
Science Education as a Tool for Achieving Socio - Economic Development of Nigeria

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ABSTRACT: *This study delves into the profound connection between science education and the socio-economic development of Nigeria. The paper explores the transformative potential of science education as a catalyst for socio-economic development in Nigeria. It examines how science education fosters innovation, shapes a skilled workforce, and drives economic diversification. By nurturing a scientifically literate populace, Nigeria can navigate challenges and seize opportunities in a rapidly changing global landscape. The paper emphasizes policy implications, including holistic education reform, industry collaboration, and international partnerships. Ultimately, science education emerges as a dynamic tool that can empower Nigeria to drive innovation, enhance competitiveness, and build a resilient and prosperous future.*

KEY WORDS: socio-economic, science education, economy, development, Nigeria.

INTRODUCTION

In the dynamic landscape of a rapidly evolving world, the role of education takes on a profound significance, acting as both a compass and a catalyst for a nation's progress. Within this realm,

science education emerges as a beacon with the potential to illuminate the path towards socio-economic development. Nowhere is this potential more critical than in Nigeria, a nation rich in human resources and natural wealth, yet facing multifaceted challenges on its journey to sustainable growth. This concept paper delves into the pivotal concept of "Science Education as a Tool for Achieving Socio-Economic Development of Nigeria," exploring the intricate interplay between knowledge, innovation, and economic transformation. By examining the ways in which science education can empower individuals, inspire innovation, and shape industries, this paper seeks to highlight the transformative power of science education as Nigeria strives to carve a resilient and prosperous future for its citizens. Through an in-depth exploration of this theme, we aim to unravel the manifold avenues through which science education can invigorate Nigeria's socio-economic landscape, fostering a thriving nation that stands as a testament to the profound impact of knowledge and learning.

Foundations of Science Education

The foundation of science education is pivotal in shaping the trajectory of the nation's progress. This foundational aspect encompasses several key components that collectively contribute to the cultivation of a scientifically literate populace, driving innovation, technological advancement, and overall socio-economic growth. At its core, the curriculum and pedagogical approaches form the bedrock of science education. The curriculum serves as a blueprint that outlines the subjects, concepts, and skills imparted to students at various educational levels. It is through this curriculum that students are introduced to the principles of physics, chemistry, biology, and other scientific disciplines. The alignment of the curriculum with national development goals is vital, as it ensures that science education serves as a conduit for equipping students with the knowledge and skills relevant to Nigeria's socio-economic challenges and aspirations.

Pedagogical approaches within science education play a transformative role. They guide how teachers impart knowledge and encourage students to engage with scientific concepts. Active learning strategies, such as problem-based learning and hands-on experiments, foster critical thinking, curiosity, and practical application of knowledge (Kuncel, 2011). Emphasizing these approaches not only enhances students' understanding but also equips them with skills that are directly transferable to innovation and problem-solving in real-world scenarios.

Educational infrastructure and resources underpin the effectiveness of science education. Well-equipped science laboratories, up-to-date textbooks, and access to digital resources are essential for immersive learning experiences. By providing students with the tools and facilities needed to conduct experiments and explore scientific phenomena, Nigeria can nurture a generation of individuals who are not only well-versed in theory but also proficient in practical applications. The significance of teacher training and professional development cannot be overstated. Teachers are the conduits of knowledge, and their expertise shapes students' learning experiences. Continuous training and development ensure that educators remain updated on the latest advancements in their respective fields and modern teaching methodologies. Empowered teachers are better positioned to inspire students and instill in them a lifelong love for learning and discovery (Agu, 2017).

Inclusivity and access are crucial elements of the foundation of science education. Ensuring that science education is accessible to all, regardless of gender, socioeconomic background, or geographical location, is essential for realizing its potential as a tool for socio-economic development. By addressing disparities and promoting inclusivity, Nigeria can tap into the full range of its human resources and foster an environment of equal opportunity. Government policies and initiatives form the overarching framework that guides the direction of science education. National policies that prioritize science education, allocate resources, and establish standards for curriculum and assessment provide a roadmap for its advancement (Aina, 2013). Investment in education, particularly in the sciences, demonstrates a commitment to nurturing the next generation of scientists, innovators, and leaders who will drive Nigeria's socio-economic growth and transformation.

