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HARNESSING THE IMPACT OF DIGITAL INNOVATION IN SCIENCE EDUCATION FOR NATIONAL DEVELOPMENT IN TEACHER EDUCATION

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Abstract
In recent years, the integration of digital innovations in education has emerged as a promising strategy to enhance teaching and learning experiences. Digital learning plays many roles in education by enhancing students' education, lowering the cost of academic expenses and providing conveniences because of their high accessibility. The purpose of this study was to investigate the role of digital innovation and the effectiveness of incorporating digital tools and resources alongside traditional teaching methods to improve student comprehension, performance, and overall outcomes in science education programs. The instrument used in this study was researchers designed structured questionnaire and a total of fifty students were randomly selected from 200 levels and 300 levels of the Department of Biology in Oyo state college of Education, Lanlae. Chi-square statistical analysis was employed. The data were analyzed at 0.05 level of significance. It was deduced from the research findings that there is a significant relationship between digital innovation method of learning in science education and students overall academic performance.It is therefore recommended that digital innovations should be integrated into teacher training programmes across all tears of educational sector in other to harness the potentials of technology to advance science education and drive sustainable development in Nigeria and beyond.
Keywords: Digital innovation, Traditional teaching, Science education,

Introduction

In the dynamic landscape of contemporary education, the integration of digital innovation has emerged as a transformative force, particularly in the domain of science education. Nigeria, a country with vast potential and aspirations for socio-economic development, stands at a critical juncture where leveraging digital technologies in science education can propel national advancement. This paper aims to explore the multifaceted intersection of digital innovation, science education, and national development within the Nigerian context. Nigeria, like many nations, grapples with challenges in its educational sector, hindering its ability to harness its demographic dividend and natural resources fully. Inadequate infrastructure, resource disparities, and traditional pedagogical methods often limit students' access to quality science education, impeding the cultivation of critical skills necessary for participation in the global knowledge economy (Adesoji, 2018). However, amidst these challenges lies an unprecedented opportunity to the power of digital innovation to revolutionize science education and drive national development.

The integration of digital technologies offers immense harnesspotential to enhance learning experiences, foster innovation, and bridge educational dividesOginni and (Ajayi, 2020). From interactive simulations and virtual laboratories to online collaboration platforms and data-driven

teaching methodologies, digital innovations hold promise in engaging students, facilitating inquiry-based learning, and nurturing the problem-solving skills essential for success in scientific fields. Moreover, digitalnationaladvancement tools can democratize access to quality education, reaching students in remote and underserved communities, thereby fostering inclusivity and equity in education—a fundamental pillar of sustainable development. However, realizing the transformative potential of digital innovation in science education requires a concerted effort from various stakeholders (Akanbi, 2020). Policymakers, educators, industry leaders, and civil society must collaborate to develop robust frameworks that integrate digital technologies into the educational ecosystem effectively (Ajayi, 2021). This entails investments in infrastructure, teacher training programs, and curriculum reforms that align with the evolving needs of the digital age.

Furthermore, addressing challenges such as digital literacy, internet connectivity, and privacy concerns is imperative to ensure equitable access and safeguard the integrity of digital learning environments. In this conference paper, we will delve into these critical issues, drawing upon theoretical insights, empirical research, and practical experiences to elucidate the opportunities and challenges associated with digital innovation in science education for national development in Nigeria. By examining case studies, best practices, and policy recommendations, we aim to provide actionable insights for policymakers, educators, and stakeholders to harness the transformative potential of digital technologies in advancing science education and driving sustainable development in Nigeria (Ogunsola and Oyelude, 2020). As Nigeria strives to position itself as a global leader in science, technology, and innovation, embracing digital innovation in science education is not merely an option but a strategic imperative. By nurturing a digitally empowered generation of scientists, engineers, and innovators, Nigeria can unleash its full potential, driving economic growth, fostering social progress, and ultimately, realizing its vision of a prosperous and knowledge-driven society (Osiki and Adeola, 2021).

Education is a vital aspect of our lives, shaping us into the individuals we are today. However, traditional learning methods have existed for centuries and may only be suitable for some in this modern age (Tony 2023). In ancient times, traditional teaching methods were more common because teachers wanted students to learn fixed knowledge and get good scores on exams (Yuemeng 2022). In a traditional classroom, education is mainly based on teaching system and often focuses on the material itself rather than the learners and differences between capabilities and learning skills (Fei Li, Jingyao, Guiwei and Xiaofeng, 2014). Teachers lead a lesson in traditional learning, by presenting, showing visuals of a modeling examples of a topic. While a teacher is presenting, students can listen, watch take note and copy the teacher's demonstration. The traditional method of teaching, also known as the teacher-centered approach, is primarily characterized by its focus on direct instruction. In this method, the teacher serves as the central figure of authority and knowledge, delivering lectures or presentations while students take notes and absorb information passively (Gholami, Moghadam, Mohammadipoor, 2016). The classroom environment is typically structured in a hierarchical manner, with the teacher controlling the pace and content of the lessons (Bada, 2015). The curriculum is usually standardized, with a strong emphasis on memorization and rote learning, and assessments often focus on students' ability to recall facts rather than apply critical thinking or problem-solving skills (Ahmad & Hussain, 2015).

