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Assessment of Science and Mathematics Curriculum Implementation in Secondary Schools in Kontagora, Niger state Nigeria

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Abstract

The effective implementation of science and mathematics curricula in secondary schools is essential for developing students' scientific literacy, critical thinking, and readiness for higher education and technological careers. This study aimed to assess the level of compliance with science and mathematics curriculum implementation, evaluate the availability of infrastructural and human resources, and examine capacity-building opportunities for secondary school teachers in the region. A survey research design was employed, targeting 176 randomly selected Science and Mathematics teachers. Data were collected using a structured questionnaire (Secondary School Teachers Questionnaire, SSTQ), which was validated by experts and tested for reliability (Cronbach's Alpha = 0.766). Collected data were analyzed using means, standard deviations, and weighted mean responses. The findings reveal that while most schools possess science laboratories, sufficient classroom furniture, and generally conducive learning environments, mathematics laboratories are largely inadequate, and laboratory capacity, utilities, and safety provisions are inconsistent. Teachers with higher academic qualifications demonstrated higher and more consistent compliance with curriculum implementation, whereas mid-level qualifications showed variability, indicating a need for targeted professional development. Recommendations include increasing government funding to equip mathematics laboratories adequately and establishing continuous, structured professional development programs for all science and mathematics teachers to improve curriculum compliance and student learning outcomes.

Key words: Secondary education, Curriculum implementation, Science and Mathematics.

Introduction

Curriculum implementation refers to the process through which educational plans, policies, and objectives are translated into practical classroom activities and learning experiences. It involves the interaction among teachers, learners, instructional materials, school facilities, and educational policies in achieving stated educational goals. In Nigeria, science and mathematics education are central to technological advancement, industrialization, and sustainable national development. Consequently, the effective implementation of science and mathematics curricula remains a major concern for policymakers and educators. The Nigerian Educational Research and Development Council through the National Policy on Education emphasizes the importance of science and mathematics education in achieving national development goals. The policy advocates the provision of quality instruction, adequate learning facilities, trained teachers, and relevant curriculum content to promote scientific literacy and technological competence among students (Federal Government of Nigeria, 2014; NERDC, 2007). However, despite these policy provisions, the implementation of science and mathematics curricula in many Nigerian secondary schools remains inadequate due to numerous systemic challenges.

Studies have consistently shown that curriculum implementation in Nigerian secondary schools faces several obstacles. Jamoh and Aminu (2021) examined the state of implementation of the senior secondary school curriculum in Nigerian schools and reported that many schools lack the necessary instructional resources, qualified teachers, and infrastructural facilities needed for effective curriculum delivery. The study further noted that inadequate funding and poor supervision contribute significantly to poor implementation outcomes. Anugwo et al. (2023) investigated the level of implementation of the secondary school science core curriculum in Nigeria and found that although the curriculum content was comprehensive, its implementation was hindered by inadequate laboratory facilities, shortage of science teachers, and insufficient instructional materials. The researchers concluded that the inability to effectively implement the curriculum negatively affects students' scientific understanding and practical skills acquisition. In another related study, Amie-Ogan and Oguru (2025) explored the prospects and challenges of STEM curriculum implementation in Nigeria. Their findings indicated that while the STEM curriculum has the potential to enhance creativity, innovation, and technological advancement, schools continue to struggle with inadequate teacher preparation, poor funding, weak policy implementation, and limited technological resources. Teacher preparedness is a critical factor in successful curriculum implementation. Teachers serve as the primary agents through which curriculum objectives are achieved in the classroom. According to Norman et al. (2025), effective curriculum implementation depends largely on teachers' understanding of curriculum objectives and their ability to apply appropriate instructional strategies. Their study revealed that inadequate teacher preparedness negatively affects curriculum compliance and classroom delivery. Mohammad et al. (2025) emphasized that compliance with educational standards and curriculum requirements significantly improves teaching and learning outcomes. The study demonstrated that regular monitoring, teacher training, and professional development contribute positively to effective curriculum implementation. In the Nigerian context, the shortage of qualified science and mathematics teachers remains a major concern. Dembele (2005) observed that many African countries experience inadequate teacher preparation and weak teacher management systems, which adversely affect curriculum delivery. This challenge is more pronounced in rural schools where qualified teachers are often unavailable.

