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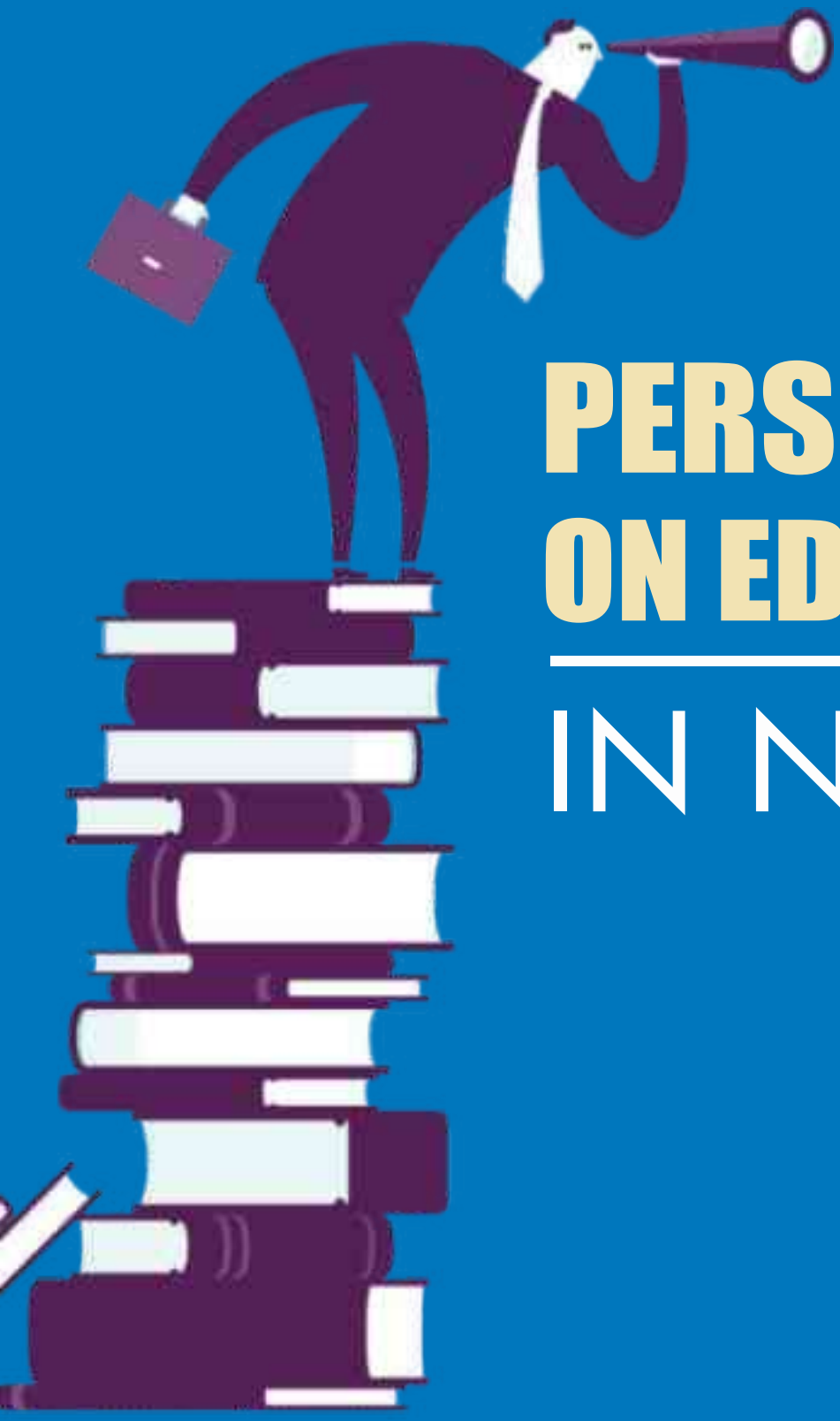

