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AVAILABILITY AND UTILIZATION OF INSTRUCTIONAL MATERIALS FOR BLENDED TEACHING AND LEARNING OF SCIENCE EDUCATION IN TERTIARY INSTITUTIONS IN ENUGU STATE.

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Abstract: This study investigated the availability and use of instructional materials for blended teaching and learning of science education in tertiary institution in Enugu state. A descriptive survey research design was adopted in the study. Sixty science educators drawn through simple random sampling served as sample. Researcher-made structured questionnaire was the instrument for data collection. Analysis of data was done using mean and standard deviation (descriptive statistics) to answer the research questions while Pearson product moment correlation (inferential statistics) was used to test the hypotheses at 0.05 level of significance. The findings revealed that science educators and students have regular access to the school computers to low extent and that most schools have resources for blended teaching and learning to a low extent and can compare materials used with an interactive whiteboard to low extent. Again most of the facilities necessary for blended teaching and learning approach are available to a low extent. The findings also revealed that teachers undergo training on blended teaching and learning to a low extent. Based on these findings, it is recommended that government should equip tertiary institutions with enough resources and facilities necessary for blended teaching and learning, and should organize regular trainings on the use of blended teaching and learning approach for science teachers in tertiary institutions.

Keywords: Utilization, Instructional materials, Blended Teaching, and Science Education

Introduction

Innovation is a cornerstone of sustained success within any organization or process, encompassing actions, strategies, and methodologies that drive progress and efficiency. It refers to the introduction of new changes, methods, or products designed to enhance productivity and conserve resources. The COVID-19 pandemic, a global crisis, starkly illustrated the necessity of innovation. As the world grappled with widespread disruptions, the routine activities of individuals and organizations were brought to an unprecedented standstill. However, through the rapid deployment of scientific knowledge and technological advancements, particularly in Information and Communication Technology (ICT), societies adapted by leveraging electronic tools to maintain continuity while adhering to safety protocols.

The post-pandemic era has underscored the critical role of ICT in sustaining various aspects of life and work. ICT innovations have become indispensable in facilitating remote operations, enabling organizations

and individuals to perform tasks that were once heavily reliant on physical presence. The adoption of digital tools has not only ensured the survival of numerous sectors but has also paved the way for more efficient and flexible modes of operation. In this context, innovation in ICT has become synonymous with resilience and adaptability, providing a blueprint for navigating future challenges.

The rapid expansion of scientific knowledge, particularly in the realm of ICT, has revolutionized the way information is exchanged and applied across various fields (Etiubun & Akpan, 2017). ICT resources, including computers, digital cameras, multimedia software, and internet connectivity, have become integral to modern education and communication. These tools offer a wide range of functionalities, from computational analysis and data management to the creation of instructional materials and enhancement of innovative practices. The ability to store, manage, and access vast amounts of information has transformed how knowledge is disseminated and utilized, making ICT a catalyst for continuous learning and development.

Moreover, ICT resources are not limited to communication or information exchange; they also play a pivotal role in fostering creativity and innovation. For instance, multimedia applications and digital tools facilitate the development of new educational content, enabling educators to create more engaging and interactive learning experiences. The integration of ICT in education has led to the creation of virtual classrooms, online laboratories, and digital libraries, which have expanded access to quality education and bridged geographical gaps. These innovations are not just responses to immediate challenges but are shaping the future of education and professional development.

Innovation, particularly through the lens of ICT, has become an essential driver of progress in the post-pandemic world. The ability to adapt and implement new technologies has allowed societies to overcome significant disruptions and continue functioning in an increasingly digital landscape. As scientific knowledge continues to grow, the role of ICT in enhancing innovation, fostering collaboration, and ensuring the continuity of critical processes will only become more pronounced. This trend highlights the importance of embracing change and leveraging technology to build more resilient and efficient systems in various sectors, including education.

