# Teachers Application of Emerging Secondary Schools Classroom Instruction Technologies Delivery in Enugu State, Nigeria

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**Abstract: The study ascertained the extent to which teachers applied emerging technologies in classroom instruction delivery in secondary schools in Enugu State. The study was guided by two research questions and tested two null hypotheses at a 0.05 significance level. A descriptive survey research design was employed. The study population included 1,892 teachers, with a sample size of 356 respondents selected through purposive random sampling. Data was collected using a structured questionnaire developed by the researchers, titled "Teachers' Application of Emerging Technologies in Classroom Instruction Questionnaire (TAETCIQ)." The questionnaire included 15 items based on the research questions. The validity of the instrument was confirmed by three research specialists from the Faculty of Education at Enugu State University of Science and Technology (ESUT). The instrument's reliability was assessed using Cronbach's Alpha method, yielding values of .83 for Cluster 1, .81 for Cluster 2, and an overall reliability index of .82, indicating good reliability. Mean and standard deviation were used to analyze the research questions, while a t-test statistic was applied to test the null hypotheses. The findings revealed that teachers applied emerging technologies such as Blockchain Technology and cloud computing to a very low extent. It was recommended that educational authorities should organize targeted professional development programs and workshops for teachers, focusing on the practical application of emerging technologies such as Blockchain and cloud computing in teaching. These training sessions should be tailored to the specific needs and technical comfort level of teachers.**

*Keywords: Emerging Technologies, Classroom Instruction, Secondary Schools, Teachers' Application, Enugu State.*

## I. INTRODUCTION

Education in Nigeria is structured into multiple stages, each with its own unique focus and objectives, as outlined by the Federal Republic of Nigeria (FRN, 2013). These stages include pre-primary, primary, secondary, and tertiary education, each designed to build upon the previous level of learning. This study specifically examines secondary education, which is positioned as a vital bridge between primary and tertiary education (Nwakpa, 2017). Secondary education is not only essential for academic development but also for vocational growth, as it equips students with the skills and knowledge required for further academic pursuits or to enter the workforce. The significance of secondary education within Nigeria's educational framework cannot be overstated, as it has a profound impact on shaping students' future academic and professional trajectories (Ogunbiyi, 2018). Given its pivotal role, secondary education, facilitated by dedicated teachers, serves as the foundation for both higher education and career advancement, influencing the course of students' lives in substantial ways. Teachers play a critical role in shaping students' academic growth, ensuring they are well-prepared for future challenges.

In secondary schools in Enugu State, the adoption of emerging technologies such as Blockchain and cloud computing for classroom instruction appears to present significant challenges for teachers. While these technologies have the potential to enhance personalized learning and improve educational outcomes, many teachers struggle to effectively integrate them into their teaching practices. Limited access to the necessary infrastructure and resources further hinders their ability to implement these tools. Moreover, insufficient training and professional development leave teachers ill-equipped to utilize these technologies effectively. The lack of clear policies, concerns about replacing traditional teaching methods, and the need to ensure equitable access for all students contribute to the difficulties teachers

face in embracing these innovations in the classroom. As a result, this study was conducted to explore teachers' use of emerging technologies in delivering classroom instruction in secondary schools in Enugu State.

The general purpose of the study was to investigate teachers' application of emerging technologies in classroom instruction delivery in secondary schools in Enugu State. Specifically, the study examined the extent to which teachers apply Blockchain and cloud computing Technology in classroom instructional delivery in secondary schools in Enugu State, guided by two research questions and hypotheses tested. It is hoped that the results of this study would facilitate teachers' application of emerging technologies in lesson delivery in Enugu State and other similar ones in Nigeria.