In summary, the foundation of science education in Nigeria is a multifaceted construct that encompasses curriculum, pedagogy, infrastructure, teacher development, inclusivity, and governmental support. Building a robust foundation not only equips individuals with scientific knowledge but also empowers them to be active contributors to socio-economic development through innovation, technological progress, and the creation of solutions tailored to Nigeria's unique challenges (Amaka & Uju 2019).

Challenges and Opportunities in Nigeria's Socio-Economic Landscape

Navigating the intricate tapestry of Nigeria's socio-economic landscape reveals a complex interplay of challenges and opportunities that profoundly influence its developmental trajectory. Within this context, the role of science education as a tool for achieving socio-economic development takes on heightened significance, as it seeks to address these challenges while harnessing the opportunities that lie ahead. Challenges abound within Nigeria's socio-economic fabric. Inadequate access to quality education, particularly in rural and marginalized communities, poses a formidable hurdle. Insufficient infrastructure, such as science laboratories and up-to-date resources, hampers effective science education delivery. Gender disparities in education further exacerbate inequalities, limiting the potential contributions of a significant portion of the population.

Economic disparities also loom large, impacting access to education and creating a divide in opportunities. A lack of robust integration between academia and industry limits the practical applicability of scientific knowledge, hindering the development of innovative solutions tailored to local challenges. Additionally, inadequate investment in research and development restricts the emergence of home-grown advancements and solutions. Despite these challenges, Nigeria's socio-economic landscape is teeming with opportunities waiting to be harnessed through science education (Nigerian Economic Summit Group, 2023). The youthful demographic presents a vast potential workforce, eager to engage with science and contribute to economic growth. Advances in technology and communication offer novel avenues for disseminating educational content, bridging geographical gaps, and democratizing access to knowledge.

The nation's abundant natural resources, from agriculture to minerals, offer a fertile ground for scientific exploration and innovation (National Institute of Open Schooling, 2023). Science education can foster sustainable practices, ensuring responsible resource management that supports long-term development. Moreover, science-driven industries, such as renewable energy and biotechnology, can pave the way for diversification and heightened economic resilience. Collaboration, both domestic and international, stands as a potent opportunity. Partnering with industries, research institutions, and global networks can infuse real-world relevance into science education, aligning it with the needs of the evolving job market. Such collaborations also open doors for knowledge exchange, research partnerships, and the sharing of best practices.

In conclusion, Nigeria's socio-economic landscape is marked by a spectrum of challenges that require strategic interventions. Science education emerges as a potent instrument for not only addressing these challenges but also capitalizing on the manifold opportunities. By enhancing access, fostering innovation, bridging academia and industry, and leveraging collaborative networks, science education has the potential to catalyze a transformative journey towards sustainable socio-economic development.

Nexus between Science Education and Socio-Economic Development in Nigeria

Science education stands as a foundational pillar with the potential to shape Nigeria's socio-economic development trajectory. Within its realm lies the power to foster innovation, propel technological advancement, and cultivate a skilled workforce that can navigate the complexities of a rapidly changing world.

Innovation, a driving force behind economic growth, emerges from a populace well-versed in scientific knowledge and critical thinking. By nurturing a culture of curiosity and exploration through science education, Nigeria can unlock novel solutions to pressing challenges, enhancing its global competitiveness (Olojo et al., 2022).

Technological progress, a hallmark of thriving economies, hinges on the foundation built by science education. Equipping individuals with the tools to comprehend and harness the forces of science opens doors to advancements across diverse sectors, from healthcare to agriculture. These advancements, in turn, amplify efficiency, productivity, and ultimately, economic prosperity.

