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Assessing Physics Teachers' Proficiency in Designing and Developing Digital Learning Resources (DLRs) for Effective Classroom Integration: A Comparative Study

[*1]Aderonmu Temitope S. B. & [2]Amezhinim Amon Agbesor

[*1]Department of Educational Technology, College of Specilised and Professional Education, Tai Solarin University of Education, Ijagun Ogun State **Email:** aderonmutsb@tasued.edu.ng **ORCID:** https://orcid.org/0000-0002-9945-4461

[2]Nigerian Navy School, Borokiri, Port Harcourt, Rivers State **Email:** agbesoraa@gmail.com

Abstract

The study assessed Physics teachers' proficiency in designing and developing Digital Learning Resources (DLRs) for effective classroom integration. The cross sectional descriptive research design was adopted for the study. Two research questions were raised and two hypotheses were tested at 0.05 level of significance. A sample size of 327 Physics teachers was selected from both public and private schools in Ogun and Rivers states, Nigeria. The instrument for data collection was Physics Teachers' Proficiency in Designing and Developing Digital Learning Resources" (PTP-3DLRs) with coefficient reliability index value of r = 0.86. Data for the study was analyzed using descriptive statistics of frequency count, mean, standard deviation while the inferential statistics of t-test was employed for the hypotheses. The findings of the study indicated that Physics teachers in Ogun State (x_1 = 2.17, SD = 0.90) and Rivers State (x_2 = 2.09, SD = 0.92) both fall within same proficiency category (1.61 – 3.30). This indicates that, while teachers in both states possess some degree of knowledge and skills in designing and developing digital learning resources (DLRs), their proficiency is not yet at an advanced level. The study also revealed that the influence on effective classroom integration for designing and developing digital learning resources (DLRs) is not yet at an advanced level Physics teachers in Ogun State (x_1 = 2.20, SD = 0.90) and Physics teachers Rivers State (x_2 = 2.08, SD = 0.91). The independent samples t-test showed no significant difference in the mean proficiency scores [t(325) = 1.23, p = .219] and the influence [t(325) = 1.25, p = 0.21 > 0.05] of classroom-integration scores of digital learning resources between Physics teachers in Ogun State. Comparatively, Physics teachers in Ogun State demonstrated slightly higher proficiency and influence on effective classroom integration for designing and developing digital learning resources (DLRs) for Physics Teaching. The study recommended that organization of regular professional development programs to enhance Physics teachers' pedagogical and technical skills in designing subject-specific digital learning resources, Government and school administrators should ensure the provision of digital tools, software, and reliable internet to support Physics teachers in effectively designing and integrating digital learning resources among others.

Keywords: Digital, Digital learning Resource, Integration, Proficiency. Physics

Introduction

The study of Physics at the secondary school level is essential for building and fostering scientific literacy, which empowers learners to understand the natural world, analyze scientific phenomena, and make informed decisions in their everyday lives. Fundamental Physics concepts such as energy, motion and electricity serves as the foundation for everyday technologies and societal challenges, ranging from renewable energy solutions to communication systems. By mastering these fundamental Physics concepts, students cultivate the capacity to critically assess scientific information and utilize evidence-based reasoning, which is vital for responsible citizenship in a technology-oriented society (Aderonmu & Adolphus, 2023). Physics acts as a gateway to STEM careers, offering the essential baseline knowledge and skills necessary for engineering, medicine, information technology, and emerging domains such as artificial intelligence and space science. The study of Physics in secondary schools provides students with essential skills in problem-solving, analysis, and mathematical reasoning, which are crucial for achieving success in both higher education and various professional careers. Consequently, nations seeking to enhance their STEM workforce place a high priority on Physics education to maintain a consistent flow of talent necessary for national progress.

Physics plays a crucial role in the progress of technology and innovation. This discipline drives advancements in energy, transportation, healthcare, and communication by encouraging students to think creatively and participate in scientific exploration. By engaging with practical experiments, simulations, and digital educational tools, students acquire hands-on experience that nurtures curiosity and fosters innovation. Strengthening Physics education at the secondary level not only equips individuals for personal development and professional achievement but also fosters societal advancement by cultivating a generation adept at addressing intricate scientific and technological challenges (Nkweke, 2020).

Globally, there has been a significant focus on integrating Information and Communication Technologies (ICT) into education to enhance teaching,

learning, and student academic outcomes. Global organizations such as UNESCO and the OECD have repeatedly emphasized the importance of ICT in fostering inclusive, equitable, and high-quality education (Zhao-Ma, et al. 2024; UNESCO, 2023 & OECD, 2020). The Sustainable Development Goal 4 (SDG 4) further highlights the necessity of utilizing technology to improve access to education, encourage innovative teaching practices, and equip learners with digital competencies for the 21st century. As a result, numerous countries are reforming their educational frameworks by integrating digital literacy into their curricula, training educators in the use of technology, and investing in digital infrastructure to develop more engaging and interactive learning environments.