Pedagogy, the art and science of teaching, plays a crucial role in the effective implementation of blended teaching and learning, particularly in the field of science education. In the context of tertiary institutions in Enugu State, pedagogy must adapt to incorporate both traditional and digital instructional methods to meet the evolving needs of students. Blended learning, which combines face-to-face instruction with online learning experiences, demands a pedagogical approach that seamlessly integrates these modalities to enhance student engagement and learning outcomes. This approach requires educators to be proficient not only in content delivery but also in utilizing various technological tools to facilitate a more interactive and flexible learning environment (Garrison & Vaughan, 2018).

The integration of instructional materials into a blended learning framework necessitates a shift in pedagogical strategies. Traditional teaching methods, which often rely on direct instruction and rote learning, must be complemented with innovative techniques that leverage digital resources. For example, the use of multimedia presentations, virtual labs, and online assessments can enhance the learning

experience by providing students with diverse opportunities to interact with the content in meaningful ways. According to Kumar and Kumar (2020), effective pedagogy in a blended learning environment requires educators to design learning activities that promote critical thinking, collaboration, and problem-solving skills. By incorporating digital instructional materials, educators can create a more dynamic and student-centered learning experience that supports deeper understanding and retention of scientific concepts.

Moreover, the success of pedagogy in blended teaching and learning is heavily dependent on the availability and effective use of instructional materials. Educators must be equipped with the necessary resources and training to effectively integrate technology into their teaching practices. This includes not only access to digital tools but also the pedagogical skills to design and deliver instruction that aligns with the goals of blended learning. As highlighted by Mishra and Koehler (2017), the Technological Pedagogical Content Knowledge (TPACK) framework emphasizes the importance of educators possessing a deep understanding of how technology can be used to enhance teaching and learning within specific content areas. In the context of science education, this involves creating instructional strategies that leverage digital tools to facilitate inquiry-based learning, experimentation, and real-time feedback, thereby enriching the overall educational experience for students.

Science, as a discipline, involves the systematic study of the natural world through observation, experimentation, and analysis. It serves as the foundation for understanding the laws of nature and contributes to advancements in technology, medicine, and various other fields. In the context of education, science is not just a body of knowledge but also a method of inquiry that encourages critical thinking, problem-solving, and the application of evidence-based reasoning. The integration of science into education, particularly in tertiary institutions, is essential for equipping students with the skills needed to address complex global challenges. As technology continues to evolve, so too must the methods by which science is taught, incorporating both traditional and innovative approaches to foster a deeper understanding of scientific principles (Osborne, 2016).

Science education, specifically in the realm of blended teaching and learning, emphasizes the need for a pedagogical shift that aligns with modern technological advancements. The traditional model of science education, which often relied heavily on theoretical instruction, is being transformed by the integration of digital tools and resources. This shift is particularly evident in tertiary institutions in Enugu State, where blended learning approaches are being implemented to enhance the teaching and learning of science. By combining face-to-face instruction with online resources, educators can create a more flexible and interactive learning environment that caters to diverse learning styles and needs (Ertmer & Ottenbreit-Leftwich, 2020).

The use of instructional materials in science education is crucial for making abstract concepts more tangible and accessible to students. In a blended learning environment, these materials can take various forms, including virtual laboratories, simulations, and interactive multimedia resources. These tools not only facilitate the comprehension of complex scientific ideas but also provide opportunities for students to engage in hands-on experimentation and inquiry-based learning. According to Finkelstein et al. (2019),

the effective use of instructional materials in science education enhances student engagement and retention by allowing learners to explore concepts in a more immersive and practical manner.

Moreover, the integration of Information and Communication Technology (ICT) into science education has broadened the scope of what can be taught and learned. ICT tools have made it possible to access a vast array of scientific resources and data, enabling students to conduct research and analyze information in real-time. This has transformed science education from a static, textbook-based approach to a dynamic, interactive process that encourages exploration and innovation. As highlighted by Azevedo and Hadwin (2019), the incorporation of ICT in science education not only supports the acquisition of scientific knowledge but also fosters the development of digital literacy skills, which are increasingly important in today's technology-driven world.

