

Qualitative Study in Mathematics Education Reforms and Pedagogical Innovations in Nigeria: Addressing Challenges in Secondary School Classrooms

AKISSANI, Ishaku¹

shakiss4real@gmail.com

<https://orcid.org/0009-0008-5844-5789>

+2348062840698

AMINU, Naziru²

aminunaziru@gmail.com

+2348061671347

RABE, Hanafi³

rabehanafi89@gmail.com

+2349132401050

¹Department of Mathematics, Isa Kaita College of Education, Dutsin-Ma, Katsina State, Nigeria

²Department of Mathematics and Computer Science Education, Umaru Musa Yar'adua University, Katsina, Katsina State, Nigeria

³Department of General Studies in Education, Isa Kaita College of Education, Dutsin-Ma, Katsina State, Nigeria

Abstract

Mathematics education remains a critical component of national development, yet persistent poor performance among secondary school students in Nigeria continues to raise concern among educators and policymakers. This paper examines mathematics education reform and pedagogical innovation in Nigeria with a focus on addressing challenges in secondary school classrooms. It reviews relevant literature on reform initiatives, instructional practices, and classroom-based constraints affecting effective mathematics teaching and learning. The paper identifies key challenges, including inadequate instructional resources, large class sizes, insufficient teacher preparation, ineffective curriculum implementation, negative student attitudes toward mathematics, limited instructional time, and teachers' continued reliance on conventional teaching methods. The study further highlights pedagogical innovations such as problem-solving, inquiry-based learning, activity-based instruction, and collaborative learning as effective approaches for improving students' engagement, conceptual understanding, and academic performance in mathematics. However, the successful implementation of these strategies is constrained by systemic and institutional factors, particularly inadequate teacher training and resource limitations. The paper argues that sustainable improvement in mathematics education in Nigeria requires a holistic reform approach that integrates curriculum enhancement, continuous teacher professional development, improved instructional resources, and supportive learning environments. It concludes that pedagogical innovation is essential for transforming mathematics classrooms into active learning spaces that foster critical thinking and problem-solving skills required in the 21st century.

Keywords: Mathematics education Reform; pedagogical innovation; mathematics; classrooms.

Introduction

Mathematics is a fundamental discipline that underpins scientific advancement, technological innovation, and economic development. Its relevance extends beyond the classroom, as it equips individuals with essential skills such as logical reasoning, critical thinking, and problem-solving required for everyday life and participation in a knowledge-driven society (Boaler, 2016). Despite its importance, students' performance in mathematics at the secondary school level in Nigeria has remained consistently low, as reflected in national examination results (Udonsa, 2015). This persistent poor performance has generated serious concerns about the quality of teaching and learning in schools. Several factors have been identified as contributing to this challenge, including ineffective instructional strategies, unfavorable learning conditions, and inadequate instructional resources (Eze & Ikpe, 2023). Among these, instructional strategies appear to play a particularly critical role in shaping students' learning outcomes (Kocak et al., 2021). Thus, the way mathematics is taught directly influences students' understanding, engagement, and overall performance in the subject. In many Nigerian classrooms, traditional or conventional teaching approaches remain dominant. These approaches are largely teacher-centered, focusing mainly on procedural instruction and passive knowledge transmission rather than fostering deep understanding and active learner participation. Consequently, students often struggle to develop conceptual understanding and meaningful

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connections within mathematical content. Such instructional practices have been widely criticized for their inability to equip learners with the critical thinking and problem-solving skills required in the 21st century (Boaler, 2016). More specifically, the continued reliance on conventional teaching methods that promote memorization and passive learning has been identified as a major factor contributing to students' poor performance in mathematics (Omolafe & Okikiayo, 2023). These methods limit opportunities for students to actively construct knowledge, engage in reasoning, and apply mathematical concepts to real-life situations, thereby hindering meaningful learning. In response to these challenges, mathematics education reform has become imperative in Nigeria. Reform efforts are aimed at improving curriculum implementation, enhancing instructional practices, and promoting better learning outcomes among students. Central to these reforms is pedagogical innovation, which emphasizes learner-centered approaches that actively engage students in the learning process. Such approaches encourage exploration, collaboration, and critical thinking, thereby fostering deeper understanding and improved performance in mathematics (Hiebert & Grouws, 2007). Given the persistent challenges in mathematics education and the growing demand for relevant skills in the modern world, it is essential to examine how pedagogical innovation can be effectively utilized to address existing gaps in teaching and learning. This paper therefore explores mathematics education reform and pedagogical innovation in Nigeria, with particular focus on addressing challenges in secondary school classrooms.