# PERSPECTIVE ON EDUCATION IN NIGERIA

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**BOOK CHAPTER**

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CHAPTER ELEVEN

# INNOVATION, INNOVATIVE TEACHING AVAILABLE FOR TEACHING AND LEARNING OF SCIENCE PROGRAMME IN TERTIARY INSTITUTIONS IN NIGERIA

**BY**

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## 1.0 Introduction

National Policy on Education (2013) of Nigeria defined tertiary education as the education given after Post Basic Education in institutions such as Universities and Inter-University Centres such as the Nigeria French Language Village, Nigeria Arabic Language Village, National Institute of Nigerian Languages, institutions such as Innovation Enterprise Institutions (IEIs), and Colleges of Education, Monotechnics, Polytechnics, and other specialized institutions such as Colleges of Agriculture, Schools of Health and Technology and the National Teachers' Institutes (NTI). Tertiary education is an organized educational system that is consciously designed for manpower production, in-service training and national development. Tertiary education is an education that advances teaching, research and community services for national development. Tertiary education is an education industry that is meant for the production of manpower and national development

via implementation of teaching, research and provision of community services (Ogunode, 2025). The objectives of tertiary education includes; to provide higher education opportunities via effective teaching, researching and provision community services; to develop produce students with specialized knowledge and skills for solving personal problem and national problem; to prepare student for national workforce and to contribute to societal and community development; to provide academic program of various disciplines; to provide quality instruction in field of studies and to conduct researches to generate new knowledge for national development and to solve complex problems(Ogunode, 2025).

Tertiary institutions in Nigeria offered science programme. Science is the field concerned with sharing science content and process with individuals not traditionally considered part of the scientific community. The traditional subjects included in the standards are physical, life earth, space and human science (Kola, 2013). Science study requires a variety of unique instructional materials in addition to those materials common to all education. A science facility must have space to accommodate this variety in combination with hands on instructional strategies. Science instructional areas have spatial and material needs that are different from those considered in designing a general use in classroom (Ndayebom, & Olamoyegun, 2022). The science programs include Mathematics, Physics, Chemistry, Biology, Further Mathematics, Technology, Technical Drawing etc. Science programs in Nigerian schools are given maximum attention due to their significant contribution to the technological development of the country. (Adolphus, 2019) asserted that in Nigeria, science is taught and learnt as Basic Science and Technology from primary to junior secondary levels, and as biology, chemistry and physics for three years in the senior secondary (SS) classes (SS1-3). The government recognizes the importance of science to the development of its young citizenry as demonstrated in the national policy and other curricula texts, “in recognition of the fundamental importance and cost-intensive nature of science, technology and trade/entrepreneurship, Government shall provide adequate funds for science, technology and trade/entrepreneurship education” (FRN 2013).

Science programme is defined according to Ogunode, & Aiyedun (2020) as programmes that are mathematical oriented. Science programme is also viewed as programme that are involved in practicals. Science programme is the programme that is very important to the social economic and technological development of a nation. The place of science programmes in the development of the social. Economic and technological development cannot be underestimate. Science education deals with sharing of science concepts and procedure with people who are not considered

customarily to be individual from the empirical researchers; the people could be students, ranchers, advertiser, sales women or an entire network. It is based on this background that this paper seek to explore the various innovative teaching methods available for the teaching and learning of science programme in the tertiary institutions in Nigeria. Thus, this chapter is discussed under the following subheadings.