At the national level, nations such as Nigeria have acknowledged the essential role of integrating ICT in enhancing science and technology education. The Nigerian National Policy on Information and Communication Technology in Education highlights the importance of utilizing digital tools and resources to elevate the quality of instruction, especially in STEM disciplines like Physics. Programs such as the Nigerian Education Management Information System (NEMIS) and ICT-in-Education policies are established to offer both hardware and software resources, along with professional development opportunities for teachers (Nwobodo & Udoka, 2025; & FME, 2019). These initiatives aim not only to modernize teaching practices but also to close the digital gap and ensure that students develop the technological skills required for national progress and engagement in a global knowledge economy (Aderonmu and Oni, 2025).

Digital Learning Resources (DLRs) refer to technology-driven materials, tools, and platforms that are designed to facilitate teaching and learning activities (Serafin, 2025). These resources encompass any type of digital content that improves learning experiences by rendering them more interactive, accessible, and engaging. DLRs can be utilized in traditional classrooms, online educational settings, or hybrid learning environments. Digital Learning Resources (DLRs) are increasingly recognized as essential tools for enhancing the teaching and learning of Physics at the secondary school level. Physics often deals with abstract concepts such as motion, electricity, waves, and energy, which students may find difficult to grasp through traditional chalk-and-talk methods

DLRs such as simulations, interactive videos, virtual laboratories, and animations make Physics concepts more engaging and visually accessible. By providing dynamic illustrations and hands-on virtual experiments, DLRs help learners to visualize and manipulate abstract phenomena, thereby fostering deeper conceptual understanding and reducing misconceptions (Obafemi and Aderonmu, 2022). Effective integration of digital learning resources (DLRs) plays a crucial role in enhancing students' conceptual understanding of Physics. Many Physics concepts, such as electricity, waves, or atomic structures, are abstract and difficult for learners to visualize through traditional teaching methods alone. When Physics teachers skillfully incorporate DLRs like simulations, animations, and virtual laboratories, students are able to interact with representations of these concepts, observe cause-and-effect relationships, and test variables in real time. This not only deepens their comprehension but also reduces common misconceptions, making Physics more accessible and meaningful. By linking abstract theories to dynamic visualizations, digital resources transform passive learning into active exploration.

Beyond improving conceptual grasp, the integration of DLRs also fosters student engagement and problem-solving skills (Alazemi, 2022). Interactive platforms, such as physics-based games or inquiry-driven simulations, encourage learners to actively participate in the learning process rather than simply receive information. This engagement increases motivation and curiosity, while structured problem-solving tasks within digital environments help students' practice critical thinking and apply Physics principles to real-world situations. As a result, DLRs not only make Physics classes more interesting but also prepare students with transferable analytical skills essential for STEM-related careers. Therefore, effective integration of digital resources directly enhances the quality and outcomes of Physics learning. In addition to enhancing the understanding of Physics, DLRs connect classroom learning with real-world applications (Alazemi, 2022). For instance, digital tools can illustrate how mechanical principles are utilized in engineering, or how energy transformation concepts are linked to renewable technologies. This connection inspires students by demonstrating the practical relevance of Physics in addressing everyday challenges. Moreover, the implementation of DLRs fosters active learning, collaboration, and critical thinking, which are essential components of 21st-century education. Consequently, the effective incorporation of DLRs not only enriches Physics instruction but also equips

students for careers in STEM fields and engagement in a technology-oriented society.

Teachers' proficiency in designing and developing digital resources can be understood in terms of their knowledge, skills, and confidence**.** Knowledge involves an understanding of both subject content and digital pedagogical strategies necessary for creating effective learning resources. Skills refer to the practical ability to use digital tools, such as multimedia software, simulations, or learning management systems, to design interactive and subject-specific materials that enhance students' learning experiences. Confidence, on the other hand, reflects teachers' self-efficacy and willingness to experiment with technology, adapt resources to different contexts, and integrate them effectively into classroom instruction. When teachers possess strong knowledge, refined skills, and high confidence, they are better positioned to create engaging, curriculum-aligned digital resources that foster meaningful learning. Several authors have separately highlighted that proficiency is understood as a multidimensional construct encompassing four interrelated components of DLRs that are essential for effective classroom integration, vis;

1. Knowledge of Digital Resource Design – Teachers' understanding of subject content, pedagogy, and instructional design principles needed for creating effective Physics DLRs (Agyei et al., 2024).
2. Technical Skills in Resource Development – The practical ability to use digital tools (software, simulations, multimedia applications) to produce Physics specific instructional resources (Kola & Azeez, 2023).
3. Applications and Creativity in Design – The capacity to adapt, contextualize, and innovate with digital resources to align with learners' needs and real world Physics applications (Sobrino Morrás et al., 2025).
4. Confidence and Proficiency – Teachers' self-efficacy and comfort in independently creating, sharing, and refining Physics DLRs for instructional purposes (Adebanjo & Orifah, 2023).