Mathematics Education Reform in Nigeria

Mathematics education reform in Nigeria has evolved over time in response to changing societal needs, global educational trends, and persistent challenges in students' learning outcomes. Historically, the development of mathematics curricula has undergone several transformations aimed at improving both the content and delivery of instruction. One of the most notable reforms was the introduction of the 9-year Basic Education Curriculum, which restructured primary and junior secondary education into a unified system designed to provide a strong foundation in mathematics for all learners (Awofala, 2012). This reform was intended to align Nigeria's education system with international standards and to promote continuity in mathematics learning. The rationale for mathematics education reforms in Nigeria is grounded in the recognition of the subject's critical role in national development. Educational policies emphasize the need for mathematics to foster essential competencies such as problem-solving, analytical reasoning, and technological literacy, which are indispensable in a knowledge-driven economy (Aminu, 2024). Consequently, recent reforms have increasingly shifted focus from content-based instruction to competency-based learning, where students are expected not only to acquire knowledge but also to apply it in real-life situations (Adeoye et al., 2025).

In line with global developments, Nigeria has embraced competency-based curriculum reforms aimed at promoting learner-centered instruction and skills acquisition. These reforms emphasize active learning, collaboration, and critical thinking, as well as the practical application of mathematical concepts (Ibrahim & Adewale, 2024). Furthermore, there has been growing advocacy for integrating mathematics with other disciplines to enhance its relevance and applicability in solving real-world problems (Anyor, 2015). Such interdisciplinary approaches are considered essential for bridging the gap between theoretical knowledge and practical application. Despite these reform efforts, their effectiveness has been limited by several systemic challenges. Studies indicate that although curriculum reforms have introduced innovative content and pedagogical expectations, implementation has often been inconsistent due to inadequate teacher preparation, insufficient funding, and lack of instructional resources (Kunle, 2025). In many cases, reforms have focused more on curriculum design than on classroom realities, resulting in a disconnect between policy intentions and instructional practices. Moreover, research suggests that while some level of alignment exists between curriculum, instruction, and assessment in Nigeria, teaching practices often emphasize lower-order cognitive skills, thereby limiting the development of higher-order thinking abilities. This indicates that although reforms have introduced progressive ideas, their impact on deep learning and conceptual understanding remains limited (Ibrahim & Adewale, 2024). The need for continuous reform is further driven by the recognition that earlier curricula were insufficient to meet the demands of contemporary society. Reforms in secondary school mathematics curricula are therefore essential for promoting human capital development and enhancing global competitiveness (Chinweoke, 2015). This underscores the importance of not only revising curriculum content but also strengthening teaching methodologies and improving teacher capacity. Overall, mathematics education reform in Nigeria represents an ongoing effort to improve the quality and relevance of education. While progress has been made in curriculum restructuring and policy development, the success of these reforms largely depends on effective



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implementation, teacher preparedness, and the integration of innovative pedagogical practices. Consequently, there is a need to complement curriculum reforms with sustained investment in teacher professional development, instructional resources, and supportive learning environments to achieve meaningful improvements in students' mathematics performance.

Pedagogical Innovation in Mathematics Education

Pedagogical innovation has emerged as a central pillar in contemporary mathematics education reform, particularly in contexts where traditional instructional approaches have proven inadequate for improving students' learning outcomes. In essence, pedagogical innovation refers to the adoption and implementation of teaching strategies that promote active learning, conceptual understanding, and meaningful student engagement. It represents a shift from teacher-centered methods to learner-centered approaches that position students as active participants in the construction of knowledge (Hiebert & Grouws, 2007). In mathematics education, pedagogical innovation is especially important because of the abstract nature of the subject and the widespread difficulties students experience in understanding mathematical concepts. Traditional instructional methods, which emphasize procedural knowledge and passive reception of information, often fail to foster deep understanding or the ability to apply knowledge in novel situations (Boaler, 2016). As a result, innovative pedagogies have been advocated as a means of enhancing both the quality of teaching and students' academic performance. In the Nigerian context, several innovative approaches have been identified to include:

Problem-Solving Instructional Strategy

The problem-solving instructional strategy is widely recognized as a fundamental approach in mathematics education that promotes active engagement and higher-order thinking. This strategy involves presenting learners with mathematical problems that require reasoning, analysis, and the application of prior knowledge to arrive at solutions. Rather than focusing on memorization of procedures, problem-solving emphasizes understanding the underlying concepts and developing flexible thinking skills (Polya, 1957). In the context of mathematics education reform, the problem-solving approach is particularly relevant as it aligns with the goal of developing students' critical thinking and analytical abilities. It encourages learners to explore multiple solution pathways, justify their reasoning, and apply mathematical concepts to real-life situations. Empirical studies in Nigeria have shown that students exposed to problem-solving strategies demonstrate significantly improved performance and deeper conceptual understanding compared to those taught using traditional lecture methods (Nwoke, 2015). Despite its effectiveness, the implementation of problem-solving strategies in Nigerian classrooms is often constrained by factors such as large class sizes, limited instructional time, and teachers' reliance on conventional teaching methods. Nonetheless, its integration into classroom practice remains essential for enhancing students' mathematical competence and preparing them for real-world problem-solving.

Inquiry-Based Learning

Inquiry-based learning is an innovative pedagogical approach that emphasizes exploration, questioning, and discovery in the learning process. In mathematics education, this strategy encourages students to investigate mathematical ideas, formulate hypotheses, and construct knowledge through guided inquiry rather than passive reception of information (Hmelo-Silver et al., 2007). This approach is grounded in constructivist learning theory, which posits that learners actively build knowledge through interaction with their environment. By engaging students in inquiry-based activities, teachers create opportunities for deeper understanding, critical thinking, and sustained engagement. Inquiry-based learning also fosters curiosity and independence, enabling students to take ownership of their learning. Researches by Hmelo-Silver et al. (2007), Simsek and Kabapinar (2010), Ahmad et al. (2023), Ugo and Oliweh (2024), and Oduwole et al. (2025) have shown that inquiry-based approaches significantly enhance students' conceptual understanding, problem-solving abilities, and mathematics performance. However, effective implementation requires careful scaffolding by teachers to ensure that students remain focused and achieve the intended learning outcomes. In the Nigerian context, challenges such as insufficient teacher training and limited instructional resources may hinder its widespread adoption. Nevertheless, inquiry-based learning remains a vital component of pedagogical innovation in mathematics education.

Activity-Based Learning Strategy

Activity-based learning is a learner-centered instructional strategy that involves engaging students in hands-on activities and practical tasks to facilitate understanding of mathematical concepts. This approach makes abstract ideas more concrete by linking them to real-life experiences, thereby enhancing students' comprehension and retention of knowledge. In

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mathematics classrooms, activity-based learning may include the use of manipulatives, experiments, games, and real-world problem scenarios. These activities encourage active participation, collaboration, and experiential learning, which are essential for developing meaningful understanding. Studies have demonstrated that students taught using activity-based methods perform better academically and exhibit greater interest in mathematics compared to those taught using traditional methods (Bature et al., 2020). The effectiveness of activity-based learning lies in its ability to cater to diverse learning styles and promote engagement among students. However, its successful implementation depends on the availability of instructional materials and teachers' ability to design and manage interactive learning activities. In many Nigerian schools, resource constraints and large class sizes pose significant challenges to the adoption of this approach.