1. Concept of Innovation

2. Concept of Innovative Teaching Methods

3. Various Innovative Teaching Method Available for Teaching and Learning of Science Programme

## 2.0 Literature Review

### 2.1 Concept of Innovation

Innovation is the act of introducing new ideas, methods and strategies that can be transformation in an institutions and in an individual. Innovation is the process that brings new ways, styles and methods into a business, products or services for improvement of the business, products or services. Innovation is the ability and capacity to brings new ideas, develop new concept, conceive new system and use them to enhance existing products, services and process to the users (Ogunode, & Araiyegbemi, & Ayoko, 2025). Innovation can be seen as something new that brings benefit for an organization and human society. It has to do with the introduction of something new to the market; the usage of new ideas or methods to improve the quality of a product or process. Innovation uses platforms already invented to create a successful product or process in a commercial quantity which will at the end satisfy a market need. For innovation to work, users should get a real value out of it. Innovation turn ideas into viable and useful products. According to Achune in Oluwuo, (2021) innovation may not always mean a clean break from existing practice, it could merely involve integrating some aspects of the old ways to new discoveries to improve the system. In other words, innovation is not invention. Invention is something that has never been made before. It is something new entirely. Invention carries inventions creatively to come up with new changes. They use the new things for a commercial success. Innovators exploit new ideas and bring to the public eye. Thus innovation is different from creativity, change, invention, and reforms.

## 2.2 Concept of Innovative Teaching Methods

Innovative teaching is the process of addressing problem of teaching with technological resources. Innovative teaching is the process of systematically implementing new teaching methods to addressing challenges hindering effective teaching in the classrooms. Innovative teaching is the implementation of teaching methods that focus more on students engagement and interest in order to promote quality teaching and learning in the classrooms (Ogunode, et al 2025). Innovative teaching is the process of proactively introducing new teaching strategies and methods into the classroom. The purpose of introducing these new teaching strategies and methods is to improve academic outcomes and address real problems to promote equitable learning (Kaltura 2020). Innovative teaching methods extend beyond the mere incorporation of cutting-edge teaching methods or a constant pursuit of the latest educational trends—they embody distinctive approaches to the teaching and learning process. These modern methods of teaching prioritize students, emphasizing classroom engagement and interaction. Innovative strategies encourage proactive participation and collaboration among students and the teacher. While this demands increased effort from students, the approach is tailored to better meet their individual needs, fostering accelerated growth (Piogroup 2025).

## 3.0 Various Innovative Teaching Method Available for Teaching and Learning of Science Programme

There are many innovative teaching methods that can be adopted in tertiary institutions in Nigeria. Some of them according to Piogroup (2025), includes;

### 1. Interactive Lessons

Interactive lessons involve innovation methods in teaching that actively engage students in the learning process. Instead of passively receiving information, students participate in activities, discussions, and exercises that require their input and involvement. This approach aims to foster a more dynamic and engaging classroom environment. Interactive lessons can take various forms, including group discussions, hands-on activities, simulations, case studies, and collaborative projects. Teachers may use technology tools, interactive whiteboards, or other resources to facilitate participation and feedback, encouraging students to take an active role in their own learning.

**Example of Interactive Lesson**

Imagine a biology lesson where students use a virtual dissecting table. Through a touch-sensitive screen, students can virtually dissect a frog. They can drag and drop tools, zoom in for a closer look, and receive real-time feedback on their technique. This interactive approach engages students actively in the learning process, making it more memorable and enjoyable.

**2. Using Virtual Reality Technology**

Virtual Reality (VR) technology creates a simulated environment that users can interact with, providing a unique and immersive learning experience. In education, VR can be used to transport students to virtual worlds that simulate historical events, scientific phenomena, or complex concepts. For example, students studying history might virtually explore ancient civilizations, while science students could conduct virtual experiments in an engaging learning environment. This technology enhances experiential learning, allowing students to visualize abstract concepts and engage with subject matter in a new way of teaching. It can be particularly beneficial in fields where hands-on experience is challenging to provide in a traditional classroom setting.

**Example of Teaching with VR Technology**

In a history class, students can put on VR headsets and be transported to historical events. For instance, they could experience the signing of the Declaration of Independence or walk through ancient civilizations. This immersive experience allows students to better understand historical contexts, fostering a deeper connection to the subject matter.

**3. Using AI in Education**

Artificial Intelligence (AI) in education involves the integration of AI technologies to enhance the learning experience for students and support educators. AI can be applied in various ways, such as:

- Personalized learning
- Automated assessment
- Adaptive learning platforms
- Virtual assistants
- Data analysis

Integrating AI into education aims to make learning more efficient, personalized, and adaptive to the needs of each student, ultimately enhancing the overall educational experience.