The proficiency of teachers is crucial for the effective utilization of digital learning resources, as mere availability does not ensure their influence on student learning. Numerous schools may possess computers, projectors, and internet connectivity; however, in the absence of skilled teachers who are capable of designing and adapting digital resources, such tools frequently go underused. Proficiency enables teachers to align digital content with

curriculum goals, choose suitable tools for particular topics in Physics, and tailor resources to meet the learning requirements of their students. Therefore, teacher competence serves as a vital link between access to ICT and its significant application in the classroom.

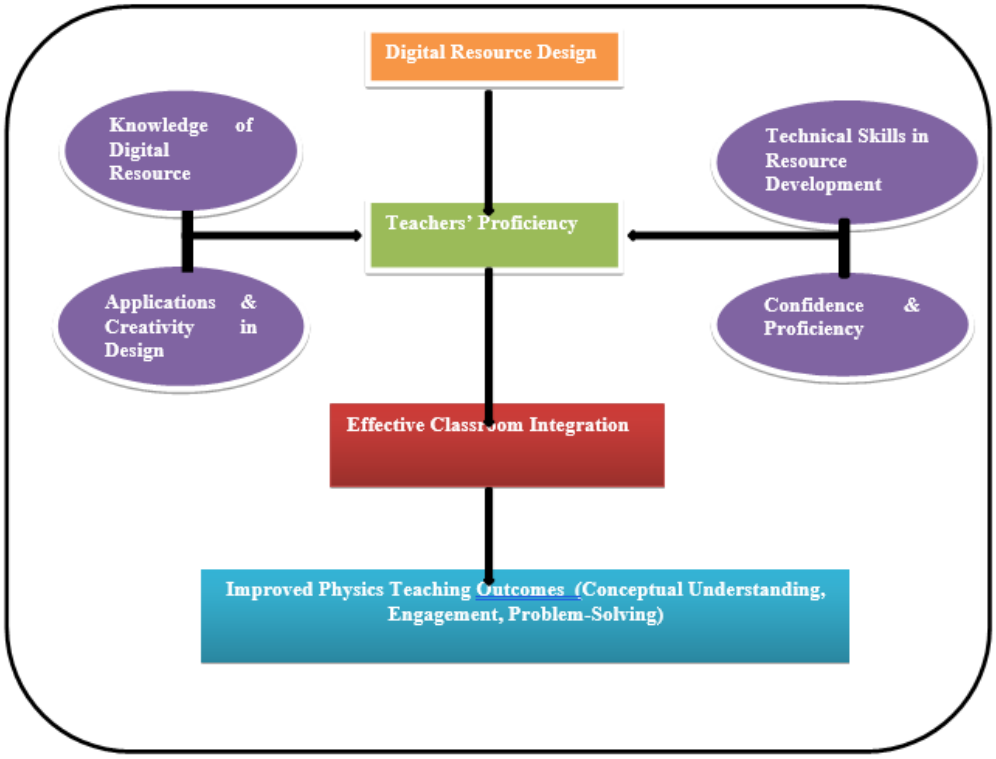

Figure 1: Components of Digital Learning Resources (DLRs)

The study of Physics at the secondary school level is mostly perceived as a subject embodied with abstract concepts, therefore, teacher proficiency is particularly important in creating digital resources that simplify complexity. For example, animations and simulations can make invisible phenomena like concepts wave motion, atomic structures or quantization of energy more concrete and easily understood by the student, but only a skilled teacher can adapt these resources to emphasize key learning outcomes. Without adequate proficiency, digital tools may be misused as mere presentation aids rather than interactive platforms that promote inquiry, experimentation, and problem solving. Therefore, teacher expertise ensures that digital resources are not only technically correct but also pedagogically effective (Aderonmu & Agbesor, 2025). Proficiency boosts teacher confidence and innovation in integrating technology into Physics instruction. Teachers equipped with the knowledge and skills to design and adapt digital learning resources are more inclined to

explore interactive methods, stimulate student involvement, and facilitate collaborative learning. This assurance enables them to move beyond traditional, teacher-focused techniques and adopt dynamic, student-oriented strategies that nurture critical thinking. Consequently, teacher expertise encompasses not only technical skills but also the ability to transform digital resources into significant learning experiences that improve outcomes in the study of Physics.