The availability and management of school facilities greatly influence curriculum implementation. Adequate classrooms, laboratories, libraries, workshops, and instructional materials are essential for effective science and mathematics teaching. Akpokiere et al. (2018) noted that physical facilities are indispensable components of the teaching-learning process and must be properly managed to enhance educational effectiveness. Akinsola (2004) also emphasized that the provision and management of school facilities significantly affect teaching quality and students' academic performance. Inadequate facilities limit teachers' ability to implement practical and activity-based instructional methods recommended in science and mathematics curricula. Furthermore, Ezeogidi (2014) highlighted the broader impact of poor infrastructural development on Nigeria's educational system. The study explained that inadequate infrastructure contributes to overcrowded classrooms, poorly equipped laboratories, and limited access to modern teaching technologies, thereby reducing the quality of curriculum implementation. Godfrey and Chuks (2010) found that the design, layout, and management of school facilities directly influence students' academic performance. Schools with conducive learning environments and adequate facilities tend to achieve better educational outcomes compared to poorly equipped schools.

Practical activities are fundamental components of science education because they help students develop scientific inquiry skills, experimentation techniques, and problem-solving abilities. However, practical science instruction in many Nigerian secondary schools remains inadequate. Mgbomo and Abbey-Kalio (2025) evaluated practical science curriculum implementation in rural secondary schools in Rivers State and reported that most schools lacked functional laboratories, chemicals, and scientific equipment required for effective practical instruction. The researchers further observed that teachers often resort to theoretical teaching due to the absence of practical resources. The findings align with those of Akpokiere et al. (2018), who investigated the implementation of primary school science and mathematics basic education curricula in North Central Nigeria. Their study revealed that inadequate instructional materials, insufficient teacher training, and poor funding significantly hinder effective curriculum implementation. The study concluded that poor implementation of science and mathematics curricula poses serious implications for national development because it limits the development of scientific and technological manpower. Niyi et al., (2024) argued that the implementation of Mathematics Education 5.0 can help address persistent challenges in Nigerian mathematics education. According to the authors, integrating innovation, technology, entrepreneurship, and practical problem-solving into mathematics instruction can improve students' competencies and prepare them for the demands of the twenty-first century.

The study further emphasized the need for curriculum reforms, teacher retraining, improved funding, and integration of modern instructional technologies to strengthen mathematics education and support national development. Poor implementation of science and mathematics curricula has serious implications for Nigeria's national development. Science and mathematics education play vital roles in manpower development, technological innovation, industrial growth, and economic competitiveness. When curricula are poorly implemented, students fail to acquire the scientific knowledge, technical skills, and critical thinking abilities necessary for national progress. Ashworth (2010) noted that inadequate curriculum implementation weakens students' creative and analytical capacities. Similarly, Akpokiere et al. (2018) maintained that ineffective science and mathematics curriculum implementation undermines Nigeria's aspirations for scientific advancement and sustainable development. Inadequate curriculum implementation also contributes to poor academic performance in national examinations, low interest in science-related careers, and insufficient technological innovation. Consequently, the country experiences shortages of skilled professionals in science, engineering, and technology-related fields.

Statement of Problem

The effective implementation of science and mathematics curricula in secondary schools is critical for developing students' scientific literacy, problem-solving skills, and readiness for higher education and technological careers. In Kontagora, Niger State, anecdotal evidence and preliminary observations suggest that schools face several challenges that may hinder the proper delivery of these curricula (Akpokiere, 2018). These challenges include inadequate laboratory facilities, insufficient mathematics laboratories, inconsistent provision of utilities such as electricity and water, limited safety equipment, and inadequate professional development opportunities for teachers (Mgbomo and Abbey-Kalio, 2025). Teacher qualifications also appear to influence curriculum compliance, with mid-level qualifications potentially correlating with inconsistent adherence to curriculum guidelines. Furthermore, while some schools possess science laboratories and classroom resources, there is uncertainty regarding whether these facilities are sufficient to accommodate all students and support meaningful practical experiences. In addition, the frequency and quality of student exposure to practical lessons may vary, affecting the overall learning outcomes. These gaps highlight the urgent need to investigate the actual level of curriculum implementation, identify infrastructural and pedagogical constraints, and understand the role of teacher capacity and professional development. Addressing these problems is essential for ensuring consistent, effective, and equitable delivery of science and mathematics education in secondary schools across the Kontagora.

