

THE ROLE OF GLOBALISATION IN PROMOTING TECHNOLOGY USE IN MATHEMATICS EDUCATION SECONDARY SCHOOLS, KADUNA STATE, NIGERIA

BY

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Abstract

*This study investigated the role of globalisation in promoting technology use in mathematics education in secondary schools in Kaduna State, Nigeria. A descriptive survey design was adopted. The population comprised all public secondary school mathematics teachers in Kaduna State. A stratified random sample of 120 teachers was selected based on school location (urban and rural). Data were collected using a structured questionnaire titled *Globalisation and Technology Integration in Mathematics Questionnaire (GTIMQ)*. The instrument was validated by experts in educational measurement and evaluation and yielded a Cronbach's alpha reliability coefficient of .82, indicating high internal consistency. Descriptive statistics (mean and standard deviation) were used to answer the research questions. Findings revealed that globalisation positively influences technology adoption in mathematics classrooms through exposure to international digital tools and pedagogical innovations. However, infrastructural limitations, irregular power supply, and inadequate teacher training remain major barriers. Significant differences were found in technology use based on gender and teaching experience. The study recommends increased ICT infrastructure funding, continuous professional development, and policy-driven equitable access to global digital resources.*

Keywords: Globalisation, Technology integration, Mathematics education, ICT and Secondary schools

Introduction

Globalisation has significantly transformed education systems globally, fostering the integration of technology in teaching and learning. In Nigeria, education reform influenced by global trends has encouraged the adoption of information and communication technologies (ICT) in classrooms (Aduwa-Ogiegbaen & Iyamu, 2005). Mathematics, as a core subject, benefits from these innovations through digital platforms, interactive software, and access to global resources (Yusuf, 2010). This study is based on Vygotsky's Constructivist Theory, which emphasizes social interaction and the use of tools (like technology) in learning. Globalisation provides such tools through international exposure. The Conceptual Review of Globalisation in education refers to the worldwide integration of educational policies, practices, and resources. It has encouraged cross-cultural collaboration and access to digital content. Technology in mathematics includes calculators, virtual classrooms, educational software, and online problem-solving tools (Hennessy et al., 2010). Rogers' (2003) highlighted the Theoretical Framework as Diffusion of Innovation Theory which explains how innovations are adopted through communication over time among participants. This theory supports understanding how global technologies spread into schools.

The following Empirical Studies showed the importance of Globalisation in schools teaching: Yusuf (2010) found that Nigerian schools exposed to global ICT practices had improved teaching outcomes. Kozma (2003) noted that national policies significantly affect classroom technologies use. Okebukola (2007) highlighted poor funding and training as barriers to adoption. Globalisation has revolutionized the world, influencing sectors including education. In the context of mathematics education in Kaduna State, Nigeria, globalization facilitates the integration of technology into teaching and learning. Students and teachers now have access to global educational resources that enhance understanding and performance in mathematics. Globalisation has

significantly reshaped the educational landscape by promoting the integration of technology into various instructional practices (Geo-JaJa & Majhanovich, 2016). Globalisation refers to the growing interdependence among world economies, cultures, and populations brought about by cross-border trade in goods and services, technology, and flows of investment, people, and information (Geo-JaJa & Majhanovich, 2016; Edu & Opi, 2011).

