

REVAMPING MATHEMATICS EDUCATION IN NIGERIA: LEVERAGING INNOVATION, ENTREPRENEURSHIP AND QUALITY EDUCATION FOR SUSTAINABLE DEVELOPMENT AND GROWTH

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Abstract

This study explores the interconnectedness of mathematics education, innovation, and entrepreneurship, and their potential to drive economic growth, sustainable development, and improved quality of life in Nigeria. Through a review of existing literature and case studies, the study examines the ways in which mathematics education can be leveraged to promote creativity, critical thinking, and problem-solving skills, ultimately preparing students for success in the 21st-century. It also identifies effective strategies and approaches for integrating innovation and entrepreneurship into mathematics education, including project-based learning, mathematical modeling, and entrepreneurship education. The findings of the study revealed that integrating innovation and entrepreneurship into mathematics can (a) increase interest in mathematics among students, especially girls and other underrepresented groups, by making mathematics more relevant and engaging, (b) promote equity and inclusion in education, by addressing the needs of diverse learners and providing tailored support, and (c) preparing students to compete in the global economy, by providing them with essential skills, such as critical thinking, problem-solving, and communication. The paper concludes with a discussion on the implications of the research findings for mathematics education policy and practice, and suggests potential directions for future investigation.

Keywords: *Mathematics Education (ME), Innovation, Entrepreneurship, Approach, Quality Education*

INTRODUCTION

Mathematics education stands as the backbone for innovation, entrepreneurship, and sustainable development in Nigeria. It has the potential to unlock critical thinking, problem-solving skills, and creativity among young minds. Quality

education, which emphasizes depth, relevance, and inclusivity, is essential for mathematics education to thrive. However, Nigeria's mathematics education currently faces challenges, including poor performance and outdated curricula. To drive sustainable development and growth, revamping mathematics education through quality education is crucial. Quality education could be defined as the provision of learning experiences that enable individuals to acquire knowledge, skills, and values necessary for personal development, social mobility, and economic growth. It is essential for individuals, communities, and societies as a whole, as it can lead to improved academic achievement, increased critical thinking and problem-solving skills, better preparation for the workforce, and increased civic engagement.

Quality education encompasses several key aspects including relevant and engaging curriculum, effective teaching and learning methods, access to quality educational resources, safe, supportive learning environment and opportunities for personal growth and development.

Quality education is a cornerstone for the development of any nation, and in the context of Nigeria, its significance cannot be overstated. The benefits of providing quality education are manifold, impacting individuals, communities, and the nation as a whole. First and foremost, quality education equips individuals with the essential skills and knowledge necessary for economic productivity. By providing individuals with the tools to succeed in various sectors, education fosters a skilled workforce capable of contributing to the nation's economic growth.

Moreover, quality education opens the door to better-paying jobs, thereby helping to alleviate poverty and reduce income inequality. By offering individuals the qualifications and competencies required by the job market, education increases access to well-paying employment opportunities. This in turn leads to an improvement in living standards and a reduction in economic disparities within society.

Beyond securing employment, education fosters entrepreneurship, innovation, and job creation. With the skills and knowledge gained through quality education, individuals are empowered to start businesses, drive innovation, and contribute to job creation. This entrepreneurial spirit is essential for stimulating economic growth and diversifying the economy, reducing reliance on traditional sectors.

Quality education also plays a critical role in enhancing socioeconomic mobility. By providing individuals with the opportunity to acquire knowledge and skills, education allows people to rise above the limitations imposed by their socio-economic backgrounds, thus promoting social mobility and contributing to the reduction of poverty. This empowerment through education can break generational cycles of poverty, offering individuals and their families the chance to achieve a higher quality of life.

In addition to economic benefits, quality education has significant implications for public health. Through informed decision-making, individuals are better equipped to understand and act on health-related issues. This knowledge leads to healthier lifestyles, improved health outcomes, and a reduction in mortality rates. Education, particularly in areas related to health, can also help curb the spread of diseases and promote preventive care, further improving the overall well-being of the population.

Education also empowers individuals to participate actively in the democratic process. By being informed, educated citizens, individuals can engage in political discourse, vote responsibly, and hold their leaders accountable. Quality education fosters an environment in which people are capable of driving positive change and contributing to the development of their communities and nation.

Furthermore, quality education is essential for the development of leaders who can drive national progress. Educated leaders, equipped with critical thinking and problem-solving skills, are essential in shaping the nation's policies and ensuring effective governance. The contributions of well-educated leaders are crucial for the long-term development and stability of Nigeria.

In addition to its direct impact on individuals and communities, education also encourages civic engagement, volunteering, and community service. An educated populace is more likely to contribute to societal well-being by participating in initiatives aimed at improving communities. This sense of civic responsibility fosters solidarity and social cohesion, further enhancing the nation's development.