Collaborative Learning Strategy

Collaborative learning is an instructional approach that involves students working together in groups to achieve shared learning goals. In mathematics education, this strategy promotes interaction, communication, and collective problem-solving, allowing students to learn from one another and develop a deeper understanding of mathematical concepts (Johnson & Johnson, 2009). Through collaborative learning, students are encouraged to discuss ideas, explain their reasoning, and evaluate alternative solutions. This process not only enhances conceptual understanding but also develops essential social and communication skills. Collaborative learning environments foster positive interdependence, where students rely on one another to succeed, thereby promoting accountability and teamwork. Empirical evidence has consistently shown that collaborative learning significantly enhances students' performance and engagement in mathematics. This instructional approach promotes interaction among learners, enabling them to share ideas, explain reasoning, and jointly solve mathematical problems. Through such interaction, students develop deeper conceptual understanding while also improving their communication and reasoning skills (Johnson & Johnson, 2009). In addition, collaborative learning has been found to reduce mathematics anxiety and build learners' confidence, particularly among students who struggle with the subject, by creating a supportive peer-learning environment (Slavin, 2014). However, the effectiveness of collaborative learning depends largely on its proper implementation. Research indicates that successful use of this strategy requires careful planning, clearly defined group roles, structured tasks, and active facilitation by the teacher to ensure meaningful participation from all students (Gillies, 2016). Without these conditions, group work may become unproductive and fail to achieve its intended learning outcomes. In the Nigerian context, collaborative learning has been identified as a promising pedagogical approach for addressing persistent challenges associated with traditional teacher-centered instruction. Studies have shown that when students engage in structured group activities, their participation, motivation, and achievement in mathematics improve significantly. For example, Nigerian classroom-based research has demonstrated that cooperative and peer-assisted learning strategies lead to higher academic performance compared to conventional lecture methods (Bature et al., 2020). By fostering interaction and shared responsibility, collaborative learning creates an inclusive classroom environment that enhances students' engagement and improves learning outcomes in mathematics.

Reflective Instructional Strategies

Reflective instructional strategies constitute an important dimension of pedagogical innovation in mathematics education, as they promote critical thinking, self-awareness, and deeper conceptual understanding among learners. Reflective teaching involves encouraging students to think about their own learning processes, evaluate their understanding, and make connections between prior knowledge and new mathematical concepts. This approach shifts learning from mere acquisition of procedures to meaningful engagement with mathematical ideas (Schon, 1983). In mathematics classrooms, reflective strategies may include activities such as self-explanation, journaling, error analysis, and guided questioning. These practices enable students to articulate their reasoning, identify misconceptions, and refine their problem-solving approaches. By engaging in reflection, students develop metacognitive skills, which are essential for independent learning and long-term retention of knowledge (Hiebert & Grouws, 2007). Empirical evidence supports the effectiveness of reflective instructional strategies in improving students' performance in mathematics. For instance, Olamide (2024) found that students exposed to reflective teaching methods demonstrated significantly higher performance and deeper conceptual understanding compared to those taught using conventional methods. Similarly, reflective practices have been shown to enhance students' confidence and reduce mathematics anxiety by promoting a supportive and interactive learning environment. Despite these benefits, the implementation of reflective instructional strategies in Nigerian classrooms remains limited. This is largely due to factors such as time constraints, large class sizes, and teachers' limited familiarity



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with reflective teaching techniques. Nevertheless, integrating reflective practices into mathematics instruction is essential for fostering higher-order thinking skills and improving students' overall learning outcomes.

Case-Based Instructional Strategies

Case-based instructional strategies represent another innovative approach that has gained attention in mathematics education due to their potential to connect abstract concepts with real-life situations. Case-based learning involves presenting students with real-world or simulated scenarios that require the application of mathematical concepts to solve practical problems. This approach enhances relevance and contextual understanding, making mathematics more meaningful to learners (Herreid, 2011). In mathematics classrooms, case-based instruction can take the form of problem scenarios, real-life applications, or situational analyses that require students to apply mathematical reasoning. By engaging with authentic problems, students develop critical thinking, analytical skills, and the ability to transfer knowledge across contexts. This aligns with contemporary educational goals that emphasize the application of knowledge rather than mere memorization. Empirical studies in Nigeria have demonstrated the effectiveness of case-based strategies in improving students' performance in mathematics. For example, Ogunsaju and Sam-Kayode (2024) reported that students taught using case-based approaches performed significantly better in algebraic problem-solving tasks than those taught using traditional lecture methods. Similarly, case-based learning has been found to enhance students' engagement, motivation, and collaborative learning experiences. However, the successful implementation of case-based instructional strategies requires careful planning, appropriate instructional materials, and teacher competence in facilitating discussion and guiding inquiry. Challenges such as limited resources, large class sizes, and rigid curriculum structures may hinder the adoption of this approach in Nigerian secondary schools. Despite these constraints, case-based instruction remains a valuable pedagogical tool for promoting meaningful learning and bridging the gap between theory and practice in mathematics education.