Furthermore, science and science education are at the forefront of shaping the future, particularly in the context of blended teaching and learning. The effective integration of instructional materials and ICT tools into science education enhances the learning experience, making it more engaging, practical, and relevant to the needs of modern students. As tertiary institutions in Enugu State and beyond continue to embrace these innovations, the potential for science education to inspire and equip the next generation of scientists, engineers, and innovators becomes even more significant.

The advent of Technology can be utilized for effective teaching and learning of science especially science education Technology has been identified as playing a crucial role in curriculum implementation as it has been detected that its proper use can enhance teaching and learning (Kulik & Ndirika, 2018).

Through the use of the blended teaching model in any science education course, the students' academic achievement level and their learning retention ability are expected to develop. With the blended teaching model, teachers are able to carry out multimedia applications which cannot be adequately taught during lessons with the use of internet to enhance learning and understanding of science courses. Blended teaching and learning represents an educational approach that combine's traditional face-to-face instruction with online learning components, aiming to create a more flexible and effective learning environment. This method leverages the strengths of both in-person and digital education to enhance student engagement and learning outcomes. In the context of science education, particularly within tertiary institutions in Enugu State, blended learning offers a unique opportunity to integrate digital resources and interactive tools with conventional teaching practices. This combination can provide students with a more comprehensive and adaptable learning experience, enabling them to engage with scientific concepts in diverse and meaningful ways (Garrison & Vaughan, 2018).

One of the key benefits of blended learning is its ability to offer personalized learning experiences that cater to individual student needs. By incorporating online modules, simulations, and interactive multimedia, educators can create customized learning paths that address varying levels of student proficiency and interest. This approach not only supports differentiated instruction but also allows students to learn at their own pace, revisit challenging concepts, and access additional resources as needed. According to Horn and Staker (2015), the flexibility

inherent in blended learning models helps accommodate diverse learning styles and can lead to improved academic performance by allowing students to engage with the material in a way that suits their personal learning preferences.

In science education, the integration of digital tools and resources through blended learning can significantly enhance the practical aspects of learning. For example, virtual laboratories and online simulations provide students with opportunities to conduct experiments and explore scientific phenomena that may be difficult to replicate in a traditional classroom setting. These tools not only enrich the learning experience but also offer students a safe and controlled environment to experiment and learn from their mistakes. As noted by Bernard et al. (2017), such technological innovations can bridge the gap between theoretical knowledge and practical application, making complex scientific concepts more accessible and engaging for students.

Blended learning also supports collaborative learning and fosters a sense of community among students. Online platforms and tools facilitate communication and collaboration outside the classroom, allowing students to work together on projects, share ideas, and provide peer feedback. This aspect of blended learning promotes teamwork and critical thinking, skills that are essential for success in science and other fields. According to Graham (2018), the ability to collaborate and engage in discussions with peers through digital platforms enhances the learning experience and helps students develop the interpersonal skills necessary for professional and academic success.

However, the successful implementation of blended learning in science education requires careful planning and consideration of various factors, including the availability of technological resources and the level of digital literacy among both students and educators. Ensuring that all students have access to the necessary technology and support is crucial for the effectiveness of blended learning approaches. Additionally, educators must be equipped with the skills and knowledge to effectively integrate digital tools into their teaching practices. As highlighted by Bonk and Graham (2018), professional development and training for educators are essential for maximizing the benefits of blended learning and ensuring that it is implemented effectively in diverse educational settings.

Blended teaching and learning represents a promising approach to enhancing science education in tertiary institutions. By combining the strengths of traditional and digital methods, blended learning can offer a more flexible, personalized, and engaging learning experience for students. As educational institutions in Enugu State and beyond continue to explore and implement blended learning strategies, it is important to address challenges related to technology access and educator training to fully realize the potential of this innovative approach. With careful planning and support, blended learning can contribute to more effective and inclusive science education.