Several recent studies have shown that while many Physics teachers are aware of the potential of ICT tools, their ability to effectively design and create specific Physics content using digital learning resources remains limited. For instance, Hamoud and Nzilano (2024) found that secondary school science teachers in Tanzania demonstrated high awareness of ICT resources but lacked the technical and pedagogical skills to design customized digital learning materials for classroom use. Similarly, Jack and Ayuba (2022) revealed that although Physics teachers in Nigerian secondary schools reported positive perceptions of ICT integration, their use of digital resources was restricted to basic functions such as PowerPoint presentations, with limited efforts to create or adapt interactive digital simulations and models.

Numerous studies indicate that although many Physics teachers recognize the potential of ICT tools, their capacity to effectively design and develop specific Physics content utilizing digital learning resources is still constrained. Hamoud and Nzilano (2024) discovered that secondary school science teachers in Tanzania exhibited a strong awareness of ICT resources but lacked the necessary technical and pedagogical skills to create customized digital learning materials for classroom application. In a similar vein, Jack and Ayuba (2022) found that while Physics teachers in Nigerian secondary schools expressed favorable views on ICT integration, their engagement with digital resources was limited to basic functionalities such as PowerPoint presentations, with minimal attempts to create or modify interactive digital simulations and models.

These findings highlight a disparity between awareness and actual design capabilities. The literature indicates that this gap is primarily attributed to insufficient professional development and a lack of practical training in digital resource design. According to Gür et al. (2024), pre-service teachers typically receive a general introduction to ICT tools but do not have structured opportunities to practice developing Physics digital content, such as

simulations or virtual laboratory activities. This deficiency undermines their confidence and creativity in utilizing technology within real classroom settings. As a result, even with increasing investments in ICT infrastructure, the lack of robust design skills among Physics teachers diminishes the educational value of digital resources, thereby restricting their ability to enhance teaching and learning in secondary education.

Statement of Problem

Despite the increasing investment in Information and Communication Technology (ICT) within the educational sector, a notable gap persists between the availability of digital tools in schools and their practical application in Physics classrooms. In order to attain global competitiveness, secondary schools across Nigeria, particularly in Ogun and Rivers State, are becoming better equipped with ICT resources such as computers, projectors, internet connectivity, and educational software. Nevertheless, research has repeatedly demonstrated that Physics teachers tend to underutilize these resources, frequently limiting their use to fundamental tasks such as preparing lesson notes or presenting PowerPoint slides. This limited application curtails the potential of ICT to revolutionize Physics instruction into an interactive, inquiry-driven process that fosters deeper conceptual understanding, enhances student engagement, and cultivates problem-solving abilities. The current emphasis on ICT integration tends to prioritize access and basic usage over teachers' expertise in crafting and developing subject specific digital learning resources. Although there is a growing awareness and utilization of digital tools among Physics teachers, evidence suggests that many lack the necessary knowledge, skills, and confidence to produce tailored digital content, such as simulations, animations, or virtual laboratory experiences that align with curriculum goals. In the absence of sufficient proficiency in the design of digital learning resources, the mere presence of ICT tools does not lead to effective classroom integration or improved student performance. This disparity underscores the pressing need to evaluate the actual proficiency of Physics teachers in designing and developing digital learning resources for successful integration into Physics education in secondary schools located in both Ogun and Rivers State.

Aim and Objectives of the Study

The aim of the study is to Assess Physics Teachers' Proficiency in Designing and Developing Digital Learning Resources for Effective Classroom Integration. Specifically, the objectives of the study are to;

1. investigate the proficiency level of Physics teachers in designing and developing digital learning resources for classroom instruction.
2. examine how Physics teachers' proficiency in digital resource design influences the effective integration of these resources into classroom teaching.

Research Questions

The following research questions were raised for the study.

1. What is the proficiency level of Physics teachers in designing and developing digital learning resources for classroom instruction?
2. How does Physics teachers' proficiency in digital resource design influence the effective integration of these resources into classroom teaching?

Hypotheses

The following hypotheses were tested at 0.05 level of significance.

Ho_1: There is no significant difference in the mean proficiency scores for designing and developing digital learning resources between Physics teachers in Ogun State and those in Rivers State.

Ho_2: There is no significant difference in the mean on the influence of classroom-integration scores of digital learning resources between Physics teachers in Ogun State and those in Rivers State.