### Example of Using AI in Education

An AI-powered adaptive learning platform can be employed in mathematics. The system assesses each student's strengths and weaknesses, tailoring lessons to their individual needs. If a student struggles with a specific concept, the AI provides additional exercises and resources to reinforce understanding. Conversely, if a student excels, the AI advances them to more challenging material, ensuring personalized and efficient learning experiences.

## 4. Blended Learning

Blended learning is an educational approach that combines traditional face-to-face instruction with online learning components. It seeks to leverage the strengths of both in-person and digital learning to create more flexible and personalized learning strategies and experience. An example of blended learning might involve students attending in-person classes for lectures and discussions while also completing online modules, interactive simulations, or collaborative projects outside of the classroom. This approach allows for a mix of teacher-led instruction, self-paced online learning, and interactive activities, catering to different learning styles and promoting student engagement. Ogunode, and Ukozor (2024) noted that blended learning can be defined as blended learning – is an organized learning model that provides an alternative to traditional means of learning and provides varieties of different means of learning that permit more access and convenience for learners. The blended learning model is a planned model that is learner-centred and provide opportunities for offline and online or traditional face-to face learning and eLearning.

### Example of Blended Learning

In a blended learning scenario, a history class might have students attend traditional lectures and participate in classroom discussions. Additionally, the teacher could integrate online modules featuring interactive timelines, virtual tours of historical sites, and collaborative research projects. Students might use online discussion forums to share their insights and engage with peers beyond the physical classroom. The blend of in-person and online activities aims to enhance the overall learning experience and provide students with more flexibility in how they access and interact with course content.

### 5. 3 D Printing

3D printing, also known as additive manufacturing, involves creating physical objects layer by layer based on a digital model. In education, 3D printing is utilized to bring concepts to life in a tangible and visual way. Teachers and students can design and print three-dimensional models that represent scientific structures, historical artifacts, mathematical concepts, or prototypes. This hands-on approach enhances understanding by allowing students to interact with physical representations of abstract ideas.

### Example of 3D Printing

In a science class studying the solar system, students could use 3D printing to create accurate models of planets, moons, and other celestial bodies. By designing and printing these objects, students not only gain a deeper understanding of the spatial relationships within the solar system but also develop skills in design and technology. The tactile experience of holding and examining 3D-printed models can significantly enhance the learning process and make complex topics more accessible.

### 6. Use the Design-thinking Process

The design-thinking process is a problem-solving approach that emphasizes empathy, ideation, prototyping, and testing. It encourages a creative and collaborative mindset to address complex challenges. In education, the design-thinking process can be applied to foster critical thinking, innovation, and real-world problem-solving skills among students.

### Example of Design-thinking Process

Let's consider a design-thinking project in a high school setting. Students might be tasked with addressing a local environmental issue, such as waste reduction. The process would start with empathizing, where students research and understand the perspectives of different stakeholders affected by the problem. Next, they would ideate, generating creative solutions to address the issue. In the prototyping phase, students might create physical or digital prototypes of their proposed solutions. Finally, they would test and refine their prototypes based on feedback and real-world observations. This design-thinking approach integrates various skills, including research, collaboration, critical thinking, and problem-solving, providing students with a holistic learning experience.

### 7. Project-based Learning (PBL)

Project-Based Learning is an instructional methodology that centers around students completing projects that require them to apply their knowledge and skills to real-world challenges. PBL emphasizes hands-on, collaborative learning, fostering critical thinking and problem-solving skills.

**Example of Project-based Learning**

In a biology class, students could engage in a PBL project focused on environmental conservation. The project might involve researching local ecosystems, identifying environmental issues, proposing solutions, and implementing a community awareness campaign. Throughout the project, students would not only deepen their understanding of biology but also develop research, communication, and teamwork skills as they work towards a tangible goal.