The responsible management of Nigeria's abundant natural resources necessitates a deep understanding of scientific principles. Science education can equip future leaders and policymakers with the insights required to strike a balance between economic growth and environmental sustainability.

Healthcare, a cornerstone of societal well-being, benefits immensely from a populace educated in the sciences. From medical research to the development of cutting-edge treatments, science education underpins advancements that enhance public health, reduce mortality rates, and bolster workforce productivity (Omotayo, 2010).

Agriculture, a vital sector in Nigeria, can be transformed by the principles of science. Science education enables farmers to adopt modern practices, increase crop yields, and ensure food security, mitigating the challenges posed by a growing population and fluctuating environmental conditions.

The nexus between science education and entrepreneurship is undeniable. Armed with a solid scientific foundation, individuals are empowered to establish science-based startups and businesses. These ventures not only diversify the economy but also generate employment opportunities, contributing to the nation's overall prosperity (Ofordum & Onyekwena 2019). For Nigeria to assert its presence on the global stage, a robust science education ecosystem is indispensable. International collaborations, research partnerships, and access to global markets are facilitated by a scientifically literate population, fostering economic growth through an interconnected world. As Nigeria aspires to eradicate poverty, science education emerges as a catalyst for change. By equipping marginalized populations with scientific knowledge and skills, this educational paradigm breaks the chains of poverty and ushers in avenues of socio-economic mobility

To harness the full potential of science education, concerted efforts are essential. Adequate investment in educational infrastructure, curriculum enhancements that prioritize hands-on learning and critical thinking, ongoing teacher training, and public advocacy are pivotal in propelling Nigeria toward a future where science education is not just a tool but a cornerstone of its socio-economic development journey (Rising, 2009).

Fostering Innovation and Technological Advancement

Fostering innovation and technological advancement lies at the heart of leveraging science education as a tool for achieving socio-economic development in Nigeria. This symbiotic relationship between science education and innovation holds the promise of propelling the nation forward in an era of rapid technological change. Science education serves as the foundation upon which a culture of innovation is built. By equipping students with a solid understanding of scientific principles, critical thinking skills, and problem-solving abilities, science education nurtures the mindset necessary for creative exploration. It encourages curiosity, experimentation, and the courage to question established norms, all of which are vital components of an innovative ecosystem.

Innovation, rooted in science education, has the potential to drive transformative changes across various sectors. By instilling an ethos of innovation early on, students are empowered to challenge conventional boundaries and conceptualize ground breaking solutions. For instance, a student well-versed in science may develop novel approaches to addressing challenges in agriculture, healthcare, energy, or environmental sustainability. Technological advancement, another direct outcome of robust science education, contributes substantially to Nigeria's economic growth. As students engage with science and technology in educational settings, they develop practical skills that translate into real-world applications. These skills can range from programming and data analysis to engineering and biotechnology. Such

capabilities enable graduates to contribute meaningfully to the development and application of cutting-edge technologies (Yabugbe, 2009).

Furthermore, science education bridges the gap between theoretical knowledge and practical application. Hands-on laboratory experiences and collaborative projects not only deepen understanding but also encourage students to think critically about how scientific principles can be translated into tangible innovations. This bridges the disconnect that often exists between academic learning and real-world problem-solving. Collaboration between academia, industry, and the public sector is a key catalyst for translating scientific knowledge into technological advancement. Science education serves as a conduit for these collaborations, nurturing a workforce that can seamlessly interact with industry professionals, contribute to research and development initiatives, and drive the implementation of innovative technologies (Yabugbe, 2009).

In an age where rapid technological changes are reshaping economies, science education also empowers individuals to adapt and thrive in a technology-driven job market. By cultivating a workforce that possesses a strong foundation in science, critical thinking, and adaptability, Nigeria can position itself to be competitive on a global scale and attract investments from tech-centric industries.

In conclusion, fostering innovation and technological advancement through science education is a linchpin for Nigeria's socio-economic development. It molds a generation of innovative thinkers who can harness scientific knowledge to create transformative solutions. By nurturing this culture of innovation, Nigeria can unleash the potential of its youth to drive technological progress, enhance economic productivity, and position the nation as a player in the global innovation landscape.