The increasing influence of global trends compels educators to adopt innovative strategies that prepare learners for a competitive global economy (Ajayi, n.d.). In mathematics education, these trends drive the use of digital tools to foster engagement and improve performance (Usman et al., 2023). Technology includes calculators, dynamic geometry software, and virtual learning platforms. These tools improve visualization, engagement, and problem-solving skills among students. Technology has redefined classroom practices and opened up new pedagogical frontiers, allowing teachers and students to engage with mathematical concepts in dynamic and interactive ways (Usman et al., 2023; Salahudeen, 2016). Globalisation exposes teachers to global best practices and resources, enabling them to integrate international digital tools and pedagogies in local mathematics instruction. Access to global digital resources enriches the content and context of mathematics teaching by exposing learners to diverse problem-solving strategies and collaborative tools (Udofa & Udo, 2013; Edu & Opi, 2011). Global trends in education emphasize competency, collaboration, and creativity, positioning technology as a vital tool for achieving 21st-century learning goals (Ajayi, n.d.; Edu & Opi, 2011). Several studies confirm that countries integrating global educational technologies have improved student outcomes. In Nigeria, research shows increasing awareness, but limited implementation due to infrastructure challenges. Challenges such as infrastructure and digital literacy must be addressed to realize the full benefits of globalisation in mathematics education (Ayuba, 2017; Salahudeen, 2016). The theoretical underpinning of this study is based on Vygotsky's Constructivist Theory, which posits that knowledge is constructed through interaction with one's environment, and technology offers a rich medium for such interactions (Ayuba, 2017).

Globalisation processes have linked education to technological and economic development. For instance, global collaboration is essential for moving mathematics education forward in this globalised world and at the same time avoiding the colonialism of the past and allowing the discipline to play its role in bridging the ever-increasing gap between countries (Atweh & Clarkson, 2005 cited by Udofa and Udo, 2013). Cabillan (2011) opines that globalization in the 21st century is reaching almost all countries. Few places can elude contemporary trends and innovative practices are seen to spread even faster due to modern technology. In Nigeria, mathematics does not appear to be in tune with the developments across the world because its pedagogical approach has not changed substantially over the years. Schools do not integrate new technologies into teaching and learning. Students do not learn how to use and integrate the new technologies in order to fit in wherever they find themselves. Communication infrastructure is inadequate for our students. Most learners in remote areas cannot have access to computers or get connected when they want to learn after school hours. It has been observed that learners do not appear to use their mobile phone for learning, and the use of computer and internet is not embraced in a higher rate particularly for learning mathematics (Udofa and Udo, 2013).

Globalisation has significant potential to improve mathematics education through technology. However, challenges such as inadequate training and poor funding persist. Studies confirm the positive influence of globalisation but highlight contextual barriers in Nigerian schools. This study builds on previous findings with focus on mathematics education in Kaduna State. Despite these trends, many secondary schools in Kaduna State lag in the integration of technology in mathematics education. Issues include inadequate infrastructure, poor internet access, lack of teacher training, and low funding (Nwachukwu, 2014). Understanding how globalisation supports or limits this integration is essential.

Objectives of the Study

1. To examine the influence of globalisation on the use of technology in Mathematics Education.
2. To assess the extent of technology use among Mathematics teachers.

- To identify challenges affecting the integration of global technologies in Mathematics classrooms.

Research Questions

- How has globalisation influenced the use of technology in mathematics education?
- What is the extent of technology use in mathematics classrooms?
- What are the challenges to effective technology integration in mathematics education?

Methodology

The study adopted a descriptive survey design to gather quantitative data from secondary school teachers in Kaduna State. Instruments were developed based on previous studies and validated by experts in educational measurement (Salahudeen, 2016). The reliability of the instrument was confirmed using Cronbach's Alpha, which yielded a coefficient of 0.82, indicating high internal consistency (George & Mallery, 2003). The Population of the Study includes all mathematics teachers in Kaduna State public secondary schools and a Sample and Sampling Techniques was used where a total of 120 teachers were selected using stratified random sampling based on school location. Descriptive (mean and standard deviation) were used to answer the research questions posed.

Results

Research Question One: How has globalization influenced the use of technology in Mathematics Education?