### 8. Inquiry-based Learning

Inquiry-Based Learning is an approach where students actively explore and investigate topics, posing questions and conducting research to construct their understanding. This method encourages curiosity, critical thinking, and a deeper engagement with the subject matter.

**Example of Inquiry-based Learning**

In a physics class, students could engage in an inquiry-based project to explore the principles of motion. They might formulate questions about the factors affecting the speed of an object and design experiments to test their hypotheses. Through hands-on exploration and data analysis, students would develop a conceptual understanding of physics principles while honing their research and analytical skills.

### 9. Jigsaw

The Jigsaw technique is a cooperative learning strategy where students work collaboratively to become experts on specific topics and then share their knowledge with their peers. This promotes teamwork, communication, and a sense of shared responsibility for active learning method.

**Example of Jigsaw**

In a history class studying a particular time period, each student could be assigned to become an "expert" on a different aspect, such as political, economic, social, or cultural elements of that era.

After researching and becoming knowledgeable in their area, students would then form new groups with members who have expertise in different aspects. In these new groups, students share their knowledge, creating a comprehensive understanding of the historical period through collaborative learning.

### 10. Cloud Computing Teaching

Cloud computing teaching involves leveraging cloud-based technologies to enhance the learning experience. This includes storing and accessing data, collaborating on projects, and utilizing online tools and resources for teaching and learning.

### Example of Cloud Computing

In an IT class, students might use cloud computing platforms to collaborate on coding projects. They could use cloud-based development environments to write and test code, store project files on cloud storage, and collaborate in real-time using cloud-based collaboration tools. This approach allows for seamless collaboration, easy access to resources, and the flexibility to work on projects from different locations, promoting a more modern and connected learning experience.

### 11. Flipped Classroom

The flipped classroom model reverses the traditional teaching approach by delivering instructional content, such as lectures, through digital media outside of the classroom. Class time is then used for interactive activities, discussions, and application of knowledge.

### Example of Flipped Classroom.

In a math class, instead of the teacher delivering a lecture on a new concept during class time, students might watch a pre-recorded video lecture at home. Class time would then be dedicated to working on math problems, engaging in group discussions, and receiving personalized assistance from the teacher. This allows students to learn at their own pace, receive more individualized support, and actively apply what they've learned in a collaborative setting.

### 12. Peer Teaching

Peer teaching involves students taking on the role of the teacher to explain concepts or assist their classmates in understanding specific topics. This approach reinforces understanding through teaching and encourages collaboration.

**Example of Peer Teaching**

In a language class, students could pair up to practice conversational skills. Each pair is responsible for teaching and correcting each other's pronunciation, grammar, and vocabulary usage. This not only provides additional practice for the students but also promotes a supportive learning community where students take an active role in each other's learning.

### 13. Peer Feedback

Peer feedback involves students providing constructive feedback to their peers on their work, presentations, or projects. This encourages a culture of collaboration, communication, and continuous improvement.

**Example of Peer Feedback**

In a writing class, students could exchange drafts of their essays with a peer. The peers would then provide feedback on the structure, clarity, and overall effectiveness of the writing. This process not only helps students improve their writing skills but also enhances their ability to critically evaluate and provide constructive feedback.

### 14. Crossover Teaching

Crossover teaching involves educators from different subjects collaborating to integrate content from multiple disciplines. This interdisciplinary approach aims to show the interconnectedness of different subjects and enhance the relevance of learning.

**Example of Crossover Teaching**

In a high school setting, a history teacher and a literature teacher might collaborate on a unit exploring a specific historical period. Students could read literature from that era, analyze historical documents, and discuss the cultural and social context. This crossover teaching approach helps students see how knowledge from different subjects can complement and enrich their understanding of a particular topic.

### 15. Personalized Learning

Personalized learning tailors the educational experience to the individual needs, preferences, and pace of each student. This can involve adapting content, pacing, and innovative methods of teaching to align with the unique learning styles and strengths of each learner.