Research Questions

The Study proffers answers to the following questions:

1. What is the level of teacher compliance in implementing the secondary school science and mathematics curricula?

2. What is the state of infrastructure and facilities supporting the implementation of science and mathematics curricula in secondary schools?
3. To what extent does the government provide opportunities for capacity building for secondary school science and mathematics teachers?

Methodology

This study employed a survey research design to collect data that facilitated the analysis and generation of findings regarding the implementation of science and mathematics curricula in secondary schools. The target population comprised all Science and Mathematics teachers in secondary schools within Kontagora, Niger State. A sample of 176 teachers was randomly selected from this population to participate in the study.

The primary instrument for data collection was a structured questionnaire, developed by the researchers and titled the Secondary School Teachers Questionnaire (SSTQ). The questionnaire was divided into sections to capture respondents' demographic information and their perceptions of factors influencing the effective implementation of science and mathematics curricula. The distribution of questionnaires was conducted by the research team and research assistants, who provided guidance to respondents where necessary and ensured proper retrieval of completed instruments. To ensure the validity of the instrument, face and construct validation was performed by three Science and Mathematics educators from tertiary institutions within Kontagora. Feedback from these experts informed the refinement of the questionnaire prior to a pilot test conducted on a small, separate sample from the population. The reliability of the instrument was evaluated using Cronbach's Alpha, which yielded a coefficient of 0.766 for the SSTQ, indicating acceptable internal consistency and confirming the instrument's suitability for the study. Collected data were analyzed using means, standard deviations, and average weighted responses.

Results

Research Question 1: What is the level of compliance in the implementation of secondary school science and mathematics curricula by teachers based on qualification?

Table 1: Level of Compliance in Curricula Implementation by Teachers based on Qualification

Qualification	Mean Response	Standard Deviation
NCE	22.00	3.483
BSc	23.45	4.886
ND	24.33	5.033

HND	24.00	6.000
BSc Ed	21.92	3.260
MSc	25.00	4.243
Med	25.00	0.000

As illustrated in Table 1, teachers holding MSc and Med qualifications exhibit the highest level of compliance, both with a mean response of 25.0. These groups also demonstrate relatively low variability in their responses, with standard deviations of 4.243 and 0.0 respectively, indicating consistent adherence to curriculum guidelines among highly qualified teachers.

Teachers with a BSc and HND show moderate compliance levels, with mean responses of 23.45 and 24.00 respectively. However, these groups have higher standard deviations, particularly the HND group (SD = 6.0), suggesting that compliance among these teachers is less uniform. Similarly, ND teachers show a mean of 24.33 with an SD of 5.033, indicating some inconsistency in implementation across the group. In contrast, BSc Ed teachers exhibit the lowest mean compliance (21.92) with a smaller standard deviation (3.26), reflecting generally lower adherence to curriculum requirements but relatively consistent behavior within this group. NCE-qualified teachers fall in between, with a mean of 22.0 and SD of 3.483.

Research Question 2: What is the state of infrastructure and facilities supporting the implementation of science and mathematics curricula in secondary schools?

Table 2: Mean response of state of infrastructure and facilities supporting the implementation of science and mathematics curricula

S/No	Item	Mean Response	Decision
1	Presence of a chemistry, biology and physics laboratory	3.05	High
2	Presence of a mathematics laboratory	1.98	Low
3	Capacity of laboratories to take all science students for practical at a time.	2.80	Moderate
4	Presence of electricity supply outlets, heat supply units, fitted wash hand basin and regular supply of water in the laboratories.	2.53	Moderate

5	Adequately exposure to practical in Chemistry, Biology and Physics before SSC examination.	2.91	Moderate
6	Teacher's use of grouping students during practical classes.	3.16	High
7	Presence of qualified laboratory assistance in school laboratories.	2.68	Moderate
8	School environment being good for learning science and mathematics.	3.21	High
9	Presence of sufficient tables and chairs in classrooms	3.24	High
10	Presence of fire extinguishers, sand buckets and other safety equipment in the laboratories.	2.83	Moderate

Table 2 presents the weighted mean scores for all ten items evaluated. The analysis reveals that certain aspects of the school infrastructure and learning environment are well-established. For instance, the presence of chemistry, biology, and physics laboratories received a high mean response (Mean = 3.05), indicating that most schools have these essential facilities available for practical science education. Similarly, classroom furniture, including tables and chairs, and the overall school environment were rated highly, reflecting favorable conditions for both science and mathematics learning. However, several areas require attention. The availability of mathematics laboratories was notably low (Mean = 1.98), highlighting a significant resource gap that could hinder effective mathematics instruction. Laboratory capacity to accommodate all science students at once received a moderate mean response (Mean = 2.80), suggesting that schools may need to conduct staggered practical sessions due to limited space or equipment. Likewise, electricity supply, water, heat, and wash facilities in the laboratories were rated moderately (Mean = 2.53), indicating that while these infrastructures exist, they are not consistently reliable across schools.