Methodology

The cross-sectional descriptive research design was adopted for the study. Wang and Cheng (2020) asserted that cross-sectional studies are observational studies that examine data from a population at a specific point in time. These studies are frequently employed to assess the prevalence of outcomes within the population, identify determinants affecting the population, and characterize various features of that population. The study was carried out in Ogun State and Rivers State in Nigeria. These states are ranked among the top ten digital

literacy and tech savy states in Nigeria (Williams, 2024). Ogun state is one of the states located in the South-West of Nigeria with approximate central coordinates of (Latitude: 7.0000° N and Longitude: 3.5833° E) with borders of Oyo State in the North, Lagos State and Atlantic Ocean in the south, Ondo State in the east and Republic of Benin in the West (Which is an International border). The state has a wide spread of both public and private secondary schools with literacy rates are above the national average, reflecting a strong emphasis on education. On the other hand, Rivers State is located in the South-South geographical location (Within the Niger-Delta) of Nigeria an approximate central coordinates of (Latitude: 4.7500° N Longitude: 6.8333° E). Rivers State has invested significantly in expanding access to secondary education with several school spread both in the upland and riverine areas of the state. The state is bordered by Imo State and Abia State to the North, Akwa Ibom State to the Eastg, Bayelsa State to the West and The Atlantic Ocean (coastal boundary) to the South.

The population of the study consisted of all secondary school Physics teachers in both Ogun and Rivers State, Nigeria. Using a stratified sampling technique, 327 Physics teachers were selected from public and private schools for both states.

Table 1: Sampling Table for Ogun and Rivers State Physics Teachers

State	Frequency	Percentage
Ogun	149	45.5%
Rivers	178	54.5%

Source: Researchers' fieldwork, 2025

The distribution of Physics teachers across the two states shows that out of the total sample of 327 teachers, 149 (45.5%) are from Ogun State, while 178 (54.5%) are from Rivers State. This indicates that Rivers State has a slightly higher representation of Physics teachers in the sample compared to Ogun State.

The instrument for data collection was the researchers' designed questionnaire titled "Physics Teachers' Proficiency in Designing and Developing Digital Learning Resources" (PTP-3DLRs). The instrument comprised of three sections; A, B and C. Section was designed to obtained demographic data of type of school, State of present teaching school, and gender. Section B consisted of 20 item statements that were further categorized into 4 sub-sections of Knowledge of Digital Resource Design, Technical Skills in

Resource Development, Application and Creativity in Design and Confidence and Proficiency. This section was designed to elicit information from the participants of the study on the proficiency level of Physics teachers in designing and developing digital learning resources for classroom instruction. The measuring scale adopted was the 5 point modified Likert scale of Never = 1 point, Beginner = 2 points, Developing = 3 points, Proficient = 4 points and Advanced = 5 points. The aggregate mean value for decision making further categorized as shown in Table 1 below.

Table 2: Aggregate Mean value and of categorization of Physics teachers level of proficiency

Aggregate Mean value	Categorization (Proficiency level)
0.00 – 1.60	Beginner
1.61 – 3.30	Developing
3.31 – 5.00	Advanced

Section C was developed to elicit information on how Physics teachers' proficiency in digital resource design influences the effective integration of these resources into classroom teaching. 15 item statements were designed using the four-point Likert scale of Strongly Agreed = 4 point, agreed = 3 points, disagree = 2 points and Strongly Disagree = 1 point. Questionnaire on Physics Teachers' Proficiency in Designing and Developing Digital Learning Resources was validated by experts in Physics Education, Educational technology and Measurement and Evaluation in ensuring that the instrument measures what it is intended to measure. The instrument was further subjected to a pilot study on 40 teachers [20 in each state] to ascertain the reliability of the instrument. The test-retest method was used to obtain the data and was further analyzed using the Cronbach Alfa reliability statistics. A coefficient value of r = 0.86 was obtained making the instrument 86% reliable for the study. The data for the study was analyzed using the descriptive statistics of frequency count, mean, standard deviation while the inferential statistics of t-test was employed for the hypotheses.

Results

Research Question 1: What is the proficiency level of Physics teachers in designing and developing digital learning resources for classroom instruction?

Table 3: Showing Physics teachers' response proficiency level of Physics teachers in designing and developing digital learning resources for classroom instruction

S/N	Item Statements	Mean (x1)	SD	Mean (x2)	SD
	Knowledge of Digital Resource Design				