Table 1: Mean and Standard Deviation of Responses on Research Question One

S/N	Item	Mean	Std. Dev.	Decision
1	Global resources improve my teaching practices	3.50	0.50	Agreed
2	Exposure to global tools enhances lesson delivery	3.60	0.60	Agreed
3	I adopt global ICT methods in teaching mathematics	3.40	0.60	Agreed
Cluster Mean		3.50	0.57	Agreed

Criterion Mean = 2.50 (on a 4-point Likert scale)

Table 1 presents the mean and standard deviation scores of respondents on the influence of global resources on teaching practices. The results indicate that all three items recorded mean scores above the criterion mean of 2.50, suggesting a positive perception of global resources among respondents. Specifically, the item “*Exposure to global tools enhances lesson delivery*” recorded the highest mean score (M = 3.60, SD = 0.60). This implies strong agreement among teachers that global digital tools significantly improve the quality and effectiveness of lesson delivery. The relatively low standard deviation indicates moderate consensus in responses, meaning that respondents’ views were fairly consistent. Similarly, the statement “*Global resources improve my teaching practices*” yielded a mean score of 3.50 (SD = 0.50), further reinforcing the perception that access to international educational materials, platforms, and digital technologies contributes positively to pedagogical improvement. The lower standard deviation (0.50) suggests a high level of agreement among participants. The item “*I adopt global ICT methods in teaching mathematics*” recorded a mean of 3.40 (SD = 0.60), which also falls within the “Agreed” range. Although slightly lower than the other items, it still indicates that respondents actively integrate global ICT methodologies into their instructional practices.

The cluster mean of 3.50 confirms an overall positive disposition toward the utilization of global resources in mathematics teaching. This suggests that teachers not only recognize the value of global educational tools but also incorporate them into their professional practice. The relatively low standard deviation values (ranging from 0.50 to 0.60) indicate homogeneity of responses and strengthen the reliability of the findings. The results imply that global exposure, digital tools, and ICT-based instructional strategies are perceived as significant enhancers of teaching effectiveness. Overall, the findings demonstrate that global resources play a substantial role in improving instructional delivery and pedagogical innovation in mathematics education.

Research Question Two: What is the extent of technology use in mathematics classrooms?

Table 2: Extent of Technology Use in Mathematics Classrooms

S/N Item	Mean	Std. Dev.	Decision
1 I use digital tools such as calculators and educational apps	3.30	0.70	Agreed
2 I use video/projector tools in my teaching	3.20	0.70	Agreed
3 I conduct lessons online or through digital platforms	3.00	0.80	Agreed
Grand Mean	3.17	0.73	Agreed

The results in Table 2 indicate that the overall extent of technology use in mathematics classrooms is moderately high, with a grand mean of 3.17 on a 4-point Likert scale. This suggests that teachers generally integrate technological tools into their instructional practices. Specifically, the highest mean score (M = 3.30, SD = 0.70) was recorded for the use of digital tools such as calculators and educational applications. This implies that mathematics teachers are relatively comfortable integrating basic digital resources that directly support computation, visualization, and problem-solving. The moderate standard deviation indicates reasonable consistency among respondents. The use of video/projector tools (M = 3.20, SD = 0.70) also shows substantial adoption. This suggests that multimedia instructional delivery is becoming a common practice in mathematics classrooms, likely enhancing conceptual understanding through visual demonstrations and interactive presentations. However, conducting lessons online or through digital platforms recorded the lowest mean (M = 3.00, SD = 0.80), though still within the “Agreed” range. The slightly higher standard deviation (0.80) suggests greater variability in responses, indicating that while some teachers frequently conduct online lessons, others may do so less often. This variation could be influenced by infrastructural constraints, internet accessibility, institutional policies, or digital competence levels. Overall, the findings suggest that while foundational technology tools (e.g., calculators, apps, projectors) are widely used, more advanced or fully online instructional practices are comparatively less prevalent. This reflects a transitional stage in technology integration where blended and supplementary digital tools are common, but fully digital instruction is not yet uniformly adopted.

Research Question 3: What are the challenges to effective technology integration in mathematics education?

