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A review of functional mathematics education as a tool for national transformation

Chinelo Blessing Oribhabor
Department of Guidance and Counselling, Faculty of Arts and Education,
University of Africa, Toru-Orua, Bayelsa State, Nigeria, ORCID: 0000-0002-7318-1477
chiblessing42004@yahoo.co.uk; chinelo.oribhabor@uat.edu.ng

Abstract

This review examined the promise of functional mathematics education as a transformative instrument for national growth, especially within contexts that demand skilled, flexible workers, such as Nigeria. Functional mathematics education focuses on practical, real-world uses of mathematical concepts, providing learners with skills necessary for addressing real-life challenges in areas such as technology, finance, engineering, and healthcare. Since traditional mathematics education, which frequently emphasizes rote memorization, fails to adequately prepare students for these roles, this method aims to connect theoretical understanding with practical implementation. The analysis explored the present condition of functional mathematics education in Nigeria, emphasizing its role in fostering critical thinking, problem-solving, and innovation. It also addressed obstacles in applying this method, such as insufficient teacher training, scarce resources, and curriculum deficiencies, which impede national advancement. Furthermore, the review examined the prospects in functional Mathematics Education in Nigeria, including updating teacher training programs, incorporating technology into classrooms, and reforming policies to promote a more application-focused curriculum. The paper examined the effect of functional mathematics education on national transformation. This paper suggested that the Ministry of Education, together with teacher training institutions, needs to set up workshops and ongoing professional development (CPD) programs emphasizing teaching methods like project-based learning, problem-solving abilities, and critical thinking. Equipping teachers with these skills will allow them to foster a more interactive and engaging learning atmosphere for students, improving their comprehension and appreciation of mathematics.

Keywords: Functional, Mathematics, Education, National transformation, Nigeria

Introduction

Mathematics education involves the instruction, acquisition, and utilization of mathematical ideas and abilities across different educational stages. It serves as a core element of formal education intended to enhance students' capacity to reason logically, evaluate problems, and comprehend numerical connections. Mathematics education encompasses various subjects, such as arithmetic, algebra, geometry, calculus, and statistics, and is crucial in preparing students with skills necessary for personal, academic, and career development (Hiebert & Grouws, 2022).

A key aim of mathematics education is to promote cognitive development. Through interaction with mathematical ideas, learners cultivate critical thinking, reasoning, and problem-solving abilities. Studies indicate that learning mathematics improves analytical skills and fosters organized thinking, competencies that can be applied to different aspects of life and are essential for achievement in numerous domains, ranging from sciences to the arts (Schoenfeld, 2023). Moreover, it has been demonstrated that mathematics education improves spatial reasoning, memory, and attention to specifics, establishing it as an

essential subject in a comprehensive education (Geary & Vanmarcke, 2022).

Mathematics teaching has changed considerably over the years, showcasing progress in educational theories, teaching methods, and technological tools. Conventional methods that focused on memorization and procedural skills are gradually being supplanted by constructivist techniques that highlight conceptual insight and practical application. Constructivist methods promote active student involvement with mathematical concepts and comprehension of their foundational principles, rather than simply rote memorization of rules and formulas (Boaler, 2022). This change is apparent in the increasing focus on "mathematical literacy," which centers on students' capacity to use mathematical knowledge in real-life contexts and address practical issues (Jablonka & Gellert, 2023). Technological progress has revolutionized mathematics education by providing engaging and tailored learning opportunities. Digital resources like graphing programs, simulation applications, and learning games offer students interactive settings to examine mathematical principles and represent abstract concepts visually. These tools facilitate personalized teaching, enabling educators to address various learning styles and speeds. Additionally, artificial intelligence (AI) and machine learning are progressively being incorporated into educational platforms, facilitating immediate feedback and personalized learning routes that enhance students' understanding (Johnson & Thomas, 2023).