Human Capital Development: Skilled Workforce for the Future

Human capital development through science education emerges as a cornerstone for shaping a skilled and empowered workforce, poised to navigate the complexities of Nigeria's future socio-economic landscape. This vital aspect not only imparts knowledge but also instills the practical skills, adaptability, and innovative thinking required for individuals to contribute effectively to the nation's growth and development. Science education equips individuals with a diverse set of skills that extend beyond the realm of science itself. Critical thinking, problem-solving, analytical reasoning, and data interpretation are some of the cognitive abilities honed through science education. These skills form the bedrock of a competent workforce capable of grappling with multifaceted challenges across industries.

A scientifically literate population is better prepared to engage with and adapt to the rapid technological changes that define the modern era. As industries evolve and new fields emerge, a foundation in science empowers individuals to embrace lifelong learning and stay relevant in a dynamic job market. This adaptability ensures that Nigeria's workforce remains competitive and resilient in the face of change. Furthermore, science education bridges the gap between theoretical knowledge and practical application. Hands-on experiences in laboratories, real-

world projects, and collaborative research not only deepen understanding but also cultivate a sense of practicality. Graduates emerge not just with academic qualifications but with the ability to apply their knowledge to real-world situations, a trait highly valued by employers (Olojo et al., 2022).

Nurturing a skilled workforce also addresses the issue of unemployment. A robust science education system produces graduates who possess specialized skills in fields that are in demand, such as technology, engineering, healthcare, and more. This, in turn, reduces unemployment rates by directly addressing the job market's needs and creating a pool of potential employees ready to contribute productively. The integration of science education with industry needs is pivotal. By aligning educational curricula with the skill requirements of various sectors, Nigeria can bridge the gap between academia and industry. Internship programs, apprenticeships, and partnerships with businesses enable students to gain practical experience and industry insights, enhancing their employability and contributing to economic growth (Amaka & Uju 2019).

In conclusion, human capital development through science education fosters the creation of a skilled, adaptable, and forward-thinking workforce. This workforce is not only equipped with scientific knowledge but also possesses the skills necessary for innovation, problem-solving, and meaningful contributions across sectors. By investing in science education, Nigeria invests in its own socio-economic development, ensuring a brighter and more prosperous future for its citizens.

Entrepreneurship and Economic Diversification

Entrepreneurship and economic diversification emerge as pivotal pathways within the framework of utilizing science education as a tool for achieving socio-economic development in Nigeria. These interconnected concepts hold the potential to drive innovation, create jobs, and stimulate economic growth, ultimately contributing to the nation's overall prosperity. Science education serves as a catalyst for fostering an entrepreneurial mindset among the population. Through the cultivation of critical thinking, problem-solving, and creativity, science education equips individuals with the skills needed to identify gaps in the market and develop innovative solutions. This mind-set, coupled with a strong foundation in scientific principles, empowers aspiring entrepreneurs to establish science-based start-up that address local challenges and meet market demands (Ofordum & Onyekwe 2019).

Furthermore, a scientifically literate workforce is crucial for industries rooted in technology and innovation. As Nigeria seeks to diversify its economy away from traditional sectors, such as oil and gas, the cultivation of science education becomes essential. Graduates well-versed in science are poised to create and lead businesses that contribute to economic diversification, such as those in renewable energy, biotechnology, and information technology. Economic diversification, fuelled by science education, reduces dependency on a single industry and enhances overall resilience. By encouraging a broad spectrum of entrepreneurial ventures, Nigeria can mitigate the risks associated with fluctuations in global commodity prices and

market dynamics. This diversification contributes to stability and long-term sustainability in the face of economic challenges (Amaka & Uju 2019).