1	I can identify Physics concepts best taught with DLRs.	2.12	0.82	2.15	0.91
2	I understand the principles of designing interactive Physics simulations.	1.52	0.93	1.21	0.97
3	I can align digital resource design with the Physics curriculum and learning objectives.	2.61	0.87	2.43	0.91
4	I know how to incorporate assessment tools into Physics digital resources.	1.58	0.95	1.33	0.80
	Technical Skills in Resource Development				
5	I can use presentation software to design Physics learning materials.	3.21	0.73	2.98	0.81
6	I can develop digital concept maps and diagrams to represent Physics ideas.	2.27	1.02	2.19	0.99
7	I can create Physics instructional videos or screencasts for classroom use.	2.71	0.84	2.55	0.93
8	I can design Physics quizzes and tests using digital platforms	2.02	1.10	2.11	1.05
9	I can use subject-specific software (e.g., PhET simulations) to design learning activities.	1.89	0.76	1.77	0.94
	Application and Creativity in Design				
10	I can integrate animations and graphics into Physics learning resources.	1.65	0.90	1.52	0.99
11	I can adapt existing digital learning resources to suit the needs of my students.	1.99	1.04	2.10	0.97
12	I can create real-life Physics problem-solving activities using digital platforms.	2.06	0.82	2.02	0.81
13	I can design interactive Physics laboratory experiments in a digital format.	1.48	0.93	1.61	0.99
14	I can combine multiple media (text, audio, video, graphics) to create Physics resources.	2.32	0.96	2.14	1.01
15	I can develop Physics learning resources that encourage student-centered inquiry.	2.71	0.77	2.82	0.84
	Integration and Teaching Effectiveness				
16	I feel confident in designing Physics resources that enhance students' conceptual understanding.	2.55	0.92	2.63	0.98
17	I am able to troubleshoot challenges when creating digital Physics resources.	1.98	1.11	1.76	0.85
18	I am comfortable sharing self-designed Physics resources with colleagues or students.	2.81	0.81	2.75	0.95
19	I can independently design Physics digital resources without external assistance.	2.05	0.87	2.09	0.91
20	I am able to improve the quality of my designed Physics digital learning resources.	1.90	0.92	1.82	0.97
Aggregate mean value		2.17	0.90	2.09	0.92

Source: Researchers' fieldwork, 2025. [x_1 = PTOGS], [x_2 = PTRVS]

The Table 3 indicated that the aggregate mean values showed that Physics teachers in Ogun State (x_1 = 2.17, SD = 0.90) and Rivers State (x_2 = 2.09, SD = 0.92) both fall within the "Developing" proficiency category (1.61 – 3.30). This indicates that, while teachers in both states possess some degree of knowledge and skills in designing and developing digital learning resources (DLRs), their influence on effective classroom integration is not yet at an advanced level. Comparatively, Physics teachers in Ogun State demonstrated slightly higher proficiency (mean = 2.17) than their counterparts in Rivers State (mean = 2.09). However, the difference is marginal, and both states remain within the same category of proficiency.

Research Question 2: How does Physics teachers' proficiency in digital learning resource design influence the effective integration of these resources into classroom teaching?

Table 4: Showing Physics teachers' proficiency in digital learning resource design influence the effective integration of these resources into classroom teaching

s/n	Item Statement	Mean (x_1)	Stdv	Mean (x_2)	Stdv
1	My proficiency in digital resource design helps me teach Physics concepts more effectively.	1.81	0.91	1.18	0.89
2	Students show improved conceptual understanding when I use self-designed digital resources.	2.01	0.84	1.87	0.88
3	My digital resources increase students' participation and interest in Physics lessons.	1.96	0.93	2.00	0.95
4	The use of my digital resources improves students' problem-solving and critical thinking skills.	2.78	0.87	2.82	0.94
5	My confidence in designing digital resources contributes to effective classroom integration.	2.03	0.91	1.95	0.92
6	I can effectively integrate self-designed digital resources into different stages of Physics lessons.	1.84	0.88	1.99	0.91
7	The use of digital resources makes abstract Physics concepts more concrete and understandable.	2.85	0.95	2.57	0.93
8	Digital resources I design help to bridge the gap between theory and practical applications in Physics.	2.08	0.90	1.94	0.87
9	I am confident that my digital resources contribute to better student achievement in Physics.	2.24	0.89	2.19	0.91
10	The digital resources I design support students in independent learning outside the classroom.	2.12	0.87	2.01	0.85
11	I use my digital resources to differentiate instruction and cater to diverse learning styles in Physics.	2.27	0.92	2.11	0.94
12	Integrating my digital resources into teaching enhances classroom interaction and discussion.	2.38	0.88	2.25	0.91
13	My digital resource integration allows me to cover Physics curriculum content more effectively.	2.32	0.93	2.19	0.95
14	I regularly evaluate the effectiveness of my digital resources based on student feedback and	2.10	0.91	1.98	0.89

	performance.				
15	The integration of my digital resources into Physics teaching has reduced my reliance on traditional teaching methods.	2.22	0.87	2.09	0.92
	Aggregate mean value	**2.20**	**0.90**	**2.08**	**0.91**

Source: Researchers' fieldwork, 2025. [x_1 = PTOGS], [x_2 = PTRVS]

The analysis on Table 4 showed the aggregate mean scores for Physics teachers in Ogun State (x_1 = 2.20, SD = 0.90) and Physics teachers Rivers State (x_2 = 2.08, SD = 0.91). This indicates that, while teachers in both states possess some degree of knowledge and skills in designing and developing digital learning resources (DLRs), their influence on effective classroom integration is not yet at an advanced level, but they demonstrate foundational competencies that can be built upon.

Hypotheses

Ho_1: There is no significant difference in the mean proficiency scores for designing and developing digital learning resources between Physics teachers in Ogun State and those in Rivers State.