Another key benefit of quality education is its role in developing human capital for sustained economic growth. As individuals acquire knowledge and skills, they contribute to the building of a skilled and capable workforce, which is crucial for the economic development of the country. The development of human capital through education is a vital driver of national prosperity.

Recent studies in Nigeria have highlighted the challenges facing the country's education sector, particularly in terms of inadequate quality education. Obeza (2023) in his study found that the education sector in Nigeria is consistently underfunded, resulting in a shortage of qualified teachers, inadequate educational infrastructure, and a lack of learning materials including classrooms, laboratories, libraries, and computer rooms. This infrastructure deficit creates an environment that is not conducive to learning, making it difficult for students to acquire the knowledge and skills they need to succeed.

The quality of teachers in Nigeria is a pressing concern, with inadequate training and a shortage of qualified educators escalating the issue. This deficiency has far-reaching consequences, compromising the quality of education and ultimately,

student performance. Remarkably, UNESCO (2020) reported that only 53% of primary school teachers and 44% of secondary school teachers in Nigeria have received formal training, highlighting the urgent need for improved teacher training and development programs.

Corruption is a significant obstacle hindering the effective management of education funds in Nigeria, resulting in a severely underfunded education sector. This lack of funding has far-reaching consequences, impacting the provision of basic facilities, teacher recruitment and training, and ultimately, the quality of education.

The 2024 Appropriation Bill's allocation of N2.18 trillion to the education sector is a substantial investment, representing 7.9% of the total budget. However, the effectiveness of this allocation depends on various factors, including the utilization of funds, the efficiency of the education system, and the government's ability to address sector challenges.

To ensure the allocated funds achieve their intended objectives, effective implementation and monitoring are crucial. The Nigerian Economic Summit Group emphasizes the importance of this allocation for improving infrastructure, enhancing teacher training, and promoting access to quality education.

Despite the Nigerian government's efforts to address these challenges through the development of various policies, poor implementation has rendered them ineffective. The failure to translate policy into practice has meant that the education system remains stagnant, unable to provide the quality education that Nigerian students deserve.

The pursuit of quality education is crucial for sustainable development, as emphasized in the United Nations' Sustainable Development Goal (SDG 4) In Nigeria. Achieving quality education remains a significant challenge, with mathematics education playing a vital role. ME fosters problem-solving skills, critical thinking, and analytical reasoning, laying the groundwork for innovation and entrepreneurship.

Challenges Facing ME in Nigeria

Nigeria's current mathematics education (ME) system is grappling with a multitude of challenges that hinder its effectiveness. At the heart of these challenges lies an overemphasis on memorization rather than genuine understanding, resulting in students struggling to apply mathematical concepts to real-world problems. Furthermore, the system fails to adequately prepare students for the demands of the 21st-century workforce, leaving them ill-equipped to navigate the complexities of an increasingly interconnected world.

Disparities in access to quality education also persist, with rural and underserved areas often being left behind. This has led to a perpetuation of educational inequality, where certain segments of the population are denied the opportunity to reach their full potential.

Studies by Ajilore (2023) and Ogunniyi (2022) have shed light on the key challenges facing mathematics education in Nigeria. One of the most pressing issues is the scarcity of qualified mathematics teachers, leading to inadequate instruction and poor student performance. Many schools also lack essential resources, including textbooks, teaching materials, and technology, making it difficult for students to engage with mathematical concepts. This is corroborated by another study from Adebayo and Oloyede (2022) who examine the relationship between teacher quality and student achievement in mathematics in Nigerian secondary school. The study found that secondary schools in Nigeria face a shortage of qualified mathematics teachers. In another manner, Nwosu and Okoro (2022) examine the challenges and prospects of teacher training and development in Nigeria. The results show that Nigerian teachers face numerous challenges, including inadequate training, lack of resources, and poor working conditions. In addition, inadequate facilities, such as classrooms and laboratories, hinder effective teaching and learning. The mathematics curriculum in Nigeria is often outdated and fails to align with current educational research and industry requirements. Moreover, the use of English as the medium of instruction can create a barrier for students who are not fluent in English, making it difficult for them to understand mathematical concepts.

Oyedeji and Akinsanya (2023) investigated the factors influencing students' performance in mathematics in Nigerian secondary schools. The results showed that students' performance in mathematics is influenced by several factors, including teacher quality, instructional materials, and students' motivation.

These challenges collectively undermine the quality of mathematics education in Nigeria, emphasizing the need for a comprehensive overhaul of the system to ensure that students receive a world-class education that prepares them for success in the 21st century.

Addressing these challenges, this paper proposes a tripartite approach, combining ME, innovation, and entrepreneurship to achieve quality education in Nigeria. By examining the intersections between these components, this research aims to:

- i. enhance student learning outcomes, increase interest in mathematics, and develop problem-solving skills.
- ii. contribute to the achievement of SDG 4, ensuring inclusive and equitable quality education for all.
- iii. develop a culture of innovation and entrepreneurship, enabling Nigeria to compete in the global economy.