Gender is a critical factor to consider in the teaching and learning of science, as it influences the social expectations and behaviors of students both during and after their educational experiences. Gender norms and stereotypes can shape students' attitudes toward science, often leading to disparities in participation and performance between male and female students. This issue is particularly evident in the field of science education, where cultural and societal expectations often discourage female students from pursuing science-related courses. According to Okeke (2018),

these gender-based differences are not only rooted in societal norms but also reflect deeper systemic issues within the educational framework that need to be addressed to foster an inclusive learning environment. The impact of gender on science education is multifaceted, involving social, cultural, and academic dimensions. In Nigeria, and indeed many other nations, science subjects tend to be dominated by male students, while female students often gravitate towards the arts and social sciences. Ogunkunle (2019) highlights that female students frequently perceive science subjects, especially those requiring mathematical calculations, as more challenging compared to their male counterparts. This perception contributes to a significant gender gap in science education, with fewer girls enrolling in courses such as physics, chemistry, mathematics, and computer science at the tertiary level. These disparities underscore the need for targeted interventions in science education policy that address the specific challenges faced by female students, including the development of instructional strategies that can help bridge the achievement gap.

Purpose of the study:

General purpose of the study was to find out the availability and utilization of instructional material for blended teaching and learning of science in the tertiary institutions in Enugu State. Specifically, the study is to:

1. Ascertain the available instructional materials utilized for blended teaching approach for science educators in tertiary institutions in Enugu State.
2. Find out the problems associated with utilization of instructional materials for blended teaching approach among science educators in tertiary intuitions in Enugu state.
3. Ascertain the extent of utilization of instructional materials for blended teaching approach by science educators among tertiary institutions in Enugu State.

Research Questions

The following research questions guided the study:

1. What are the available instructional materials for blended teaching approach for use by science educators in tertiary institutions in Enugu State?
2. What are the problems associated with utilization of instructional materials for blended teaching approach among science educators in tertiary intuitions in Enugu state?
3. What is the extent of utilization of instructional materials for blended teaching approach by science educators in tertiary intuitions in Enugu State?

The following null hypotheses were stated to guide the study;

H_{01}: There is no significant difference in the availability of instructional material used for blended teaching approach by science educators in the urban and rural areas in tertiary institutions in Enugu state.

H_{02}: There is no significant difference in the utilization of instructional materials for blended teaching approach by male and female science educators in Tertiary institutions in Enugu state.

Method

A descriptive survey research design was used for the study. A sample of 60 science educators from tertiary institutions in Enugu State was selected through simple random sampling. Questionnaire was the instrument used for data collection. Four-point Likert scale questionnaire for teachers was used and the response modes were Very High Extent, High Extent, Low Extent, and Very Low Extent. The data were analyzed using mean and standard deviation to answer

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the research questions. Inferential statistics involving Pearson Product Moment Correlation was used to ascertain the reliability of the instrument and the reliability coefficient of 0.86 was obtained. The hypotheses were tested at 0.05 level of significance.

Result

Question 1: What are the available instructional materials for blended teaching approach for use by science educators in tertiary institutions in Enugu State?

Table 1: Extent of availability of instructional materials for blended teaching approach for use by science educators in tertiary institutions Enugu State

SN	Items	N	$\bar{X}$	S.D	Remarks
1	The computer laboratory in the school is equipped with computers to go round the students	60	1.87	.700	Low Extent
2	The teachers and the students have regular access to the school computers	60	1.78	.666	Low Extent
3	The school has regular electricity supply	60	1.85	799	Low Extent
4	The school has enough resources necessary for blended learning approach	60	1.67	.729	Low Extent
5	Computer laboratory in the school is equipped with internet facilities	60	1.83	.	Low Extent
6	The school has most of the facilities necessary for blended learning approach	60	1.73	806	Low Extent
				.733	

Grand Mean= 1.79

Result in the table 1 showed that, computer laboratory in tertiary institution is equipped with internet facilities to low extent. Those tertiary institutions also have regular supply of electricity to low extent. The table further showed that the teachers and students have regular access to a low extent. Also, tertiary institution have resources necessary for blended learning approach to a low extent and most of the facilities necessary for blended learning approach are available at low extent.

Question2: What are the problems associated with utilization of instructional materials for blended teaching approach among science educators in tertiary institutions in Enugu state?