Table 5: Independent sample t-test analysis of Physics teachers on proficiency scores for designing and developing digital learning resources

Group	N	Mean	Std. Dev.	df	T	p-value	Decision
PTOGS	149	2.17	0.90				
PTRVS	178	2.09	0.92	325	1.23	0.219	Not Sig.

Source: Researchers' fieldwork, 2025.

The independent samples t-test showed no significant difference in the mean proficiency scores for designing and developing digital learning resources between Physics teachers in Ogun State (M = 2.17, SD = 0.90) and those in Rivers State (M = 2.09, SD = 0.92), t(325) = 1.23, p = .219. Therefore, the null hypothesis (Ho_1) is retained, meaning that both groups of teachers have comparable proficiency levels.

Ho_2: There is no significant difference in the mean on the influence of classroom-integration scores of digital learning resources between Physics teachers in Ogun State and those in Rivers State.

Table 6: Independent sample t-test analysis of Physics teachers on the influence of classroom-integration scores of digital learning resources between Physics teachers in Ogun State.

Group	N	Mean	SD	df	T	p-value	Decision

Group	N	Mean	SD	df	T	p-value	Decision
PTOGS	149	2.20	0.90				
PTRVS	178	2.08	0.91	325	1.25	0.21	Not Sig.

Source: Researchers' fieldwork, 2025.

The independent samples t-test shows no significant difference in the mean on the influence of classroom-integration scores of digital learning resources between Physics teachers in Ogun State (M = 2.20, SD = 0.90) and Rivers State (M = 2.08, SD = 0.91), $t(325) = 1.25$, $p = 0.21 > 0.05$. This indicates that both groups of teachers demonstrate a similar level of influence of classroom integration of digital learning resources. Therefore, the null hypothesis (Ho_2) is retained.

Discussion

The findings of this study revealed that Physics teachers in both Ogun State (M = 2.17, SD = 0.90) and Rivers State (M = 2.09, SD = 0.92) demonstrated a "Developing" proficiency level in designing and developing digital learning resources (DLRs). This suggests that while teachers possess foundational knowledge and skills in the use of digital tools, their competence remains below the advanced level required for transformative teaching and learning practices. The results are consistent with earlier studies which highlighted that many Nigerian teachers, although aware of digital technologies, still face challenges in effectively designing resources that align with curriculum needs (Dogo et al., 2021). A closer comparison indicates that teachers in Ogun State showed slightly higher proficiency than their counterparts in Rivers State. Although the difference is marginal, it may reflect subtle variations in exposure to digital tools, training opportunities, or policy implementation in the two states. White and Downey (2025) emphasized that access to appropriate hardware and software significantly influences teachers' ability to create meaningful digital resources, which may explain why proficiency levels vary across different contexts. This aligns with the current finding that both groups of teachers are still developing, implying systemic gaps in professional development.

The "Developing" category of proficiency highlights that teachers are not entirely novice but are still building competence. This reflects the transitional phase of digital integration in Nigeria's education sector, where teachers recognize the potential of digital resources but often lack the advanced skills to design high-quality, interactive, and student-centered tools (Okonkwo,

2022). The implication is that without structured capacity-building programs, teachers may remain limited in leveraging digital resources for effective instruction, especially in complex subjects like Physics that require visualization and simulation. Another possible explanation for the developing proficiency is the lack of continuous professional training and inadequate institutional support. Studies have shown that even when teachers are familiar with digital technologies, effective integration depends on regular training and supportive learning environments (Afolabi & Oyeniran, 2020). In this case, the findings suggest that while Physics teachers are experimenting with digital resource design, their progress may be hindered by insufficient mentorship, limited access to subject-specific software, and weak infrastructural support in schools. The findings emphasize the urgent need for targeted training programs, policy interventions, and resource provision to help teachers transition from a developing to an advanced proficiency level. As highlighted by Olibie and Eze (2021), professional development tailored to subject-specific needs enhances teachers' capacity to integrate ICT into pedagogy more effectively. Thus, improving teachers' proficiency in digital resource design is not only necessary for better Physics instruction but also crucial for advancing Nigeria's broader educational goals in the digital era. Also by adopting a holistic approach, teachers across states can be better equipped to integrate digital resources effectively into Physics classrooms, thereby improving instructional quality and student learning outcomes. The result of the independent samples t-test revealed that there was no significant difference in the mean proficiency scores for designing and developing digital learning resources between Physics teachers in Ogun State ($M = 2.17$, $SD = 0.90$) and those in Rivers State ($M = 2.09$, $SD = 0.92$), $t(325) = 1.23$, $p = .219$. This finding suggests that both groups of teachers share similar levels of proficiency in digital learning resource (DLR) design, indicating that state location may not be a strong determinant of teachers' competence in this area.

