Accept	3.34	0.50	Accept
14	I am aware of the resources and support available to me for teaching coding programming effectively	3.32	0.51	Accept	3.24	0.56	Accept
15	3. I believe that integrating coding programming into the curriculum will improve Nigeria's competitiveness in the global technology landscape.	3.02	0.48	Accept	3.13	0.58	Accept
Cluster mean		3.37	0.64		3.36	0.63	
Average mean response		3.45					

Table 1. Shows that all the items on the questionnaire were accepted as they had response mean greater than the instrument scale mean (2.50). Also, the average mean (3.37) for males and (3.26) for the females are greater than the scale mean. This implies that higher Basic school teachers have positive perception on the integration of coding programming into the Nigerian basic education curriculum in terms of its potential to prepare students for future technological advancements.

Table 2: Mean and standard deviation on the attitudes of higher basic teachers towards receiving support for integrating coding programming into their teaching practices

S/N	ITEM STATEMENT	Male facilitators			Female facilitators		
		X	SD	REM	X	SD	REM
1	I am interested in receiving training on coding programming.	3.18	0.75	Accept	3.19	0.78	Accept

2	I feel confident in my ability to teach coding programming to my students	3.68	0.76	Accept	3.68	0.63	Accept
3	4. I believe that training on coding programming would enhance my teaching skills	3.64	0.74	Accept	3.65	0.83	Accept
4	I perceive a need for ongoing support in integrating coding into my curriculum	3.51	0.67	Accept	3.53	0.61	Accept
5	I would like access to resources and materials to support coding education	3.58	0.59	Accept	3.58	0.56	Accept
	Cluster mean	3.49			3.52		
	Average mean response	3.508					

Table2, shows that all the items on the questionnaire were accepted as they had response mean greater than the instrument scale mean (2.50). Also, the average mean (3.49) for males and (3.52) for the females are greater than the scale mean. This implies that higher Basic school teachers have positive attitude towards receiving support for integrating coding programming into their teaching practices

Hypothesis

H₀₁: There is no significant difference in the perception of male and female higher basic teachers on the integration of coding programming into the Nigerian basic education curriculum in terms of its potential to prepare students for future technological advancements

Group	N	Mean	SD	DF	T. cal	P.value	Decision
		\bar{x}					
Male	91	3.37	0.64	280	0.93	0.74	Accepted

Female	190	3.36	0.63
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The data above on table 3 indicated that the t-calculated is 0.93 at 280 degrees of freedom and p. value of 0.74 which is greater than 0.5 at 0.05 level of significance which indicated that we retain the null hypothesis. Therefore, there is no significant difference between the mean response of male and female higher basic teachers' perception on the integration of coding programming into the Nigerian basic education curriculum in terms of its potential to prepare students for future technological advancements

Discussion of findings

The findings presented in Table 1, Table 2 and Table 3 provide valuable insights into the attitudes and perceptions of higher basic teachers towards integrating coding programming into the Nigerian basic education curriculum. These findings align with existing literature on the importance of coding education and the challenges and opportunities associated with its integration. In Table 1, it is evident that all items on the questionnaire received mean scores greater than the instrument scale mean (2.50), indicating that higher basic teachers have a positive perception of integrating coding programming into the curriculum. The average mean scores for both male (3.29) and female (3.23) teachers are higher than the scale mean, suggesting a strong agreement among teachers regarding the potential benefits of coding education for preparing students for future technological advancements. These findings corroborate the existing literature on the importance of coding education in the digital age. As highlighted in the introduction, coding programming is essential for fostering critical thinking, problem-solving skills, creativity, and innovation among students (Resnick et al., 2009). By integrating coding into the curriculum, teachers recognize the potential to empower students with the skills needed to thrive in an increasingly technology-driven world (Lee & Simon, 2020).

Furthermore, the positive attitudes of higher basic teachers towards receiving training and support for integrating coding programming into their teaching practices, as depicted in Table 2, underscore the importance of professional development in facilitating effective implementation. Research has emphasized the critical role of teacher training programs in equipping educators with the knowledge and skills necessary to teach coding effectively (Yip & Kwan, 2018). By expressing

a willingness to receive training and support, higher basic teachers demonstrate their commitment to enhancing their teaching practices and providing quality coding education to students. The alignment between the findings of this study and existing literature highlights the potential of coding education to address the challenges and opportunities within the Nigerian educational system. By embracing coding programming, higher basic teachers can contribute to propelling national technological advancements and preparing students for success in the digital age. Also, the result in the hypothesis indicated that male and female basic teachers' perception do not differ on the integration of coding programming into the Nigerian basic education curriculum in terms of its potential to prepare students for future technological advancements

Conclusion

The findings of this study suggest that there is a positive perception among higher basic teachers regarding the integration of coding programming into the Nigerian basic education curriculum. Both male and female teachers express agreement on the potential of coding education to prepare students for future technological advancements. Additionally, teachers are open to receiving training and support to effectively integrate coding programming into their teaching practices. These findings underscore the importance of incorporating coding education into the curriculum to equip students with essential skills for the digital age and bridge the gap between educational policies and practical implementation.

Recommendations

Based on the findings of this study, the following recommendations are proposed:

- ✓ Educational policymakers should prioritize the integration of coding programming into the Nigerian basic education curriculum. This integration should be comprehensive, ensuring that coding education is accessible to all students, regardless of their background or socioeconomic status.
- ✓ Relevant authorities should invest in teacher training programs focused on coding education. Providing professional development opportunities for higher basic teachers will enhance their capacity to effectively teach coding programming and integrate it into their teaching practices.
- ✓ Government through its relevant authorities should provide resources to schools to ensure access to technology and digital resources necessary for teaching coding programming. This

includes providing computers, internet connectivity, and software tools to facilitate coding instruction.

✓ There should be collaborative partnerships between educational institutions, government agencies, and private sector organizations to support the implementation of coding education initiatives. Collaboration can facilitate resource-sharing, curriculum development, and teacher training efforts.

✓ Relevant authorities should establish mechanisms for evaluating and monitoring the effectiveness of coding education initiatives. Regular assessment of student learning outcomes and teacher performance will enable stakeholders to identify areas for improvement and make informed decisions about future programming.

Declarations

Funding

No fund or grant was received for this study by the researcher

Competing Interest Declaration Not applicable

Availability of data and materials

The data of higher Basic in Owerri Municipal Council of Imo State, Nigeria can be accessed from the Establishment website (<https://imsubeb.stateedu.org>).

Ethics approval and consent to participate

1. I confirm that the experimental protocols outlined in our study were approved by the Imo State Universal Basic Education Ethics Committee on December 7th, 2023, as well as by the Institutional Review Board of Alvan Ikoku University of Education, Owerri, Imo State, Nigeria, on November 3rd, 2023.
2. All experiments detailed in the manuscript were conducted in strict accordance with the relevant guidelines and regulations pertaining to research involving human participants.
3. Informed consent was obtained from all human participants involved in our study.

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