## II. LITERATURE REVIEW

Teachers are central to secondary education, as their teaching methods, guidance, and support greatly impact students' academic success and career prospects. A teacher is a professional who facilitates learning by imparting knowledge, skills, and values, guiding students' intellectual and personal growth through various teaching strategies. According to Masor, Ibok, and Etura (2023), a teacher is someone who imparts knowledge and interacts with students in ways that lead to meaningful changes in their lives. Unachukwu and Odumodu (2015) emphasized that teachers play a foundational role in the educational process, shaping students' intellectual and moral development at all levels of education. Furthermore, Okeke, Okaforcha, and Ekwesianya (2019) underscored the essential role of teachers in fostering educational growth and development, stressing that a nation's progress is closely tied to the effectiveness of its educators. Teachers play a crucial role in effectively integrating emerging technologies into the classroom, enhancing learning experiences and preparing students for a rapidly evolving digital world.

Emerging technologies refer to innovative tools and systems that are in the process of development or expected to emerge in the coming years, with the potential to significantly influence various industries and society at large (Schmidt & Cohen, 2013). These technologies are generally new, not yet widely adopted, but hold significant promise for future use. They involve advancements in areas such as artificial intelligence, biotechnology, nanotechnology, robotics, and others. Key examples include artificial intelligence (AI), blockchain, augmented and virtual reality (AR/VR), cloud computing, Internet of Things (IoT), and advanced robotics, all of which contribute to improved efficiency and new capabilities (Anih and Ukeh, 2024, Wang et al., 2020). The rapid progress of these technologies often brings about disruptive changes, reshaping business models and creating new markets, while also presenting ethical and regulatory challenges (Bessen, 2019). As these technologies become more integrated into daily life, they are expected to foster innovation across sectors such as healthcare, education, finance, and manufacturing (Dufva & Rask, 2019). Their adoption can lead to better decision-making, personalized services, and increased productivity, making it crucial for organizations to stay informed about these advancements (Feng et al., 2020). The ongoing evolution of emerging technologies presents vast opportunities to transform individual experiences and organizational practices. The present study focused on Blockchain technology and cloud computing. Blockchain technology is a distributed, decentralized

ledger system that records transactions across several computers, ensuring security, transparency, and immutability (Nakamoto, 2018). Each block in the chain holds transaction data, which, after being verified by a network of participants, is added to the chain, making data manipulation virtually impossible (Yli-Huumo et al., 2016). In secondary schools, blockchain can enhance instructional delivery by providing secure and transparent records of student achievements, attendance, and academic credentials, fostering trust in educational data (Sharples &Domingue, 2016). Moreover, blockchain can support personalized learning through smart contracts that adjust educational content and assessments based on individual student needs and progress, promoting a customized educational experience. Blockchain and cloud computing are closely linked, as blockchain enhances cloud services by introducing a decentralized, secure, and transparent approach to data management, ensuring that data integrity is maintained without relying on a central authority. The decentralized nature of blockchain ensures that data is distributed across multiple nodes, making it resistant to tampering and unauthorized access, which adds a layer of security and trust to cloud-based systems. On the other hand, cloud computing provides the necessary infrastructure to support blockchain.

The integration of emerging technologies in secondary school classrooms has significantly transformed traditional teaching methods, improving student engagement and academic performance (Keengwe & Onchwari, 2015). Tools such as interactive whiteboards, digital learning platforms, and virtual simulations provide teachers with innovative methods to present complex concepts, making learning more accessible and engaging for all students, regardless of gender (Spector, 2012). These technologies also support personalized learning, allowing students to advance at their own pace, access a variety of educational resources, and collaborate more effectively with peers, promoting inclusivity and addressing diverse learning needs (Johnson et al., 2016). Consequently, the incorporation of emerging technologies leads to a more interactive, innovative, and student-centered approach to teaching, enhancing instructional delivery and academic outcomes for students in secondary education, while also supporting gender equality in learning (Alqahtani & Mohammad, 2015).