Mathematics Education, Innovation and Entrepreneurship: A Tripartite Approach Literature review .

Recent studies in Nigeria have explored the connections between mathematics education, innovation, and entrepreneurship. For instance:

A study by Oladunjoye (2023) on ME as a tool for entrepreneurship development highlighted the importance of mathematics education in developing entrepreneurship skills among Nigerian secondary schools students.

Similarly, Ogundele & Adegboye (2020) in their study emphasized the role of ME in developing entrepreneurial skills, such as financial literacy, marketing, and decision-making. Adeyemi and Ogunniyi (2020) in another study investigated the impact of mathematics education on entrepreneurial skills of secondary school students in Nigeria. The findings highlighted the importance of practical applications in mathematics education.

These studies demonstrate the growing recognition of the interconnectedness of mathematics education, innovation, and entrepreneurship in Nigeria.

Examples of Successful Implementation

Examples of some exemplary programs that have successfully integrated mathematics education, innovation, and entrepreneurship, yielding impressive outcomes are discussed here below:

Internationally, the mathematics and entrepreneurship program (MAEP) has made significant strides. For instance, the University of Waterloo in Canada offers a pioneering program that combines mathematics and entrepreneurship education, equipping students with the skills to turn mathematical concepts into innovative business ventures. Similarly, Stanford University's mathematics and entrepreneurship program seamlessly integrates mathematics, computer science, and entrepreneurship, providing students with a comprehensive education that fosters creativity and innovation.

In Nigeria, several initiatives have also achieved remarkable success. The mathematics education and entrepreneurship development (MEED) program, implemented by the Nigerian Mathematical Society (NMS), has been instrumental in promoting mathematics education and entrepreneurship development. The entrepreneurship and mathematics education initiative (EMEI) has also made significant strides, integrating entrepreneurship and mathematics education in secondary schools. Furthermore, the mathematics-innovate program, implemented by the African institute for mathematical sciences (AIMS) Nigeria, has been successful in promoting innovation and entrepreneurship in mathematics education.

Other notable examples include the global mathematics project (GMP), an international initiative that promotes mathematics education and innovation, and

the mathematics and innovation network (MAIN), a global network that connects mathematics educators, innovators, and entrepreneurs. The entrepreneurship and innovation in mathematics education (EIME) project is another exemplary initiative that integrates entrepreneurship and innovation in mathematics education.

These programs demonstrate that integrating mathematics education, innovation, and entrepreneurship can yield remarkable outcomes, providing valuable insights for educators, policymakers, and entrepreneurs.

CONCLUSION

The findings of this study have profound implications for mathematics education policy and practice, highlighting the imperative for innovative and entrepreneurial approaches. Revamping mathematics education in Nigeria is pivotal to unlocking sustainable development and growth. By harnessing innovation, entrepreneurship, and quality education, Nigeria can empower its students with the skills and knowledge necessary to drive economic prosperity and technological advancements, ultimately realizing its full potential. This research also underscores the need for further investigation, particularly in developing and testing innovative pedagogical approaches that integrate mathematics education and entrepreneurship, to propel Nigeria's growth and development.

Recommendations and Practical Suggestions for Policy Makers and Educators

To foster a culture of innovation and entrepreneurship in mathematics education, policymakers and educators can implement several strategies. Firstly, encouraging students to work on real-world projects that integrate mathematics, innovation, and entrepreneurship can help them develop practical skills and apply mathematical concepts to tangible problems. Additionally, using mathematical modeling to solve real-world problems can promote critical thinking and problem-solving skills.

Incorporating coding and computer science into mathematics education can also develop computational thinking and programming skills. Utilizing games and simulations can make mathematics education engaging, interactive, and fun, while establishing entrepreneurship clubs or organizations can provide students with opportunities to develop mathematics-related projects and ventures.

To further support student entrepreneurship, educators can encourage students to develop business plans that incorporate mathematical concepts and models. Hosting pitch competitions can provide students with a platform to showcase their mathematics-based entrepreneurial ideas and projects. Collaborating with industry partners can also offer students real-world entrepreneurial experiences and mentorship.

Moreover, educators can benefit from collaborating with colleagues from other disciplines, such as business, engineering, and computer science, to develop innovative and entrepreneurial approaches. Using real-world examples and case studies can illustrate mathematical concepts and entrepreneurial principles, while encouraging student-centered learning can empower students to take ownership of their learning and develop entrepreneurial mindsets.

To assess student progress, educators can design assessment strategies that promote creativity, innovation, and entrepreneurial thinking. In addition, educators can harness the power of technology by utilizing specialized software, online platforms, and educational resources to craft interactive and immersive mathematics lessons that cultivate innovative and entrepreneurial mindsets.

¹ Ultimately, educators can create mathematics education experiences that empower students to navigate the complexities of the 21st century, think creatively, and develop innovative solutions to real-world problems.

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