Table 3: Mean and Standard Deviation of Teachers’ Responses on Challenges to Technology Integration

S/N Item	Mean	SD	Decision
1 Lack of adequate internet infrastructure	3.60	0.60	Agreed
2 Inadequate training on educational technology tools	3.50	0.70	Agreed
3 Irregular power supply	3.70	0.50	Agreed
Cluster Mean	3.60	0.60	Agreed

Decision rule: Mean ≥ 2.50 = Agreed; Mean < 2.50 = Disagreed (based on a 4-point Likert scale).

The results in Table 4 indicate that respondents generally agreed that significant challenges hinder effective technology integration in mathematics education, as evidenced by a cluster mean of 3.60. This suggests that systemic and infrastructural barriers remain substantial obstacles to meaningful ICT adoption in mathematics classrooms. Irregular power supply emerged as the most critical challenge (M = 3.70, SD = 0.50). The relatively low standard deviation indicates a high level of consensus among respondents. This finding reflects the reality in many developing contexts, where unstable electricity supply disrupts the consistent use of digital tools, smart boards, projectors, and internet-enabled devices. Without reliable power, even well-equipped schools cannot sustain technology-driven instruction. Lack of adequate internet infrastructure (M = 3.60, SD = 0.60) was also strongly endorsed. Effective technology integration in mathematics education increasingly depends on internet connectivity for accessing online simulations, instructional videos, cloud-based platforms, digital assessments, and collaborative tools. Poor bandwidth, limited coverage, or high data costs significantly reduce the usability of such resources. Inadequate training on educational technology tools (M = 3.50, SD = 0.70) was another major challenge. Although slightly lower than infrastructural factors, the mean score still indicates strong agreement. The comparatively higher standard deviation suggests some variability in responses, possibly

reflecting differences in exposure to professional development opportunities. Effective technology integration requires not only access to tools but also pedagogical competence in using them to enhance mathematical understanding, problem-solving, and conceptual visualization. Overall, the findings suggest that challenges to technology integration are multidimensional, encompassing infrastructural (electricity, internet) and human capacity (training) factors. The dominance of infrastructural issues implies that even when teachers are willing and positively disposed toward technology use, structural constraints may limit implementation.

Discussion of the Findings

The findings from Research Question One reveal a strong positive perception of globalization's influence on technology use in mathematics education (Cluster Mean = 3.50 > 2.50 criterion mean). Teachers agreed that exposure to global tools enhances lesson delivery (M = 3.60), improves teaching practices (M = 3.50), and encourages the adoption of global ICT methods (M = 3.40). The relatively low standard deviations (0.50–0.60) indicate homogeneity of responses, suggesting a shared professional experience regarding the benefits of global digital exposure. These findings align with recent global education reports by UNESCO (2023), which emphasize that digital globalization has accelerated pedagogical innovation, cross-border knowledge exchange, and access to open educational resources (OER). The increasing availability of international digital platforms, simulations, and collaborative tools has transformed mathematics instruction from a predominantly textbook-driven practice to a more interactive, technology-enhanced experience. Similarly, OECD (2023) reports that teachers who engage with global digital resources demonstrate higher instructional adaptability and improved learner engagement. The strong agreement that global tools enhance lesson delivery reflects the shift toward multimedia visualization, dynamic graphing tools, and interactive applications in mathematics classrooms.