Technology-Enhanced Learning

In recent years, technology-enhanced learning has also become a key component of pedagogical innovation in mathematics education. The integration of digital tools such as computer simulations, virtual manipulatives, and online learning platforms enables teachers to present mathematical concepts in dynamic and interactive ways. These technologies support visualization, immediate feedback, and personalized learning experiences, which can enhance students' understanding and retention of mathematical knowledge (Clark-Wilson et al., 2014). However, the effective use of technology requires adequate infrastructure and teacher competence, which remain challenges in many developing countries, including Nigeria.

Formative Assessment Practices

Formative assessment practices represent an important innovative strategy for improving teaching and learning in mathematics. Unlike traditional summative assessments, formative assessment focuses on continuous monitoring of students' learning progress and providing timely feedback to guide instruction. This approach helps teachers identify learning gaps and adjust their teaching strategies accordingly, thereby improving student outcomes (Black & Wiliam, 2009). Empirical evidence from Nigeria provides strong support for the effectiveness of pedagogical innovation in improving students' performance in mathematics. For instance, Akinpelu et al. (2024) found that the application of mastery learning strategies significantly enhanced students' academic performance. Similarly, Olamide (2024) reported that the use of reflective instructional strategies improved students' conceptual understanding and overall performance in mathematics. In addition, studies have shown that activity-based and other learner-centered approaches lead to higher academic performance compared to conventional lecture methods, largely due to increased student engagement and active participation in the learning process (Bature et al., 2020). Despite these demonstrated benefits, the adoption and effective implementation of pedagogical innovation in Nigerian secondary school classrooms remain limited. Several constraints continue to hinder its widespread use, including inadequate teacher training, insufficient instructional resources, large class sizes, and resistance to change among educators. These challenges significantly limit teachers' capacity to adopt innovative instructional practices and highlight the need for sustained professional development programmes that equip teachers with the requisite pedagogical skills and competencies (Darling-Hammond et al., 2017). Furthermore, pedagogical innovation extends beyond the mere introduction of new teaching techniques; it involves a comprehensive transformation of the teaching and learning environment. This transformation requires a shift in teachers' beliefs, attitudes, and classroom practices, as well as the provision of supportive institutional frameworks and adequate resources. When effectively implemented, pedagogical innovation has the potential to bridge the gap between curriculum intentions and classroom

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realities, thereby enhancing students' engagement, understanding, and academic performance in mathematics. Within the broader context of mathematics education reform in Nigeria, pedagogical innovation plays a pivotal role in addressing persistent challenges related to poor student performance and ineffective teaching practices. By promoting learner-centered instruction and fostering higher-order thinking skills, innovative pedagogies contribute significantly to improving the quality and relevance of mathematics education. Therefore, integrating pedagogical innovation into reform initiatives is essential for achieving sustainable improvements in teaching and learning outcomes. However, the persistent constraints affecting their implementation underscore the need to critically examine the challenges confronting mathematics classrooms in Nigerian secondary schools.

Challenges in Secondary School Mathematics Classrooms in Nigeria

Despite ongoing efforts toward mathematics education reform in Nigeria, several challenges continue to hinder effective teaching and learning at the secondary school level. These challenges are multifaceted and interconnected, affecting both instructional delivery and students' academic outcomes. Some of these challenges include:

1. Inadequate Instructional Resources

One of the most critical challenges facing mathematics education in Nigerian secondary schools is the inadequacy of instructional resources. Many schools lack essential teaching materials such as textbooks, mathematical tools, and technological facilities required to support effective instruction. This deficiency limits teachers' ability to employ interactive and innovative teaching methods, thereby reducing students' engagement and understanding of mathematical concepts (Ibe-Moses et al., 2024). Additionally, poor infrastructure, including poorly equipped classrooms and absence of laboratories, further constrains effective teaching and learning (Babajide & Smith, 2022).