Gender refers to the roles, behaviors, and traits that societies attribute to men and women, shaped by social constructs rather than biological differences (Butler, 2015). In contrast to biological sex, which is based on physical characteristics, gender is shaped by cultural, social, and psychological influences (West & Zimmerman, 2017). Gender roles can vary significantly across different cultures and historical periods, often reflecting societal power dynamics (Connell, 2015). These roles play a crucial role in shaping individual identity, societal expectations, and available opportunities, making gender an important issue in social and political discourse. The socially constructed expectations related to gender can impact how teachers utilize emerging technologies, as gender norms can influence access to, confidence in, and attitudes toward the integration of technology in educational environments.

Chain networks, offering scalable resources and computing power that can accommodate the growing demands of blockchain operations. By combining the strengths of both technologies, organizations can benefit from more secure, efficient, and scalable systems for managing and processing data in various sectors, including education, finance, and healthcare.

Cloud computing plays a crucial role in societal progress and development. It involves delivering computing services, including storage, processing, and software, via the internet, allowing users to access and manage resources remotely without requiring local infrastructure (Mell & Grance, 2016). Cloud computing offers on-demand access to shared resources and scalable services, providing flexibility and efficiency in data management and application deployment (Armbrust et al., 2015). Users can create, edit, and save files in the cloud based on their needs (Paul, Chatterjee, Aithal & Saavedra, 2023). The main advantage of cloud computing is that it allows users to access applications and data from anywhere at any time, removing spatial and temporal constraints (Okechukwu & Ukeh, 2022). As a form of Internet-based computing, it can be applied across various sectors, including education, which relies on IT resources. The rapid progress of emerging technologies has had a profound impact on how they are applied in classroom instruction, transforming how teachers engage students and improve learning experiences.

## III. RESEARCH METHODOLOGY

This study adopted a descriptive survey research design. According to Nworgu (2018), descriptive survey research design involves studying a group of people or items by collecting and analyzing data from a sample that is considered representative of the entire group. The study's population consisted of 1,892 teachers, with a sample size of 356 respondents selected through purposive random sampling. A structured questionnaire, titled "Teachers' Application of Emerging Technologies in Classroom Instruction Questionnaire (TAETCIQ)," was the data collection instrument. This instrument contained 15 items aligned with the two research questions. The questionnaire was validated by three research experts from the Faculty of Education at Enugu State University of Science and Technology (ESUT). The reliability of the instrument was assessed using the Cronbach Alpha method, resulting in reliability coefficients of .83 for cluster 1 and .81 for cluster 2, with an overall reliability index of .82, indicating that the instrument was reliable. Mean and standard deviation were used to analyze the research questions, while t-test statistics were employed to test the null hypotheses.

Out of the 356 questionnaires distributed, the researcher, along with the research assistants, successfully retrieved 329, resulting in a 92.42% response rate. Mean scores and standard deviations were utilized to address the research questions, while t-test statistics were applied to test the hypotheses. Each response option was assigned a numerical value based on the real limits of numbers: Very Great Extent (VGE) = 3.50-4.00, Great Extent (GE) = 2.50-3.49, Low Extent (LE) = 1.50-2.49, and Very Low Extent (VLE) = 0.00-1.49. The interpretation of the hypotheses testing was determined using the significance values from the SPSS output, where the null hypothesis was retained if the p-value was less than 0.05 and rejected if greater than 0.05.

## IV. RESEARCH ANALYSES AND RESULTS

As guided by the two research questions preceding each table analysis and result and testing of two hypotheses, the following results emerged:

➤ *Research Question 1*
To what extent do teachers apply Blockchain Technology in classroom instructional delivery in secondary schools in Enugu State?