Table 2: The problems associated with utilization of instructional materials for blended teaching approach among science educators in tertiary institutions in Enugu state.

SN	Items	N	$\bar{X}$	S.D.	Remarks
1	I can operate the computer very easily	60	2.47	.892	Low Extent
2	I have undergone training on blended learning approach in Science education	60	1.72	.825	Low Extent
3	I can browse/search the internet to collect				

	information to prepare lectures	60	1.93	.899	Low Extent
4	I can browse/search the internet to collect recourses to be used during lectures	60	1.85	.917	Low Extent
5	I can post home work for students on the institution website	60	1.65	.606	Low Extent
6	I can download/upload materials from the institution website	60	1.42	.619	Low Extent
7	I can use e-mail to communicate with others	60	1.95	.928	Low Extent
8	I can compare materials to use with an interactive whiteboard	60	1.60	.827	Low Extent
9	I can download/upload Science resources from/to website for students use	60	1.90	.736	Low Extent
10	I attend seminar/workshops regularly	60	2.33	.837	Low Extent

Grand Mean =1.88

The results in the table2 showed that science educator cannot operate computer easily to high extent, those science educators can also browse/search the internet to collect information to prepare lectures to a low extent. Further revealed in the table is that, science educators can use e-mail to communicate with others, also download or upload science education resources from/to websites for students to use and attend seminar/workshop regularly to low extent. The result in the table further showed that science educators undergo training on blended learning approach in science education, can browse/search the internet to collect resources to be used during lectures, can post home work for students on the institutions website, can download/upload materials from the institution website and can compare materials to use with an interactive whiteboard to low extent.

Question 3: What is the extent of utilization of instructional materials for blended teaching approach by science educators in tertiary institutions in Enugu State?

Table3: Extent of Utilization of instructional materials for Blended Teaching Approach by Science Educators in tertiary institutions in Enugu State

SN	Item	N	X	S.D.	Remarks
1	The science education lectures are very interactive	60	2.33	.816	Low Extent
2	I utilize blended learning in the science education lectures	60	1.93	.733	Low Extent
3	I give the students assignment involving the use of Science website	60	1.77	6.73	Low Extent
4	I prepare the science education lectures on power point and present it in an interactive manner to the students	60	1.82	.469	Low Extent
5	I sometimes carry out computer-based laboratory experiments in science education for students	60	1.73	.482	Low Extent

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6	I also lecture science education course with the interactive whiteboard in addition to using the chalk board.	60	1.90	.511	Low Extent
7	I occasionally use the computer laboratory to lecture some science education concepts.	60	1.87	.566	Low Extent

Grand Mean=1.91

The result in the table 3 revealed that science education lectures are not very interactive to a high extent. Also, science educators utilize blended learning in science education course lecture to a low extent. Nevertheless, the science educator gives students assignment involving the use of science education websites; prepare science education on PowerPoint and present it in an interactive manner to students; carry out computer-based laboratory experiments in science education for students; teach science education courses with the interactive whiteboard in addition to using the chalk board to a low extent.

Hypothesis 1: There is no significant different in the availability of instructional material used for blended teaching approach by science educators in the urban and rural areas in tertiary institutions in Enugu state.

Table 4: The availability of instructional material used for blended teaching approach among science educators in the urban and rural areas in tertiary institutions in Enugu state.

SN		$\overline{X}$	S.D	N	t_{cal}	p
1	Extent of availability of instructional facilities for blended teaching approach	10.78	3.523	60	0.161	0.218
2	Extent of science educators' utilization of blended teaching approach of science education	13.18	2.038	60		

P>0.05(Not Significant Result)

Table 4 showed that tcal (0.161) is not significant at 0.05 level of significance. The null hypothesis is accepted. This implies that there is no significant relationship between the extent of availability of instructional facilities and extent of utilization of blended of science education in Enugu State.

Hypothesis 2: There is no significant difference in the utilization of instructional materials used for blended teaching approach by male and female science educators in Tertiary institutions in Enugu state.