2. Poor Teacher Preparation

Effective mathematics instruction requires well-prepared teachers with strong subject knowledge and pedagogical skills. However, evidence suggests that many teachers in Nigerian secondary schools are inadequately prepared to meet the demands of modern mathematics teaching. Teacher education programmes often suffer from outdated curricula and insufficient practical training, resulting in teachers who lack the competence to implement innovative instructional strategies (Disciplines.ng, 2024). This inadequacy negatively impacts the quality of instruction and students' learning outcomes.

3. Large Class Size

Large class size remains a major challenge in Nigerian secondary school classrooms. In many public schools, the number of students per class far exceeds the recommended teacher–student ratio, making effective classroom management and individualized instruction difficult. Studies have shown that overcrowded classrooms reduce students' participation, increase disruptive behaviour, and negatively affect academic performance in mathematics (Akanmu, 2025). Consequently, teachers are often unable to attend to the diverse learning needs of students.

4. Ineffective Curriculum Implementation

Although Nigeria has introduced several curriculum reforms aimed at improving mathematics education, implementation remains a significant challenge. Research indicates that factors such as inadequate funding, lack of instructional materials, and teachers' poor understanding of curriculum content hinder effective implementation (Ige & Arekemase, 2021). In many cases, there is a disconnect between curriculum objectives and classroom practices, resulting in limited achievement of intended learning outcomes.

5. Negative Attitudes towards Mathematics

Students' attitudes toward mathematics play a crucial role in their learning outcomes. In Nigeria, many students perceive mathematics as a difficult and abstract subject, leading to low motivation and poor engagement. Negative attitudes often stem from previous learning experiences, ineffective teaching methods, and lack of relevance of mathematical concepts to real-life situations (Aduwa, 2021). This psychological barrier significantly contributes to poor performance in the subject.

6. Limited Instructional Time

Another challenge affecting mathematics education is the limited time allocated for instruction. The broad nature of the mathematics curriculum, combined with insufficient teaching periods, often prevents teachers from adequately covering the syllabus. This results in superficial teaching of concepts and limited opportunities for practice, which are essential for mastering mathematical skills.



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7. Teachers' Reliance on Conventional Teaching Methods

Despite the emphasis on learner-centered approaches in recent reforms, many teachers still rely heavily on traditional, lecture-based methods. These methods emphasize passive learning and procedural knowledge rather than conceptual understanding and active engagement. Research has shown that such approaches limit students' ability to develop critical thinking and problem-solving skills, which are essential for success in mathematics (Bature et al., 2020).

8. Insufficient Teacher Training and Professional Development

Continuous professional development is essential for equipping teachers with modern pedagogical skills. However, in Nigeria, opportunities for in-service training, workshops, and professional development are often limited. This lack of ongoing training prevents teachers from updating their knowledge and adopting innovative teaching strategies, thereby limiting the effectiveness of mathematics instruction (Disciplines.ng, 2024).

Implications for Teaching and Learning in Mathematics Education in Nigeria

The findings from literature on mathematics education reform, pedagogical innovation, and classroom challenges in Nigeria have important implications for both teachers and students. These implications are critical for improving instructional quality, enhancing learner engagement, and ultimately raising students' performance in mathematics.

1. Implications for Teachers

For teachers, the literature underscores the need for a fundamental shift from traditional teacher-centered instruction to more learner-centered and interactive pedagogies. Teachers are expected to move beyond procedural teaching approaches and adopt innovative strategies such as problem-solving, inquiry-based, collaborative, and activity-based learning that promote conceptual understanding and critical thinking (Boaler, 2016; Hiebert & Grouws, 2007). This shift implies that teachers must continually develop their professional competencies through sustained training and professional development programmes. Effective teaching of mathematics requires not only strong content knowledge but also pedagogical content knowledge that enables teachers to present abstract concepts in meaningful and relatable ways (Shulman, 1986). However, studies have shown that many Nigerian teachers lack adequate exposure to modern instructional strategies due to insufficient in-service training and limited professional development opportunities (Akanmu, 2025). Furthermore, teachers are expected to integrate formative assessment practices into their instruction to monitor students' understanding and provide timely feedback. This approach helps to identify learning gaps and adjust instructional strategies accordingly, thereby improving learning outcomes (Black & Wiliam, 2009). In addition, teachers must create inclusive classroom environments that encourage participation, reduce mathematics anxiety, and support diverse learners. Overall, the implication is that teachers are central agents of reform, and their readiness, beliefs, and instructional practices significantly determine the success of mathematics education reforms in Nigeria.