Table 1 Mean Ratings of Male and Female Principals on the Extent to which Teachers Apply Blockchain Technology in Classroom Instructional Delivery in Secondary Schools

| ITEMS | Respondents 329 | | |
|---|---|---|---|
| **S/N Teachers apply the following Blockchain Technology in classroom instructional delivery to the following extent:** | **X** | **SD** | **Dec** |
| 1 Secure Student Records. | 1.08 | .78 | VLE |
| 2 Peer-to-Peer Learning. | 1.11 | .80 | VLE |
| 3 Collaborative Projects. | 1.03 | .78 | VLE |
| 4 Learning Analytics. | 1.26 | .80 | VLE |
| 5 Decentralized Educational Resources. | 1.20 | .76 | VLE |
| 6 Grading Transparency. | 1.15 | .80 | VLE |
| 7 Smart Contracts for Course Enrollment. | 1.18 | .69 | VLE |
| 8 Data Privacy for Assessments. | 1.24 | .78 | VLE |
| **Cluster Mean/SD** | **1.16** | **.77** | **VLE** |

The table presents the mean ratings from male and female principals regarding the application of Blockchain Technology by teachers in secondary schools in Enugu State. Each item reflects a low mean score, indicating that the extent of application is minimal, with all items classified as "Very Low Extent" (VLE). The highest mean rating of 1.26 is associated with "Learning Analytics," while the lowest rating of 1.03 pertains to "Collaborative Projects." Overall, the cluster mean of 1.16 reinforces the conclusion that teachers are not significantly utilizing Blockchain Technology in their instructional delivery.

➤ *Research Question 2*
To what extent do teachers apply cloud computing in classroom instructional delivery in secondary schools in Enugu State?

Table 2 Mean Ratings of Male and Female Principals on the Extent to which Teachers Apply Cloud Computing in Classroom Instructional Delivery in Secondary Schools

| ITEMS | Respondents 329 | | |
|---|---|---|---|
| **S/N Teachers apply the following cloud computing tools in classroom instructional delivery to the following extent:** | **X** | **SD** | **Dec** |
| 9 Online Learning Management Systems (LMS). | 1.03 | .78 | VLE |
| 10 Collaborative Document Editing. | 1.28 | .74 | VLE |
| 11 Virtual Classrooms. | 1.16 | .80 | VLE |
| 12 Interactive Learning Platforms. | 1.12 | .74 | VLE |
| 13 Automated Assessment Tools. | 1.32 | .72 | VLE |
| 14 Learning Analytics Platforms. | 1.17 | .77 | VLE |
| 15 Classroom Management Tools. | 1.21 | .71 | VLE |
| **Cluster Mean/SD** | **1.18** | **.88** | **VLE** |

The table shows the mean ratings of male and female principals on teachers' application of cloud computing in classroom instructional delivery in secondary schools in Enugu State. The low mean scores for all items indicate that the use of cloud computing tools by teachers is very limited, with each item categorized under "Very Low Extent" (VLE). The highest-rated tool, "Automated Assessment Tools," has a mean score of 1.32, while the lowest, "Online Learning Management Systems (LMS)," has a mean score of 1.03. The overall cluster mean of 1.18 suggests minimal adoption of cloud computing in instructional delivery.

➢ *Hypotheses*

There is no significant difference between the mean scores of male and female teachers on the extent to which teachers apply Blockchain Technology in classroom instructional delivery in secondary schools in Enugu State.

Table 3 T-Test on the Mean Ratings of Male and Female Principals on the Extent to which Teachers Apply Blockchain Technology in Classroom Instructional Delivery in Secondary Schools

| Group | n | x | SD | df | p-value | Decision |
|---|---|---|---|---|---|---|
| Respondents | 329 | 1.16 | .77 | 327 | .003 | H01 not rejected |

Table 3 presents the t-test analysis of male and female principals' mean ratings on the extent to which teachers apply Blockchain Technology in classroom instructional delivery in secondary schools. With a p-value of .003, which is less than the significance level (typically .05), there is a 12 statistically significant difference between the mean scores of male and female respondents. Despite this, the null hypothesis (H01), stating no significant difference, is not rejected. This indicates that while the statistical test shows a difference, it is not enough to reject the assumption of no significant difference in practical terms.

There is no significant difference between the mean scores of male and female teachers on the extent to which teachers apply cloud computing in classroom instructional delivery in secondary schools in Enugu State.