In terms of teaching practices, teachers generally employ effective student grouping during practical classes (Mean = 3.02), fostering engagement and collaborative learning. However, student exposure to practical sessions before final examinations was only moderate (Mean = 2.91), implying that the frequency and quality of hands-on experience may vary. Safety provisions, including fire extinguishers, sand buckets, and other equipment, were moderately available (Mean = 2.70), suggesting potential risks during practical activities. Additionally, the presence of qualified laboratory assistants was moderate (Mean = 2.16), which may affect supervision and guidance in laboratories.

Research Question 3: To what extent does the government provide opportunities for capacity building for secondary school science and mathematics teachers?

Table 3: Analysis of provision of Capacity building opportunities for Secondary School Teachers

S/No.	Item	Mean Response	Decision
1	There are adequate facilities and finances for proper inspection in the schools	2.72	Moderate
2	You are adequately trained in educational supervision for the implementation of the reformed Science and Mathematics curricula	3.04	High
3	Your teachers have been properly educated on the purpose and principles of science and mathematics curricula	3.31	High
4	Government provides opportunities for Science and Mathematics teachers to attend capacity building workshops, seminars, conferences and professional development courses	2.1	Moderate

From Table 3, the provision of adequate facilities and finances for proper inspection received a mean of 2.72, which is moderate. While some resources are available, they are insufficient across schools, suggesting the need for increased funding and infrastructural support to ensure proper supervision and inspection. Teachers' training in educational supervision scored a mean of 3.04, reflecting high provision. This indicates that most teachers have received adequate training to effectively supervise science and mathematics curriculum implementation, highlighting a strong focus on professional development programs. Similarly, teachers' understanding of the purpose and principles of the science and mathematics curricula was rated highly, with a mean response of 3.31. This underscores that teachers are well-informed about the curriculum objectives, which is crucial for effective classroom implementation. Government-provided opportunities for attending workshops, seminars, conferences, and professional development courses had a mean of 2.10, indicating moderate provision. Although some initiatives exist, their accessibility and frequency appear limited, highlighting the need for more systematic and inclusive professional development opportunities.

Discussion of Findings

The analysis of the level of compliance in curriculum implementation and the provision of resources for science and mathematics in secondary schools reveals both strengths and areas requiring improvement. One of the key findings is that higher academic qualifications among teachers, such as MSc and Med degrees, are associated with higher and more consistent compliance with curriculum standards. In contrast, mid-level qualifications such as HND and ND display greater variability in adherence, indicating potential gaps in curriculum delivery. This pattern underscores the importance of targeted professional development and continuous support to ensure uniform compliance across all qualification levels. These findings reflect practical realities rather than ideal expectations, echoing the observations of Norman et al. (2025), who emphasized that enhancing teachers' preparedness through focused professional development and the provision of appropriate resources leads to better adherence to curriculum standards.

In terms of infrastructure, the study shows a mixed picture. The availability of chemistry, biology, and physics laboratories was rated highly, indicating that most schools have established facilities to support practical science education. Similarly, classroom furniture and a generally conducive school environment were rated positively, suggesting that basic learning conditions are largely met. However, the provision of mathematics laboratories was notably low, highlighting a critical gap in resources for applied mathematics teaching. The capacity of science laboratories to accommodate all students at once received a moderate rating, suggesting that schools often implement staggered practical sessions due to space and equipment limitations. Additionally, the reliability of essential utilities such as electricity, water, and heat supply, as well as wash facilities in the laboratories, was moderate, indicating that while infrastructure exists, it is inconsistently maintained across schools. Regarding teaching practices, the study finds that teachers generally employ effective grouping strategies during practical sessions, which promotes engagement and collaborative learning. Nevertheless, student exposure to practical sessions before final examinations was only moderate, implying variability in the frequency and quality of hands-on experience. Safety provisions in laboratories, including fire extinguishers, sand buckets, and other protective equipment, were similarly moderate. Their uneven availability could pose risks during practical lessons. Furthermore, the presence of qualified laboratory assistants was rated moderately, which may affect the quality of supervision and guidance during experiments.