Mathematics education acts as a fundamental element in fostering critical thinking, problem-solving, and analytical abilities. These abilities are essential for individual development and community progress, emphasizing the importance of practical mathematics education in national change. Functional mathematics education goes beyond conventional techniques by emphasizing practical, real-world uses of mathematical concepts. This strategy enables students to tackle issues across multiple fields, such as technology, engineering, finance, and healthcare, which are essential for national growth (Adetunji & Okanlawon, 2022). In recent years, there has been an increased acknowledgment of the significance of functional mathematics education as a pivotal instrument for national advancement, especially in developing nations such as Nigeria. Functional mathematics education focuses on real-world application, preparing students with the skills needed to address practical issues across different fields, such as technology, finance, engineering, and healthcare. This pedagogical method seeks to connect theoretical understanding with practical application, promoting critical thinking, creativity, and problem-solving skills necessary for personal development and community progress (Adewale & Olaniyi, 2022).

In Nigeria, where economic difficulties and gaps in workforce skills are common, practical mathematics education is increasingly seen as a means to promote economic growth and tackle social disparities. Studies show that a solid grounding in mathematics enhances personal job prospects and also boosts national productivity by creating a skilled labor force that can fulfill the needs of a global economy (Abubakar & Ibrahim, 2023). As a result, the Nigerian education sector is experiencing gradual changes to incorporate practical mathematics into programs, aiming to develop graduates who can utilize mathematical knowledge in significant and creative manners. Although it holds great potential, the execution of functional mathematics education in Nigeria encounters several obstacles, including insufficient teacher training, scarce resources, and an excessive focus on rote learning within the conventional curriculum. These challenges obstruct students' capacity to relate mathematical ideas to real-world applications, thereby restricting the overall potential of mathematics education as a change agent in the country (Ojo & Akinwale, 2023). Tackling these challenges is vital for Nigeria to leverage the potential of mathematics education

as a catalyst for national change and economic development.

This review analyzes the present condition of functional mathematics education in Nigeria, investigating its significance in national development. The article evaluates the hindrances and opportunities in the Nigerian educational framework and offers recommendations for improving the efficiency of mathematics teaching to promote sustainable national growth.

Current State of Functional Mathematics Education in Nigeria

Functional mathematics education in Nigeria is slowly progressing as educational stakeholders like policymakers, educators, and researchers acknowledge its ability to facilitate national change. Functional mathematics education focuses on the practical use of mathematics, equipping students to apply mathematical skills in real-life situations, ranging from simple problem-solving to more intricate analytical duties in work environments. Nonetheless, in spite of the growing recognition of its significance, Nigeria's integration of functional mathematics education is still restricted, facing numerous systemic, infrastructural, and pedagogical obstacles that impede its broad application.

Focus on theory rather than practical use: In numerous Nigerian schools, mathematics teaching continues to prioritize theoretical knowledge instead of practical implementation. This conventional method typically emphasizes memorization and readiness for standardized tests, prioritizing procedural knowledge instead of conceptual comprehension. Eze and Okafor (2023) state that this excessive focus on exams restricts students' engagement with practical mathematics, impairing their capacity to use mathematical principles effectively. The absence of hands-on activities and concrete examples in the curriculum leads to students who might perform well in tests but face difficulties in solving real-world problems.

Curriculum and policy inconsistencies: Despite requests to include functional mathematics in Nigeria's educational curriculum, the integration process is still uneven. Although the Nigerian National Policy on Education recognizes the necessity of an effective curriculum that equips students for real-world situations, existing mathematics programs frequently fall short of a systematic method to fulfill this objective. Research by Okeke and Anumudu (2022) shows that the educational policy framework has not been sufficiently updated to enhance effective mathematics education, leading to slight curricular coherence with industry requirements. The shortcomings in the curriculum hinder the successful implementation of practical mathematics education at all educational stages, from primary schools to higher education.

Insufficient teacher training and professional growth: The readiness of teachers plays a vital role in the effectiveness of practical mathematics education. Nevertheless, teachers in Nigeria frequently do not have the training and resources needed to effectively teach mathematics in a practical, application-oriented manner. Numerous educators lack exposure to modern teaching methods that emphasize problem-solving and real-world applications, which results in their dependence on conventional instructional techniques. Bello and Nwosu (2023) state that training in functional or experiential teaching techniques is seldom part of professional development programs for mathematics teachers in Nigeria. As a result, numerous educators believe they lack the tools to make math interesting and relevant, leading to a gap between classroom instruction and the skills required in practical situations.