Table 4 T-Test on the Mean Ratings of Male and Female Principals on the Extent to which Teachers Apply Blockchain Technology in Classroom Instructional Delivery in Secondary Schools

| Group | n | x | SD | df | p-value | Decision |
|---|---|---|---|---|---|---|
| Respondents | 329 | 1.18 | .88 | 327 | .002 | H02 not rejected |

Table 4 presents the t-test analysis of male and female principals' mean ratings on the extent to which teachers apply cloud computing in classroom instructional delivery in secondary schools. The p-value of .002, which is less than the significance level (usually .05), suggests a statistically significant difference between the mean scores of male and female respondents. However, the null hypothesis (H02), which posits no significant difference, is not rejected. This means that despite the statistical difference, it is considered not substantial enough to reject the hypothesis of no significant difference in practice.

## V. DISCUSSIONS OF FINDINGS

The study's findings showed that teachers made minimal use of emerging technologies, particularly Blockchain Technology, in their instructional practices. This limited application 13 suggests that, despite the potential benefits Blockchain could offer in education, teachers have not yet widely adopted it in their classrooms. The low usage may be attributed to factors such as a lack of awareness, training, or the necessary infrastructure to support its implementation. These results are consistent with Kshetri (2021), who observed that although Blockchain has transformative potential in education, its adoption is still limited due to inadequate teacher preparation and technical expertise. Similarly, Alammary et al. (2019) pointed out that the integration of Blockchain in classrooms is low, attributing this to insufficient training and poor infrastructure in schools. Both studies agree that these barriers contribute significantly to the limited application of Blockchain technology in educational settings.

The study also found that teachers applied cloud computing technology to a very limited extent in their instructional practices. This minimal usage highlights the disconnect between the availability of cloud computing tools and their actual use in classrooms, suggesting that many educators may not fully grasp or utilize the potential advantages of cloud computing. Contributing factors such as inadequate infrastructure, insufficient training, and a lack of support likely hinder the adoption of cloud computing technology in schools. These findings align with Johnson and

Cummins (2020), who noted that many educators face challenges in implementing cloud computing in classrooms due to limited technological infrastructure and lack of proper training. Similarly, Zhao (2021) emphasized that a shortage of professional development opportunities and support systems impedes teachers' effective use of cloud-based tools, despite their wide availability. Both studies agree that overcoming these challenges is essential to bridging the gap between the potential of cloud computing and its practical application in education.

## VI. CONCLUSION

The findings of the study revealed that teachers were only using emerging technologies such as Blockchain Technology and cloud computing to a very limited extent in their teaching practices. This low level of application suggests that these advanced tools have not yet been effectively integrated into classroom instruction. Several factors contribute to this underutilization, including inadequate access to necessary technology infrastructure, insufficient training opportunities for educators, and a lack of awareness regarding the educational benefits these technologies offer. As a result, the full potential of these emerging technologies to enhance teaching and learning experiences remains largely untapped. To address this, targeted interventions are needed, including professional development programs to improve teachers' technical skills and knowledge. Additionally, providing better access to technology resources and creating awareness about the advantages of these tools can help ensure that teachers can use emerging technologies more effectively, ultimately improving educational outcomes.

## RECOMMENDATIONS

➢ *Based on the Findings, the Study Recommended that:*

- Educational authorities should organize targeted professional development programs and workshops for teachers, focusing on the practical application of emerging technologies such as Blockchain and cloud computing in teaching. These training sessions should be tailored to the specific needs and technical comfort level of teachers.
- Schools should invest in the necessary infrastructure, including reliable internet connectivity and accessible devices, to support the adoption of emerging technologies.
- Additionally, there should be technical support teams to assist teachers with the integration of these technologies into their teaching practices.
- Schools and educational organizations could offer incentives such as recognition, professional growth opportunities, or grants for teachers who effectively integrate

Blockchain and cloud computing into their teaching. This could motivate teachers to explore and adopt these technologies in their classrooms.

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