Science education also nurtures the capacity to develop science-driven products and services. Innovations born from the fusion of scientific knowledge and entrepreneurial spirit have the potential to create entirely new markets. Entrepreneurs who understand both the science behind their innovations and the intricacies of business are better positioned to commercialize their ideas and contribute to economic growth. Government support and collaboration between academia and industry play a pivotal role in fostering entrepreneurship and economic diversification. Policies that encourage innovation, provide funding for research and development, and streamline the process of starting a business can create an enabling environment for aspiring entrepreneurs. Partnerships between educational institutions and businesses facilitate knowledge exchange, mentorship, and access to resources, further nurturing a culture of entrepreneurship (Omotayo, 2010).

In conclusion, the fusion of science education, entrepreneurship, and economic diversification serves as a dynamic engine for socio-economic development in Nigeria. By fostering an ecosystem that supports innovative startups and encourages economic diversification, Nigeria can create a resilient economy that thrives in a rapidly changing global landscape. Through this integration, science education becomes a driving force behind a new era of economic growth and opportunity.

Global Competitiveness and International Collaboration

Global competitiveness and international collaboration emerge as key dimensions in the context of utilizing science education as a tool for achieving socio-economic development in Nigeria. These dimensions hold the potential to position Nigeria on the global stage, foster knowledge exchange, and drive innovation through cross-border partnerships. Science education, serving as the bedrock of a skilled and knowledgeable workforce, plays a critical role in enhancing Nigeria's global competitiveness. A scientifically literate population is better equipped to engage with international markets, adapt to global trends, and contribute to innovation that can compete on an international scale. This global perspective fosters a sense of aspiration and drives the pursuit of excellence in various sectors.

International collaboration in science and education opens doors for knowledge exchange, research partnerships, and exposure to best practices. Collaborating with institutions and experts from around the world provides Nigerian students and researchers with diverse perspectives and insights, enriching their educational experience and broadening their horizons. These collaborations can lead to the transfer of advanced technologies, methodologies, and innovative solutions that have the potential to catalyze local development (Olojo et al., 2022). Participation in global networks and partnerships also positions Nigeria to contribute its unique knowledge and expertise to the global arena. The nation's challenges, resources, and innovative ideas become part of an international conversation, allowing Nigeria to make meaningful contributions to scientific advancements that transcend borders. This not

only enhances the nation's reputation but also creates opportunities for collaboration and investment.

Moreover, the collaboration between academia, industry, and research institutions on a global scale accelerates technological advancement. Research partnerships can lead to breakthrough discoveries, technological innovations, and the development of solutions that address both local and global challenges. These solutions can range from sustainable agricultural practices to renewable energy solutions, contributing to the broader global effort towards sustainability. International collaboration also has the potential to attract foreign investment and create avenues for technology transfer. As Nigeria positions itself as a hub for innovation and scientific advancement, foreign companies and investors may be drawn to contribute resources, funding, and expertise to local initiatives. This infusion of resources can accelerate development and elevate Nigeria's economic and technological standing.

In conclusion, global competitiveness and international collaboration play an integral role in maximizing the impact of science education on Nigeria's socio-economic development. By fostering a globally competitive workforce and engaging in cross-border partnerships, Nigeria can position itself as a formidable player in the global innovation landscape. Through these dimensions, science education becomes a conduit for both knowledge dissemination and knowledge acquisition, accelerating progress and contributing to a brighter future (Agu, 2017).

Policy Implications and Recommendations

The policy implications and recommendations arising from the integration of science education as a tool for achieving socio-economic development in Nigeria hold significant potential to shape the nation's future trajectory. These implications underscore the need for strategic, comprehensive, and collaborative approaches that prioritize education, innovation, and sustainable growth.