2. Implications for Students

For students, pedagogical innovation implies a shift from passive learning to active engagement in the learning process. Students are expected to take greater responsibility for their learning by participating in discussions, collaborative tasks, problem-solving activities, and inquiry-based investigations (Johnson & Johnson, 2009). This active engagement enhances students' conceptual understanding, critical thinking skills, and ability to apply mathematical knowledge to real-life situations. Studies have shown that when students are exposed to learner-centered instructional strategies, their academic performance and interest in mathematics improve significantly (Bature et al., 2020; Olamide, 2024). In addition, students benefit from reduced mathematics anxiety and increased confidence when learning is structured in supportive and interactive environments. Collaborative learning, in particular, fosters peer support and shared understanding, which helps weaker students improve their performance (Slavin, 2014). However, for these benefits to be fully realized, students must also develop positive attitudes toward mathematics and a willingness to engage actively in learning activities. Negative perceptions of mathematics as a difficult subject must be addressed through consistent exposure to meaningful and engaging instructional experiences (Akanbi et al., 2024). In summary, students are no longer passive recipients of knowledge but active participants in knowledge construction, and their engagement is essential for the success of mathematics education reform.

Recommendations

Based on the review of literature on mathematics education reform, pedagogical innovation, and classroom challenges in Nigerian secondary schools, the following recommendations are made to improve teaching and learning outcomes in mathematics:

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1. Government and educational stakeholders should organize regular and sustained professional development programmes to equip mathematics teachers with modern pedagogical skills that focus on learner-centered strategies such as problem-solving, inquiry-based learning, collaborative learning, and reflective teaching practices.
2. Mathematics teachers should be encouraged and supported to move away from traditional lecture-based instruction toward more interactive and student-centered approaches.
3. Government and school administrators should ensure that schools are adequately equipped with instructional materials, including mathematical tools, textbooks, and digital resources. The integration of technology-enhanced learning tools should also be prioritized to support visualization and engagement in mathematics instruction.
4. Policy interventions should be implemented to reduce overcrowded classrooms, particularly in public secondary schools. Smaller class sizes will enable teachers to provide individualized attention and improve classroom interaction, thereby enhancing student learning outcomes.
5. Curriculum developers should ensure that mathematics curriculum reforms are effectively implemented at the classroom level. There should be strong monitoring and evaluation mechanisms to bridge the gap between curriculum objectives and instructional practices.
6. Teachers should adopt motivational and engaging instructional approaches that reduce mathematics anxiety and promote positive attitudes toward the subject.
7. Students should be encouraged to actively participate in classroom activities, group discussions, and problem-solving tasks. This will promote deeper engagement, collaboration, and improved understanding of mathematical concepts.

Conclusion

This paper has examined mathematics education reform and pedagogical innovation in Nigeria, with particular attention to the challenges affecting secondary school mathematics classrooms. The study revealed that despite various curriculum reforms and policy initiatives, students' performance in mathematics remains persistently low due to systemic and instructional challenges. Key issues identified include inadequate instructional resources, large class sizes, insufficient teacher preparation, ineffective curriculum implementation, and teachers' continued reliance on traditional teaching methods. These challenges collectively hinder effective teaching and limit students' ability to develop critical thinking and problem-solving skills necessary for success in mathematics and in the wider society. The paper further established that pedagogical innovation plays a crucial role in addressing these challenges. Strategies such as problem-solving, inquiry-based learning, collaborative learning, and activity-based instruction have been shown to significantly improve students' engagement, understanding, and academic performance. However, the successful implementation of these strategies depends on adequate teacher preparation, supportive learning environments, and effective educational policies. In conclusion, sustainable improvement in mathematics education in Nigeria requires a holistic approach that integrates curriculum reform with strong pedagogical innovation and systemic support. Teachers, students, policymakers, and other stakeholders must work collaboratively to transform mathematics classrooms into dynamic learning environments that promote active engagement, conceptual understanding, and lifelong learning skills. Only through such coordinated efforts can Nigeria achieve meaningful improvement in mathematics education outcomes and prepare learners for the demands of the 21st century.

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