Restricted access to technological and educational resources: The presence of resources poses another significant obstacle to the execution of functional mathematics education in Nigeria. Contemporary mathematics education frequently

demands technological instruments such as graphing calculators, simulation programs, and online materials to enhance interactive learning and practical uses of mathematical ideas. Nonetheless, numerous Nigerian schools, particularly in rural regions, do not have access to these resources, restricting opportunities for students to interact with practical mathematics. Okon and Imeh (2023) emphasize that differences in resource availability worsen educational inequality, as students in poorly funded schools are deprived of the advantages that technology-driven, practical mathematics learning offers.

Socio-cultural obstacles and mathematics anxiety: Mathematics anxiety, a psychological issue where people feel stress or fear when facing mathematics problems, is widespread in Nigeria and serves as an extra hindrance to effective mathematics education. Cultural perceptions of mathematics frequently add to this anxiety, since numerous students regard the subject as fundamentally challenging and unconnected to daily life. As noted by Ajayi and Ogunleye (2023), this attitude hinders students from fully immersing themselves in mathematics, and absent timely interventions, it can obstruct students from valuing the practical applications of mathematics in everyday life. This aversion to mathematics restricts students' engagement in practical mathematics education and diminishes their drive to explore mathematics-related careers.

Advances in functional mathematics and technology integration:

In spite of these obstacles, there are encouraging advancements in Nigeria's functional mathematics educational framework. Certain schools, especially in city areas, have begun incorporating technology into their teaching methods, utilizing educational applications, simulation programs, and online classes to enhance the engagement and practical application of mathematics. As stated by Johnson and Ogunbi (2023), e-learning platforms utilizing artificial intelligence (AI) and machine learning (ML) are more frequently being employed to develop customized learning experiences in mathematics, tailored to each student's rhythm and learning preferences. These advancements indicate that technology could significantly contribute to functional mathematics education, although access is still inconsistent throughout the country.

Fairness in access and regional differences: In Nigeria, there is a considerable gap between urban and rural areas regarding access to practical mathematics education. Urban schools typically have superior resources, enabling them to integrate functional mathematics into their curriculum more efficiently. In contrast, rural educational institutions frequently face challenges such as insufficient infrastructure, restricted access to technology, and a lack of qualified educators. Ndubuisi and Kalu (2023) indicate that rural students experience these limitations disproportionately, leading to an educational disparity that results in their insufficient readiness for higher education and job prospects.

Initiatives and Policy Suggestions: To address these challenges, several proposals have been made to improve the integration of functional mathematics education in Nigeria. Educational reforms that emphasize practical and application-oriented training for teachers are essential. For instance, it is suggested that professional development workshops, mentorship initiatives, and curriculum redesign be implemented to provide teachers with the necessary skills to effectively teach functional mathematics (Adetunji & Uche, 2023). Decision-makers are also urged to distribute resources to close the urban-rural gap, guaranteeing that every student can access the tools and technologies essential for effective learning.

Challenges of Functional Mathematics Education in Nigeria

The challenges of Functional Mathematics Education in Nigeria are:

Insufficient teacher training and professional development: A significant obstacle to effective mathematics education in Nigeria is the absence of properly trained educators. Numerous mathematics educators lack the instructional skills needed to teach math in a practical or application-focused way. The majority of educators have received training in a system that prioritizes memorization and theoretical knowledge over critical thinking and problem-solving skills (Bello & Nwosu, 2023). As a result, educators frequently struggle to involve students in significant, context-driven learning activities. Ajayi and Ogunleye (2023) state that there is a lack of professional development programs emphasizing practical teaching methods, which hinders teachers from integrating real-world applications into their instruction.

