

---

## INTEGRATED SCIENCE EDUCATION AS A SOLID FOUNDATION IN SCIENCES, TECHNOLOGY, ENGINEERING, MATHEMATICS, AND EDUCATION (STEME): A TOOL FOR SUSTAINABLE DEVELOPMENT

**DELPHONSO BAMIDELE TOKUNBO (PhD)**

E-Mail: [delphonsobt@lasued.edu.ng](mailto:delphonsobt@lasued.edu.ng)

**OSUNLOYE OLAWALE ADEJUMO**

E-Mail: [Osunloyeo.a@lasued.edu.ng](mailto:Osunloyeo.a@lasued.edu.ng)

**ABOLOJI TOYIN JOY**

E-Mail: [abolajitj@lasued.edu.ng](mailto:abolajitj@lasued.edu.ng)

**SUNDAY ERNEST FRANK**

E-Mail: [sundayef@lasued.edu.ng](mailto:sundayef@lasued.edu.ng)

**JAIYESIMI OLADELE OMOTAYO**

E-Mail: [jaiyesimio.o@lasued.edu.ng](mailto:jaiyesimio.o@lasued.edu.ng)

**LAWAL ABDULAFEEZ SEWANU**

E-Mail: [lawalas@lasued.edu.ng](mailto:lawalas@lasued.edu.ng)

Department of Natural Science, College of Science Education, Lagos State University of Education, Oto/Ijanikin, Lagos state.

---

### Abstract

*This paper focuses on the crucial role of Integrated Science Education in achieving sustainable development. The significance of Science, Technology, Engineering, Mathematics, and Education (STEME) in building a sustainable future cannot be overstated. STEME serves as a key catalyst for achieving sustainable development goals. This paper acknowledges the pivotal role of STEME in driving the scientific and economic development of any nation. The paper investigates the objectives and benefits of integrated science education, including its role in promoting scientific, technological, and engineering advancements. It explores the rationale for incorporating integrated science into the junior secondary school curriculum. The 21st century has witnessed rapid advancements in Information Science and Technology, including Artificial Intelligence (AI), across all aspects of life. To effectively adapt to these developments, we must embrace and foster scientific and technological experimentation that will drive national sustainable development. Based on this premise, the paper strongly advocates for the inclusion of STEME within the integrated science curriculum. Furthermore, the teaching of integrated science at all levels should be closely linked to real-life situations.*

**Keywords:** Integrated Science, Technology, Engineering, Mathematics and Education (STEME), sustainable development.

**DOI:** <https://doie.org/10.0218/SER.2025764280>

### Introduction

The National Policy on Education (2013) asserts that a truly educated individual possesses the competencies necessary for successful living and working within society. These competencies serve as the definitive proof of education. Individuals lacking life

skills and job-related competencies are prone to identity crises and social disorientation (Fahmy, 2012).

Clearly, there is an urgent need to reform our educational practices to better prepare young people for the challenges of their future and society. The curriculum at all levels of formal education, from primary to tertiary institutions, should prioritize the development of civilized and enlightened living, along with essential competencies.

Integrated science plays a crucial role in sustainable national development by addressing complex challenges such as climate change, biodiversity loss, pollution, and poverty reduction. It fosters innovative solutions and drives sustainability science. This approach emphasizes cross-disciplinary methods to enhance our understanding of human-environment interactions and systems, which is essential for addressing sustainability challenges.

The National Commission for Colleges of Education (NCCE) emphasizes the importance of focusing on concepts common to all sciences, the scientific process, and the associated skills.

Integrated science education serves as a gateway to scientific and technological development, cultivating scientifically and technologically literate individuals. It forms the bedrock upon which scientific and technological advancement depends. By providing students with knowledge, skills, and attributes, integrated science lays the foundation for future endeavors in science and related fields.

The NCCE (2012) defines integrated science as "the acquisition of knowledge and an approach to teaching science where the course is designed and presented to help students understand the fundamental unity of science, recognize common approaches to scientific problems, and appreciate the role and function of science in everyday life." Recognizing the significance of these aspects, this paper examines the concept of integrated science, its key role in scientific development, and its importance for technological advancement. Furthermore, the paper critically analyzes the role of integrated science in laying a solid foundation for science and engineering-oriented careers and explores its development within the junior secondary school curriculum.