1. **Holistic Education Reform:** Policymakers should prioritize a holistic reform of the education system to place science education at the core. This involves updating curricula, enhancing teaching methods, and aligning educational goals with the demands of a rapidly evolving job market.
2. **Investment in Educational Infrastructure:** Adequate funding should be allocated to build and upgrade science laboratories, classrooms, and educational facilities. Modern infrastructure is essential for providing hands-on learning experiences and fostering practical skills.
3. **Teacher Training and Development:** Continuous professional development programs should be established to equip science educators with the latest teaching methodologies, technological tools, and subject expertise. Well-prepared teachers enhance the quality of education.
4. **STEM Promotion and Incentives:** Incentivizing students to pursue STEM fields through scholarships, grants, and rewards can boost interest and enrollment. Such initiatives can cultivate a pipeline of skilled professionals in science, technology, engineering, and mathematics.

5. **Collaboration with Industry:** Strong partnerships between educational institutions and industries can provide real-world context to education. Internship programs, guest lectures, and joint research projects connect academia with practical applications, fostering innovation and employability.
6. **Innovation Hubs and Incubators:** Establishing innovation hubs and incubators that provide resources, mentorship, and funding to science-based startups can encourage entrepreneurial ventures and technological advancements.
7. **Research and Development Funding:** Increased investment in research and development is crucial for generating new knowledge, technologies, and solutions. Funding for both basic and applied research can drive innovation across sectors.
8. **STEM Outreach and Inclusivity:** Outreach programs should target underrepresented groups, particularly women and marginalized communities, to ensure inclusivity in science education. These initiatives can contribute to a diverse and skilled workforce.
9. **Policy Alignment Across Sectors:** Policies related to education, research, innovation, and industry need to be aligned to create a cohesive ecosystem that supports the seamless flow of knowledge and expertise.
10. **Global Collaborations:** Government should facilitate international collaborations and partnerships in science education, research, and technology transfer. Collaboration can bring in expertise, resources, and global best practices.
11. **Public Awareness Campaigns:** Raise public awareness about the importance of science education and its role in socio-economic development. This can foster a supportive environment for educational reforms and initiatives.
12. **Measurement and Evaluation:** Develop mechanisms for assessing the impact of science education on socio-economic development, such as tracking graduates' contributions to various sectors and monitoring advancements.

In essence, these policy implications and recommendations emphasize the need for a coordinated effort involving governments, educational institutions, industries, and civil society.

CONCLUSION

In conclusion, the integration of science education as a tool for achieving socio-economic development in Nigeria represents a transformative opportunity to shape the nation's future. This journey, marked by challenges and aspirations, underscores the profound impact that knowledge, innovation, and collaboration can have on elevating Nigeria's socio-economic landscape. Science education stands as a cornerstone, nurturing a generation equipped not only with scientific knowledge but also with the critical thinking skills, problem-solving abilities, and innovative mindset required for sustainable progress. As Nigeria navigates its path towards development, science education serves as a compass, guiding the nation's endeavors towards a more inclusive, technologically advanced, and globally competitive future.

The implications of this integration are far-reaching. From fostering innovation that addresses local challenges to driving economic diversification that builds resilience, science education's

ripple effects touch diverse sectors. The development of a skilled workforce poised for entrepreneurship, industry leadership, and global collaboration is central to shaping a vibrant and dynamic economy. Realizing this vision requires collaborative efforts between policymakers, educators, industries, and communities. Strategic reforms in curriculum design, investment in educational infrastructure, continuous professional development for educators, and partnerships with industries form the foundational framework. By embracing science education, Nigeria can empower its citizens to not only adapt to a changing world but also to actively shape it.

As science education takes center stage, the broader narrative of Nigeria's socio-economic development evolves. It embodies the nation's commitment to nurturing talent, fostering innovation, and harnessing the power of knowledge to overcome challenges and seize opportunities. This transformative approach ensures that Nigeria is not merely a participant but a driving force in the global pursuit of progress. In the intersection of science education and socio-economic development, Nigeria has the chance to write a narrative of resilience, innovation, and prosperity. The impact of this journey goes beyond economic indicators; it resonates in the lives improved, the technologies advanced, and the challenges overcome. Through the fusion of education, innovation, and collaboration, Nigeria is poised to craft a brighter, more inclusive future for its citizens and stand as an exemplar of the profound potential of science education in shaping a nation's destiny.

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