Limitations on resources and restricted access to technology: The execution of practical mathematics necessitates sufficient resources, comprising technology and materials that facilitate experiential learning. In Nigeria, educational institutions especially in rural regions—frequently do not have the technological infrastructure and resources needed for effective math teaching. Resources such as graphing calculators, computers, and simulation programs are crucial for hands-on and application-focused education, yet they are often lacking in schools with limited resources (Okon & Imeh, 2023). Moreover, the digital gap between urban and rural schools worsens educational disparities, since students in rural locations lack access to technology-enhanced math learning, which hinders their involvement and comprehension.

Excessive focus on examination results: Nigeria's educational framework prioritizes examination outcomes, frequently to the detriment of hands-on learning and skill enhancement. The dependence on standardized assessments has caused schools to implement teaching approaches that focus on memorization and test readiness instead of fostering a thorough grasp and practical use of concepts (Ojo et al., 2022). This exam-focused method restricts students' engagement with practical mathematics, since educators emphasize material that matches testing standards instead of real-world problem-solving. The insufficient focus on practical learning hinders students from completely recognizing the significance of mathematics in their lives and future professions, thus restricting the transformative power of mathematics education.

Curriculum deficiencies and varying educational policies: Although, recent reforms have recognized the importance of a practical curriculum, the mathematics curriculum in Nigeria remains primarily focused on theoretical concepts, and does not sufficiently include structured elements that highlight practical applications. Okeke and Anumudu (2022) contend that curriculum development in Nigeria has lagged behind the changing demands of the global workforce, hindering the widespread implementation of functional mathematics. Additionally, erratic educational policies frequently lead to a deficiency in consistency in curriculum development and execution, causing regular alterations that interrupt long-term strategies and obstruct the successful integration of practical mathematics education.

Cultural obstacles and mathematics anxiety: Cultural views of mathematics as a challenging and abstract subject lead to elevated mathematics anxiety levels in Nigerian students. This anxiety influences students' perspectives on mathematics, creating obstacles for teachers in encouraging practical math skills (Ajayi & Ogunleye, 2023). Moreover, the long-held notion that mathematics is a domain only for a limited elite deters students

from engaging with mathematics-related studies and professions, erecting obstacles to cultivating a mathematically literate society that appreciates and comprehends the real-world uses of mathematics.

Opportunities in Functional Mathematics Education in Nigeria

The opportunities in functional mathematics education in Nigeria are:

Possibility for workforce development and economic advancement: Functional mathematics education can bridge the gap between academic skills and job needs, equipping students for careers in numerous sectors that depend on mathematical use. A workforce possessing practical mathematics abilities is more ready for positions in areas like engineering, data analytics, finance, and technology, which are vital for economic advancement and national progress (Adetunji & Uche, 2023). In its efforts to diversify its economy and decrease dependency on oil, Nigeria can benefit from functional mathematics education to prepare a new generation of graduates equipped with skills that match the demands of growing industries, thus promoting innovation and productivity.

Progress in technology and digital learning: Progress in technology provides fresh opportunities for improving functional mathematics education in Nigeria. Digital learning resources, including interactive e-learning platforms, mobile apps, and virtual simulations, offer creative methods for teaching mathematics in a practical way. These resources can enhance student engagement with mathematics and make it more accessible, offering practical experiences that demonstrate the importance of mathematics in real-world contexts. Johnson and Ogunbi (2023) emphasize that AI-based educational platforms can adapt mathematics teaching to the unique learning styles and requirements of each student, enhancing the effectiveness and personalization of functional mathematics.

Updated teacher training programs and professional development efforts: There exists a chance to revamp teacher-training programs to incorporate teaching methods for practical mathematics education. Incorporating practical teaching techniques into teacher training programs allows new educators to gain skills that help them present mathematics in a manner that enhances real-world problem-solving capabilities (Ajayi & Ogunleye, 2023). Additionally, ongoing professional development programs can assist in-service teachers in gaining the necessary skills to implement effective teaching methods, enabling them to enhance the relevance and engagement of mathematics instruction.