**Example of Personalized Learning**

In a science class, students might engage in personalized learning through adaptive online platforms. The educator support platform assesses each student's strengths and weaknesses and provides customized learning paths, offering additional resources or challenges based on individual progress. This approach allows students to move at their own pace, reinforcing concepts they find challenging and advancing more quickly through material they grasp easily.

### 16. Active Learning

Active learning involves strategies that engage students in the learning process through activities, discussions, and participation, rather than passive listening. It encourages students to think critically and apply their knowledge actively.

**Example of Active Learning**

In a biology class, instead of a traditional lecture format, students might participate in a hands-on lab where they conduct experiments to understand cellular processes. The teacher facilitates discussions, and students actively work together to analyze results and draw conclusions. This hands-on approach not only reinforces theoretical knowledge but also enhances critical thinking and problem-solving skills.

### 17. Gamification

Gamification integrates game elements into non-game contexts, such as education, to enhance engagement and motivation. Points, levels, challenges, and rewards are used to make learning more enjoyable.

**Example of Gamification**

In a language learning app, students earn points for completing lessons, quizzes, and interactive exercises. As they accumulate points, they unlock new levels and earn virtual rewards. This

gamified learning approach incentivizes consistent learning, provides a sense of achievement, and makes the language learning process more enjoyable and interactive.

### 18. Problem-Based Learning

Problem-Based Learning (PBL) is an instructional method where students learn through solving real-world problems. It promotes critical thinking, collaboration, and the application of knowledge to practical situations.

### Example of Problem-Based Learning

In a physics class, students might be presented with a real-world problem, such as designing a sustainable energy solution for a community. Working in groups, students would need to research, analyze, and propose a solution that considers the principles of physics, environmental impact, and cost-effectiveness. This approach not only deepens their understanding of physics but also develops problem-solving skills in a practical context.

### 19. Mistake-Led Teaching

Mistake-led teaching emphasizes the value of mistakes as opportunities for learning and growth. Instead of penalizing mistakes, this approach encourages reflection, analysis, and understanding through the process of making and correcting errors.

### Example of Mistake-Led Teaching

In a mathematics class, when students make mistakes in problem-solving, the teacher could use those mistakes as teaching moments. Instead of providing the correct answer immediately, the teacher facilitates a discussion where students analyze the errors, identify misconceptions, and collectively work towards the correct solution. This fosters a positive learning environment where mistakes are viewed as a natural part of the learning process.

### 20. Collaborative Learning

Collaborative learning involves students working together in groups to achieve shared learning goals. It promotes communication, teamwork, and the exchange of innovative ideas in education.

### Example of Collaborative Learning

In a history class, students could be assigned a research project on a specific historical event. Each group member is responsible for investigating different aspects of the event, such as political, social, and economic impacts. The group collaborates to synthesize information and create a comprehensive presentation. This collaborative approach not only deepens individual understanding but also enhances teamwork and communication skills.

## 5.0 Conclusion and Recommendations

The paper examined the various innovative teaching methods available for the teaching and learning of science programme in the tertiary institutions in Nigeria. The study concluded that the available innovative teaching methods available for the teaching and learning of science programme includes; interactive lessons, virtual reality technology, AI in Education, blended learning, 3D Printing, design-thinking process, project-based learning (PBL), inquiry-based learning, jigsaw, cloud computing teaching, flipped classroom, peer teaching, peer feedback, crossover teaching, personalized learning, active learning, gamification, problem-based learning, mistake-led teaching and collaborative learning.

Based on this findings, the paper recommends that the management of tertiary institutions in Nigeria should encourage their academic staff especially the science inclined to adopt the latest innovative teaching methods that suitable for their various courses. The management should ensure academic staff are training in the application of latest innovative teaching methods in order to increase their skills and knowledge on innovative teaching methods. Private institutions and international organizations should support the institutions with capacity building in various academic programme.

**Revise Questions**

1. Define Innovation

2. Explain Innovative Teaching Methods

3. Outline ten forms of Innovative Teaching Method Available for Teaching and Learning of Science Programme

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