## **Concepts of Integrated Science Education**

### **Integrated Science: A Foundation for Scientific Development**

Integrated science is a comprehensive and interdisciplinary field that combines aspects of physics, chemistry, biology, and earth sciences. Integrated science education emphasizes teaching these scientific fields in a unified manner rather than in isolation. According to the National Commission for Colleges of Education (NCCE, 2012), integrated science is "the acquisition of knowledge and an approach to teaching science where the course is devised and presented in such a way that students gain the concept of the fundamental unity of science." Ajewole (2016) argues that this approach fosters scientific literacy among learners.

---

Integrated science is considered an interdisciplinary subject that prepares students for higher education in science disciplines and various careers. Importantly, the subject aims to:

- i. Be relevant to students' needs and experiences.
- ii. Emphasize the fundamental unity of science.
- iii. Lay a strong foundation for subsequent specialist study.
- iv. Integrate a cultural dimension into science education.

In essence, integrated science has been proposed as a means to enhance scientific literacy, foster an understanding of the scientific process, and increase student interest in science. The Nigerian integrated science project emphasizes the learning process of science rather than solely focusing on the acquisition of scientific knowledge.

### **Integrated Science as a Tool for Scientific Development**

Integrated science learning employs an interdisciplinary approach, often organized around integrated themes or concepts. For instance, topics in biology, chemistry, and physics can be explored concurrently. This integrated approach helps students understand the role and function of science in everyday life (Afuwoye, 2012).

By its very nature, integrated science is an activity-based course. Through hands-on activities, students develop essential scientific skills such as observation, measurement, experimentation, manipulation, and problem-solving. Additionally, it fosters scientific attitudes like honesty, objectivity, open-mindedness, and a willingness to cooperate and accept criticism (Twiga, 2013).

Functional integrated science emphasizes the application of scientific knowledge and methods to address real-world problems at the individual, local, and national levels.

### **Integrated Science as a Tool for Technological and Engineering Development**

In recent years, many countries have adopted Science, Technology, Engineering, and Mathematics Education (STEME) (Kelley & Knowles, 2016). STEME education is increasingly recognized as a critical driver of opportunity. To equip students with the knowledge and skills necessary to address the challenges of the Fourth Industrial Revolution, STEME education should focus on five core disciplines: Science, Technology, Engineering, Mathematics, and Education (Summuntino, 2017).

STEME is an extension of the traditional STEM acronym, which includes Science, Technology, Engineering, and Mathematics. The addition of "E" emphasizes the crucial role of education in these fields within the modern world. STEME encompasses a range of interconnected disciplines essential for innovation, problem-solving, and sustainable development. This interdisciplinary approach combines the natural sciences, technology, engineering, and mathematics to address real-world challenges and promote environmental stewardship.

STEME education emphasizes knowledge that is collaboratively constructed and integrates multiple STEM subject areas. This perspective integrates the disciplines of science, technology, engineering, mathematics, and education to solve everyday

science-related problems. Wang (2012) proposes integrating these four disciplines to gain a deeper understanding of science by relating it to technology and engineering. This approach aims to develop students' interest in STEME-related professions, improve academic achievement, and equip them with skills crucial for future jobs.

Delphonso, *et al.* (2024) emphasize that a strong scientific and technological foundation is essential for a nation's success. Quality STEME education is vital for the future success of students. To make learning more relevant, integrated STEME education offers an effective approach. As teachers implement integrated STEM education, the STEME model serves as a valuable framework for connecting the disciplines and enhancing student learning (Zemelman, Daniels & Hyde, 2005).

Adaobi (2000) identified the following key practices for teaching Integrated Science:

- i. Cooperative learning
- ii. Problem-solving approach
- iii. Activity-based learning
- iv. Hands-on learning
- v. Teacher as a facilitator
- vi. Integration of technology

### **Rational for Including Integrated Science in Junior Secondary School Curriculum**

As we look to the future of science education, it is crucial to consider the role of integrated science in junior secondary schools. This forward-thinking approach allows us to envision the potential of integrated science in shaping the minds of tomorrow's leaders and innovators. This section explores the rationale for incorporating integrated science into junior secondary school curricula:

1. **Enhance Scientific Literacy:** In a world increasingly shaped by science, every individual deserves a basic understanding of scientific principles. While not everyone needs to become a scientist, scientific literacy is essential for navigating daily life. Given that many children in Nigeria do not progress beyond primary or junior secondary school, introducing science as an elementary subject, particularly in an integrated format, is crucial.
2. **Provide a Sound Foundation for Continuing Science Education:** Students with a broad, foundational understanding of science through integrated science at the primary and junior secondary levels are better equipped to specialize in specific science disciplines (Physics, Chemistry, Biology) at the senior secondary level.
3. **Enable Pupils/Students to Gain Composite Knowledge of Their Environment:** The human environment is a complex system that cannot be fully understood by compartmentalizing it into separate subjects like Biology, Agricultural Science, and Geography. Integrated science fosters a holistic understanding of the environment.
4. **Enable Pupils/Students to Have a General View of the World of Science:** Even if a learner specializes in a particular science subject later in life, an integrated science foundation provides a broader understanding of the scientific world, preventing them from becoming isolated within their specific field of study.

## **Conclusion**

As highlighted in this paper, effective integrated science instruction, utilizing appropriate methods and approaches, can significantly enhance learners' understanding of real-world issues and connect their scientific learning to everyday life. The essence of integrated science lies in providing students with the right skills, knowledge, and values, as well as developing the necessary attitudes and competencies for sustainable national development.

It is evident that Nigeria's scientific and technological development has not reached its full potential, possibly due to shortcomings in science education. There is a pressing need to prioritize employment-generating subjects and courses, aligning with the national philosophy of education as outlined in the national policy on education. This includes fostering a comprehensive understanding of the world around us, acquiring appropriate skills, and developing both mental and physical abilities to equip individuals for life in society and contribute to its development.

## **Suggestions**

Based on the paper, the following suggestions are made:

1. Integrated Science teachers should endeavour to relate scientific concepts to real life situation.
2. There is need to improve on the quality of science, technology, engineering, mathematics and education teaching in schools so that learners can gain knowledge, skills and competencies needed for achieving sustainable development.
3. Government should provide well equipped science laboratory for effective teaching and learning of integrated science
4. Government should organise an in-service training programme for integrated science teachers in order to improve on their capacity building
5. Science education should be well funded by government in order to meet with international standard global world.
6. The government should avail the general population with sound stem educating national development can be achieved.

## Reference

- Adaobi, A (2000). Basic instructional technology on published handbook, teacher educational series .pg 6-7.
- Afuwaye, M.O (2012). “Teachers and school factors as predictors of student’s achievement in Integrated Science”. *African journal of education research*, **12**: 89 – 96. Doi
- Ajewole, G.A (2016). *History and Philosophy of Science and science technology*, Lagos Published by Piostcity.
- Curriculum Technology. *Education in the 21<sup>st</sup> Century Journal*, **7** (3): 111 – 118.
- Delphonso, B.T., Osunloye, O.A, Sunday, Ernest Frank & Ajose, O.O. (2024). Quality Science and Technology Education as a Veritable tool for Eradication of Poverty in the face of gross National Unemployment. *LASU Educational Perspectives Faculty of Education Publication*, **12** (1).
- Fahmy, S. M. (2012). Crises management and youth, Alexandra, modern university office.
- Kelly, and Knowles, (2016). A conceptual framework for Integrated (STEME) Education. *International journal of (STEME) Education*, **3** (1): 1 – 11.
- NCCE (2012). *National Commission for College of Education*. 2012 Edition.
- Suminitino, B. (2017). science education Malaysia challenges in the 21<sup>st</sup> Century, *Journal Cakrahlapendidollan*, **3**: 459 – 471.
- Twiga, S. (2013). The effects of blended learning on EFL Student vocabulary enhancement. *Procedia soc. behau. Sci.*, 1999; 641-647.
- Wang and Park (2012). Sustainability in Science Education? How the next generation science Standards Approach Sustainability, and why it matters, *Science Edu*, **9** (1): 121 - 144.
- Yarker, S.O. (2012). Science, teaching and economic growth a report of the International Congressional Science and Economic Growth. Lallar, 4<sup>th</sup> – 20<sup>th</sup> January 2012.
- Zemelman, D. and Hyde, (2015). Applying (STEME) instruction to design Technology