Overall, these findings suggest that while secondary schools in the study area are relatively well-equipped for science education, mathematics infrastructure remains underdeveloped. Inconsistencies in laboratory capacity, safety provisions, and student practical exposure reveal areas in need of targeted interventions. This evidence underscores the need for policies aimed at strengthening mathematics laboratories, standardizing safety equipment, and ensuring consistent practical experiences for students. Additionally, enhancing teacher training and professional development, particularly for those with mid-level qualifications, can further improve compliance with curriculum standards and enhance the overall effectiveness of science and mathematics education.

Conclusion

This study assessed the implementation of science and mathematics curricula in secondary schools in Kontagora, Niger State, focusing on teacher compliance, infrastructure, resources, and capacity-building opportunities. The findings reveal a mixed but informative picture. While science laboratories, classroom furniture, and general learning environments were largely available and conducive to learning, critical gaps exist in mathematics laboratories, laboratory capacity, safety provisions, and the consistency of student exposure to practical lessons.

Teacher qualifications significantly influence compliance with curriculum standards. Highly qualified teachers, such as those holding MSc or Med degrees, exhibit higher and more consistent adherence, whereas mid-level qualifications, including HND and ND, show more variability. This emphasizes the need for targeted professional development and continuous support to ensure uniform curriculum implementation across all teacher qualification levels. The study underscores the importance of strengthening both the physical and human resource components of science and mathematics education. Enhanced funding, improved laboratory infrastructure, systematic professional development, and consistent provision of safety and utility facilities are critical to achieving effective curriculum implementation. By addressing these gaps, policymakers and school administrators can improve both teacher performance and student learning outcomes, ensuring that secondary school science and mathematics education meets the desired standards of quality and effectiveness.

Recommendations

1. **Increase Funding and Provide Better Facilities for School Inspections**: Adequate funding is essential to ensure that schools are properly inspected for compliance with science and mathematics curriculum standards. Increased financial resources would allow for the provision of modern laboratory equipment, sufficient practical materials, and improved classroom infrastructure. Regular inspections can ensure that all facilities meet the minimum requirements, enabling students to participate in practical exercises effectively.
2. **Expand Government-Led Workshops, Seminars, and Professional Development Opportunities**: Teachers' capacity to implement the science and mathematics curricula can be significantly enhanced through continuous professional development. The government should organize more frequent and accessible workshops, seminars, and professional development courses, ensuring that all secondary school teachers, especially in rural or under-resourced areas, have equal access. These programs should focus on practical skills, curriculum objectives, pedagogical strategies, and the effective use of teaching aids and laboratory facilities.
3. **Monitor and Evaluate the Effectiveness of Capacity Building Programs**: Beyond providing training, it is crucial to assess whether these capacity building initiatives translate into improved classroom practices and student outcomes. A structured monitoring and evaluation framework should be established, including follow-up assessments, classroom observations, and feedback from teachers and students. This will help identify gaps in training delivery, highlight areas for improvement, and ensure that investments in professional development have a measurable impact on curriculum implementation.
4. **Strengthen Mathematics Infrastructure and Resources**: The analysis highlighted a severe lack of mathematics laboratories and resources. It is recommended that schools be equipped with functional mathematics labs, learning aids, and sufficient classroom materials. Providing

adequate tools for hands-on learning in mathematics will foster better understanding and engagement among students.

5. **Ensure Consistent Laboratory Capacity and Utilities**: Schools should be supported to expand laboratory space and resources so that all students can participate in practical exercises simultaneously. Ensuring consistent electricity, water, and heat supply, as well as functional safety equipment, will create a conducive environment for practical learning and reduce disruptions during lessons.
6. **Institutionalize a Continuous Feedback Mechanism**: Establishing a feedback system where teachers, students, and school administrators can report challenges or successes will help policy makers make timely adjustments. This mechanism can help identify barriers to effective curriculum implementation, assess the utilization of capacity building programs, and guide future resource allocation.

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