While the traditional teaching method has been effective in ensuring curriculum coverage and providing a disciplined learning environment, it has been critiqued for its limitations in fostering student engagement and interaction (Ramsden, 2003). Opportunities for collaborative learning and discussion are often minimal, limiting students' ability to develop skills such as critical

thinking, creativity, and communication (Felder & Brent, 2005). In recent years, educational trends have been shifting towards more student-centered approaches, which prioritize active learning, collaboration, and the development of higher-order thinking skills, challenging the conventional practices of the traditional method (Felder & Brent, 2005).

Statement of Problem

Despite Nigeria's rich human capital and abundant natural resources, the nation faces significant challenges in its educational sector, particularly in the realm of science education. Traditional pedagogical approaches often fail to adequately engage students, foster critical thinking skills, and prepare them for the demands of the 21st-century knowledge economy. Furthermore, limited access to quality educational resources, inadequate infrastructure, and disparities in educational opportunities exacerbate these challenges, particularly in underserved rural and marginalized communities (Adesoji, 2018; Oginni and Ajayi, 2020). In light of these challenges, there is a pressing need to explore how digital innovation can be effectively leveraged to enhance science education in Nigeria. While digital technologies hold immense promise to transform learning experiences, promote active engagement, and facilitate personalized instruction, their integration into the educational landscape is often hindered by various barriers and constraints. These may include limited access to technology and internet connectivity, insufficient training and capacity-building for educators, as well as concerns about digital literacy, privacy, and cyber security (Ogunsola and Oyelude, 2019; Osiki and Adeola, 2021). Moreover, the effectiveness of digital innovation in science education hinges not only on technological infrastructure but also on the alignment of educational policies, curriculum frameworks, and pedagogical practices.

In Nigeria, there is a critical need to harmonize efforts across government agencies, educational institutions, civil society organizations, and the private sector to create an enabling environment for the sustainable integration of digital technologies into science education (Akanbi, 2020; Ajayi, 2021). Therefore, the central problem addressed in this paper is: How can digital innovation be effectively harnessed to address the challenges facing science education in Nigeria and contribute to national development goals? By examining this problem from multiple perspectives, including technological, pedagogical, policy, and socio-economic dimensions, this paper aims to identify actionable strategies, best practices, and policy recommendations to advance digital innovation in science education for the benefit of Nigeria's youth, economy, and society as a whole.

Objectives of The Study

1. To investigate the role of digital innovation in science education for National development
2. To investigate the effectiveness of incorporating digital resources with traditional teaching method to improve student academic performances
3. To make recommendation that would help to formulate policies that will enhance the digital innovation in science education for National development

Research Hypotheses

Ho 1: There is no significant relationship between digital innovation in science education and students' overall academic performance

Ho 2: Traditional method of learning in science education does not have influence on students overall academic performance.

Methodology

Research Design:

A research design is a master plan specifying approaches and strategies for collectingand analyzing required information. Zikmund (2000) cited in Mahemba (2003).The design of this study is a survey type aimed at harnessing the impact of digital innovation in science education for National development in teacher education. The studies were conducted using the Department of Biology School of Secondary Education, Science programmes of the Oyo State College of Education, Lanlate Oyo State as a case study.

Population and Sample

The researchers used data from the primary source extensively because of the nature of the subject matter under study. The information was collected through the administration of questionnaire to a cross-section of 50 students from 200 level and 300 level students which represents student of 2022/2023 and 2023/2024 academic set respectively. However, only student who have CGPA were considered while 100 levels students were not involved in the study because they did not have CGPA yet.

Sample Method

Purposive sampling method was used in selection of the respondents in which only student with CGPA were giving the opportunity of being selected.

Instrumentation

The instrument used in this work was a close-ended questionnaire which contains twelve items relating to the impact of digital innovation in science education for national development in teacher education.

Method of Data Analysis

The data gathered was analyzed using chi-square statistical method that was tested at 0.05 significant level

Data Presentation and Analysis

Hypothesis 1:

Ho 1: There is no significant relationship between digital innovation in science education and student overall performance.

Table 1: Digital innovation method and student overall academic performance

Digital Innovation Method	**Student's Overall Academic Performance**		**Total**	**X·t**	**Xcal**	**DF**	**P**
	Yes	No					
Q1	30 (20.83%)	20 (35.71%)	50				
Q2	42 (29.17%)	08 (14.29%)	50				
Q3	34 (23.61%)	16 (28.57%)	50	7.81	7.92	5	0.05
Q4	38 (26.39%)	12 (21.43%)	50				
Total	144 (100%)	56(100%)	200				

The table value of X^2 at 5% significant level is 7.81 (X·t) while the X calculated is 7.92 since calculated value is greater than the table value i.e 7.92 > 7.81, we reject the null hypothesis and accept the alternative hypothesis. Hence we concluded that digital innovation method as a significant impact on student overall academic performance

Hypothesis 2

Ho 2: Traditional method of learning in science education does not have influence on student overall academic performance.