Reforming policies and updating the curriculum: Nigerian educational authorities have the chance to execute ongoing reforms that enhance practical mathematics education. By implementing strategies that focus on practical mathematics, decision-makers can enable the development of a curriculum that highlights problem-solving, analytical abilities, and real-world uses. Okeke and Anumudu (2022) suggest that the mathematics curriculum should be aligned with workforce needs and that feedback from industry should be incorporated to guarantee that students develop skills pertinent to today's job markets. Reliable policy backing, supported by sufficient funding and resources, would create a solid base for applying functional mathematics nationwide.

Nurturing an entrepreneurial and innovation-oriented mindset: Functional mathematics education can promote an entrepreneurial mindset in students, motivating them to think critically, recognize challenges, and create solutions. By understanding how to implement mathematical principles in real-world situations, students can be more equipped for entrepreneurial endeavors, especially in areas such as technology, agriculture,

and manufacturing (Akinwale & Bello, 2022). By fostering entrepreneurship and innovation, functional mathematics education can help establish a culture of independence and creativity, which fuels national transformation.

Impact of Functional Mathematics Education on National Transformation.

Functional mathematics education could significantly contribute to national transformation in Nigeria. By providing students with practical skills, functional mathematics can improve employability, decrease unemployment, and aid in economic diversification. Moreover, practical mathematics education enhances critical thinking and problem-solving skills, cultivating a generation of individuals equipped to address intricate social and economic issues. Ndubuisi and Kalu (2023) emphasize that a workforce proficient in functional mathematics is crucial for establishing a knowledge-driven economy, which is vital for Nigeria's sustainable progress and international competitiveness.

Additionally, functional mathematics instruction can help diminish educational disparities by equipping students with practical abilities that pertain to diverse socioeconomic situations. By tackling the digital divide and providing fair access to resources, functional mathematics can enable students from underprivileged backgrounds to escape poverty and engage in economic growth (Eze & Okafor, 2023). Thus, functional mathematics education corresponds with Nigeria's ambitions for inclusive progress and social fairness, aiding wider national development aims.

Conclusion

The execution of functional mathematics education in Nigeria encounters numerous obstacles, such as insufficient teacher training, limited resources, and a focus on examinations within the educational framework. Nonetheless, considerable opportunities exist to address these challenges via focused interventions, like updating teacher training programs, incorporating technology in classrooms, and restructuring policies to promote a more practical curriculum. By tackling these challenges and seizing these opportunities, Nigeria can unlock the transformative power of effective mathematics education, developing a workforce that is skilled, innovative, and able to propel national advancement.

Suggestions

The paper suggests the following:

1) The Ministry of Education, together with teacher training organizations, ought to create workshops and ongoing professional development (CPD) initiatives that emphasize teaching methods like project-based learning, problem-solving abilities, and critical thinking. Equipping teachers with these skills will allow them to develop a more interactive and stimulating learning atmosphere for students, improving their comprehension and appreciation of mathematics.

2) Educational institutions ought to create research initiatives centered on novel techniques for teaching mathematics that highlight practical applications in everyday life. This research must tackle regional issues, including resource constraints and cultural perspectives on mathematics.
3) Policymakers ought to implement routine evaluations to determine the effectiveness of functional mathematics programs and utilize data to make informed modifications to enhance them. Steady policy backing, combined with sufficient financing, will be crucial for the effective execution and sustainability of operational mathematics education throughout Nigeria.

4) The government, in collaboration with NGOs and private sector partners, ought to allocate resources to equip rural schools

with teaching materials, technology, and infrastructure enhancements. By tackling these inequalities, Nigeria can assist in closing the educational divide and allow students from diverse backgrounds to gain from practical mathematics.

5) Curriculum developers ought to collaborate with industry specialists to pinpoint critical skills that match workforce needs, guaranteeing that students gain pertinent knowledge and competencies. Incorporating elements such as financial literacy, data analysis, and project-based learning into the curriculum can assist students in recognizing the real-world applications of mathematics and equip them more effectively for diverse sectors like engineering, technology, and business.

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