Table 5: The utilization of instructional materials used for blended teaching approach by male and female science educators in Tertiary institutions in Enugu state.

SN	$\overline{X}$	S.D.	N	t_{cal}	p

1 2	Utilization of instructional materials by male educators	18.88	5.699	60		
	Utilization of instructional materials by Female educators	13.18	2.038	60	0.340	0.008

P<0.05(Significant Result)

Table 5 showed that tcal (0.340) is significant at 0.05 level of significance. The null hypothesis is not accepted. The table presents the results of a study on the utilization of instructional materials by male and female science educators in tertiary institutions in Enugu state. The mean scores for male and female educators are 18.88 and 13.18, respectively, indicating a significant difference in the utilization of instructional materials between the two groups. The t-calculated value of 2.038 and p-value of 0.008, which is less than 0.05, indicate a statistically significant difference between the two groups.

Discussion

The result presented in the table1 shows that computer laboratory in the institutions were equipped with computers to go round the students to a low extent. Therefore, some of the computer laboratories in tertiary institution were equipped with internet facilities and supply of electricity to a low extent.

The table1 further shows that the science educators and students have regular access to school computers to a low extent. Therefore, schools have resources with facilities necessary for blended teaching approach to a low extent, while most of the facilities necessary for blended learning approach are available at a low extent.

The findings in the table2 also indicated that science educators cannot operate computers very we easily to a high extent. In addition, science educators can also browse/search the internet to collect information to prepare lessons to low extent. Therefore, science educators cannot use e-mail to communicate with others, download/upload science education resources from/to website for students to use and attend seminars/workshop to a high extent.

The result in the table3 further shows that science educators used in this study do not utilize blended teaching approaching in teaching science education courses. This could be as a result of not being trained in blended teaching approach. The science educators agree to being competent in operating and browsing the computer and having a functional e-mail to communicate with others. Moreover, the teacher can browse the internet to collect resources to be used during lectures and post of assignment for students on the institution website to low extent. Again, the teachers can download/upload materials from the institution website and can compare materials to use with an interactive whiteboard to a low extent.

The result also revealed that science educators prepare science lectures on PowerPoint and present it in an interactive manner to students to a low extent.

Furthermore, the table 4 also shows that there is no significant relationship between the extent of availability of instructional facilities and extent of the utilization of blended teaching for teaching science/ education courses in Enugu State.

The table 5 shows that male science educators in Enugu state's tertiary institutions use instructional materials more effectively than female educators, with potential factors including differences in teaching styles, experience, and resource access. The findings suggest that targeted support, such as workshops and mentoring, could help female

educators improve their use of instructional materials, ultimately promoting more effective teaching and learning practices in tertiary institutions.

Conclusion

In conclusion, the researchers highlighted a critical gap between the technological resources available and their effective utilization in science education at tertiary institutions in Enugu State. Although many institutions are equipped with computers and have a consistent supply of electricity, the ability of science educators to integrate modern technological tools into their teaching remains limited. The reliance on traditional chalkboard methods, coupled with insufficient training in digital technologies, underscores a need for substantial improvements in both educator support and resource availability.

The limited access to computers and internet resources further exacerbates the challenge, preventing the full implementation of blended learning approaches. While the infrastructure exists to support modern teaching methods, the lack of regular access to these tools and inadequate internet connectivity in computer laboratories hinder the effective use of technology in the classroom. This situation reflects a broader issue where the potential of blended learning to enhance science education is not fully realized due to systemic constraints.

Recommendations

Based on the result of this study, the following recommendations were made:

1. Government should equip tertiary institutions with enough resources and facilities necessary for blended teaching and learning to encourage the science educators and students to have regular access to the school computers.
2. Government should organize regular trainings on the use of blended teaching approach for tertiary institutions Science educators.
3. Government should provide interactive whiteboard to all tertiary institutions to improve on teaching science education.
4. The Government should install solar energy facilities to argument the supply of power from hydro energy supply from the mains.
5. Teachers and students should have regular access to school computer laboratories to aid in blended teaching.

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