Table 2: Traditional method of learning and student overall academic performance

Traditional Method of Learning	**Student's Overall Academic Performance**		**Total**	**X·t**	**Xcal**	**DF**	**P**
	Yes	**No**					
Q6	30 (27.78%)	20 (47.62%)	50				
Q7	43 (39.81%)	07 (16.67%)	50	5.99	8.53	2	0.05
Q8	35 (32.41%)	15 (35.71%)	50				
Total	108 (100%)	42(100%)	150				

The table value of X^2 at 5% significant level is 5.99 (X·t) while X calculated is 8.53. Since calculated value is greater than the table value i.e 8.53 > 5.99 we reject the null hypothesis and accept the alternative hypothesis. Hence we concluded that there is a significance relationship between the traditional method of learning in science education and student overall academic performance.

Discussion of Findings

The overall result from the study have shown that the two null hypotheses generated were rejected. In the first place, the result shows that there is a significant relationship between digital innovation method of learning in science education and student overall academic performance. This is in line with the work of Adesoji (2018) who discovered that students perform better in Science subjects if they are taught using the combination of digital innovation and traditional methods. It was revealed in the survey that digital learning resources provide more opportunities for the student expansion of learning. Some student prefer uses of computer or laptop in teaching than the traditional whiteboard. Typically, when learning a particular topic that may be harder to understand without visualization, the instructor of the courses may use digital resources to provide more information to the students and enhance the students overall abilityto see beyond what is on paper. This availability and access to digital resources allows students to balance between the traditional paper based courses materials they are assigned in their traditional classroom and selectively implement digital learning resources when they may need further clarification on the courses contents.

The analysis from the second hypothesis has shown that traditional method of learning has influence on student overall academic performance to certain extent. It was revealed in the survey that, concerning the use of textbooks, some student prefer traditional paper-based textbooks to online textbooks. The reason given is that online textbooks are limited to a specific amount of accessibility because access to the resources depend on the battery life of the devices that are being used on. It was also revealed that not all students can afford the cause of online learning resources as some of the resources are not only costly but also not necessarily readily available to all students

Conclusion

Digital learning resources are effective tools that can improve students' learning in ways that a textbook might not be able to. While these digital resources have advantages, traditional paper-based learning materials, such as textbooks, also give students access to experiences that digitalized learning resources might not be able to provide. Every resource, whether digital or traditional paper-based, has advantages and disadvantages when it comes to raising the standard of instruction for students. There is a growing trend in the number of students using digital tools

to improve their learning. The increasing tendency suggest that the number of students utilizing these digital resources will increase as more things become digital

Recommendations

Based on the findings of the study, several recommendations can be made to harness the impact of digital innovation in science education for national development in teacher education:

i. **Integrate Digital Innovations into Teacher Training Programs**: Educational institutions should incorporate digital innovations into teacher training programs to equip educators with the necessary skills and knowledge to effectively utilize technology in the classroom. This includes providing professional development opportunities focused on integrating digital tools and resources into lesson planning and instructional delivery.
ii. **Invest in Infrastructure and Resources**: Governments and educational stakeholders should prioritize investments in infrastructure and resources to support the integration of digital innovations in science education. This includes ensuring access to reliable internet connectivity, adequate computer hardware, educational software, and other digital resources essential for enhancing teaching and learning experiences.
iii. **Promote Collaborative Learning Environments**: Encourage collaborative learning environments where students can engage with digital technologies to explore, create, and problem-solve collaboratively. This fosters a supportive and interactive learning environment conducive to knowledge sharing and peer learning.
iv. **Provide Ongoing Support and Training**: Offer continuous support and professional development opportunities for educators to enhance their digital literacy skills and pedagogical practices. This may include workshops, seminars, online courses, and mentoring programs tailored to meet the evolving needs of teachers in integrating digital innovations into their teaching practices.
v. **Foster Research and Innovation**: Encourage research and innovation in digital pedagogy and instructional design to identify effective strategies for integrating digital innovations into science education. This includes supporting research initiatives, collaborative partnerships between academia and industry, and pilot projects to test and evaluate innovative approaches to teaching and learning.
vi. **Ensure Accessibility and Inclusivity**: Take proactive measures to ensure that digital innovations are accessible and inclusive for all students, including those with diverse learning needs and backgrounds. This may involve designing instructional materials and digital resources that are adaptable, customizable, and responsive to the needs of diverse learners.
vii. **Evaluate and Assess Impact**: Continuously monitor and evaluate the impact of digital innovations on teaching and learning outcomes to inform evidence-based decision-making and improvement strategies. This includes collecting and analyzing data on student performance, engagement, and satisfaction to identify areas of strength and areas for improvement.

By implementing these recommendations, stakeholders can harness the transformative potential of digital innovation in science education to empower educators, enhance student learning experiences, and contribute to national development in teacher education.

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