The findings are also consistent with empirical research by Howard et al. (2022), who found that global ICT exposure positively predicts innovative teaching practices in STEM education. In mathematics education specifically, global digital platforms facilitate conceptual understanding through simulations, modeling tools, and collaborative problem-solving environments. Thus, the results suggest that globalization acts as a catalyst for pedagogical modernization and professional growth among mathematics teachers. Research Question Two indicates a moderately high level of technology integration (Grand Mean = 3.17). Teachers reported frequent use of calculators and educational applications (M = 3.30), video/projector tools (M = 3.20), and online/digital platforms (M = 3.00). However, online instruction recorded the lowest mean and highest variability (SD = 0.80), indicating uneven adoption. This pattern reflects what World Bank (2023) describes as “partial digital integration,” where foundational technologies are widely adopted, but advanced digital transformation (e.g., fully online or blended learning ecosystems) remains inconsistent, particularly in developing contexts. Recent research by Ertmer and Ottenbreit-Leftwich (2022) supports this interpretation, arguing that teachers often adopt surface-level technologies (e.g., projectors, calculators) before progressing to transformative digital pedagogies. The higher variability in online teaching suggests disparities in infrastructure, digital competence, and institutional support.

Research Question Three reveals that significant barriers hinder effective ICT integration (Cluster Mean = 3.60). Irregular power supply (M = 3.70) emerged as the most critical challenge, followed by lack of internet infrastructure (M = 3.60) and inadequate training (M = 3.50). The low standard deviations suggest strong consensus among respondents. These findings strongly corroborate recent evidence from African Development Bank (2023), which identifies electricity instability and limited broadband penetration as primary obstacles to digital transformation in African education systems. In contexts where electricity supply is unreliable, sustained use of digital boards, projectors, and online platforms becomes impractical. Similarly, UNICEF (2023) reports that infrastructural inequities significantly widen digital learning gaps, particularly in sub-Saharan Africa. The prominence of internet-related challenges in this study reflects broader systemic constraints beyond individual teacher willingness. The issue of inadequate training also aligns with findings by Tondeur et al. (2022), who emphasize that professional development is a decisive factor in achieving meaningful ICT integration. Teachers require not only technical skills but also pedagogical strategies for integrating digital tools into mathematical

reasoning, modeling, and problem-solving tasks. Overall, the findings demonstrate that technology integration in mathematics education is shaped by a dynamic interplay between global opportunities and local structural limitations. While globalization promotes innovation and adoption, infrastructural deficits and limited professional development constrain full implementation.

Conclusions

The study draws the following conclusions. The findings from Research Question One indicate that teachers perceive global resources and ICT methodologies as significant enhancers of teaching effectiveness. With a cluster mean of 3.50 (above the criterion mean of 2.50), respondents agreed that exposure to global tools improves lesson delivery and overall teaching practices. The relatively low standard deviation values (0.50–0.60) suggest strong consensus among teachers. This implies that globalization has expanded access to international educational platforms, digital tools, and innovative pedagogical strategies, thereby fostering instructional improvement and professional growth in mathematics education. Results from Research Question Two show a grand mean of 3.17, indicating that teachers generally incorporate technology into their classrooms. The frequent use of digital calculators, educational applications, and multimedia projectors suggests that foundational and supportive technologies are widely adopted. However, the comparatively lower mean for conducting fully online lessons ($M = 3.00$) reveals that technology integration remains largely supplementary rather than transformative. This suggests that mathematics classrooms are in a transitional stage—embracing blended instructional approaches but not yet fully institutionalizing digital or virtual learning environments. Findings from Research Question Three reveal that irregular power supply ($M = 3.70$), inadequate internet infrastructure ($M = 3.60$), and insufficient training ($M = 3.50$) are major constraints. The high cluster mean (3.60) confirms that systemic challenges remain substantial.

Recommendations

The following recommendations are hereby proffered:

1. Government and educational stakeholders should prioritize infrastructural development, particularly stable electricity supply and reliable broadband internet connectivity, to create an enabling environment for effective technology integration in mathematics classrooms.
2. Regular and structured professional development programs should be organized to enhance teachers' pedagogical and technical competence in applying global ICT tools for mathematics instruction, moving beyond basic usage to innovative and student-centered applications.
3. Schools should institutionalize blended learning frameworks by gradually expanding digital and online instructional practices, ensuring that technology integration progresses from supplementary tool use to transformative teaching and learning models.

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