The findings of the study also indicated that aggregate mean scores revealed that Physics teachers in Ogun State ($M = 2.20$, $SD = 0.90$) and Rivers State ($M = 2.08$, $SD = 0.91$) demonstrated moderate levels of proficiency in designing and integrating digital learning resources (DLRs) into classroom teaching. This finding suggests that teachers in both states are at a developing stage, showing some degree of competence but not yet reaching advanced proficiency. Such results align with previous studies that observed teachers in Nigeria and other developing contexts often possess basic ICT literacy but

lack the advanced skills required for effective integration into subject teaching (Okonkwo, 2022; Yusuf & Alabi, 2021).

The findings also highlight that teachers' proficiency directly influences the quality of integration of DLRs in Physics classrooms. With moderate proficiency, teachers may succeed in designing simple presentations, quizzes, or simulations but struggle with advanced creative tasks such as interactive laboratory experiments or adaptive learning systems. This limited capacity means that while DLRs are used, their transformative impact on teaching and learning outcomes may not be fully realized. As Afolabi and Oyeniran (2020) argue, ICT integration is most effective when teachers move beyond basic tool usage to innovative pedagogical applications. Moreover, the results show only a marginal difference between Ogun (M = 2.20) and Rivers (M = 2.08), implying that geographic location is not a strong predictor of proficiency levels. Instead, the finding underscores a systemic challenge across Nigerian secondary schools where teachers receive limited training and support for digital pedagogies (Olibie & Eze, 2021). Another important implication of this finding is the relationship between teacher confidence and classroom effectiveness. Teachers with moderate proficiency may experience hesitation or lack the confidence to fully integrate DLRs into lessons, which can limit classroom engagement and innovation. Research by Amusa (2024) supports this, showing that even when digital tools are available, teachers often underutilize them due to limited proficiency and confidence. Thus, addressing teacher preparedness is essential if digital learning is to positively impact Physics education. The results also emphasize the need for targeted professional development to move teachers from developing to advanced proficiency. Training workshops, peer collaboration, and institutional support structures are necessary to improve both the technical skills and pedagogical applications of DLRs in Physics. As noted by Oladejo and Oyeniran (2023), equipping teachers with advanced ICT competencies can foster deeper conceptual understanding among students, improve problem-solving abilities, and enhance overall classroom interaction. Therefore, investing in teacher capacity building remains critical to maximizing the potential of digital learning resources in Physics education. The findings of the independent samples t-test revealed no significant difference in the mean classroom-integration scores of digital learning resources between Physics teachers in Ogun State (M = 2.20, SD = 0.90) and Rivers State (M = 2.08, SD = 0.91), $t(325) = 1.25$, $p = 0.21 > 0.05$. This result indicates that both groups of teachers demonstrate similar levels of proficiency when it comes to integrating

digital resources into classroom instruction. The lack of significant difference suggests that the challenges and opportunities associated with digital resource integration are systemic rather than state-specific, reflecting broader patterns in teacher preparedness and ICT adoption across Nigerian secondary schools.

Conclusion

The comparative assessment of Physics teachers' proficiency in designing and developing Digital Learning Resources (DLRs) for effective classroom integration revealed that teachers in Ogun and Rivers States remain at a "developing" level of proficiency with overall mean scores reflecting moderate competence in areas such as knowledge, technical skills, creativity, and confidence.. While this indicates that they possess some knowledge and skills in digital resource design, they have not yet attained the advanced level required for innovative and impactful classroom practices. The study highlights that although digital tools are increasingly present in schools, teachers' capacity to effectively design, adapt, and utilize them in Physics instruction is still evolving. The absence of a statistically significant difference between the two states suggests that the challenges facing teachers are systemic rather than state-specific. These points to broader issues such as inadequate training opportunities, limited access to subject-specific digital tools, and a lack of ongoing professional support. Even though Ogun State teachers showed slightly higher mean scores compared to their counterparts in Rivers State, both groups require structured interventions to strengthen their digital pedagogical practices. Improving Physics teachers' proficiency in digital resource design is critical for advancing science education and preparing students for the demands of the 21st century.

Recommendation

The following recommendations were stipulated for the study;

1. Regular and targeted professional development programs should be organized to strengthen Physics teachers' knowledge, technical skills, creativity, and confidence in digital resource design. These training programs should emphasize both the pedagogical and technical aspects of developing subject-specific DLRs.
2. Educational stakeholders, including government agencies and school administrators, should ensure equitable access to digital tools, software, and reliable internet connectivity in both public and private

schools. This will provide Physics teachers with the necessary resources to effectively design, develop, and integrate DLRs into classroom instruction.

3. Platforms for peer collaboration and mentorship should be established, allowing teachers to share experiences, co-develop digital resources, and evaluate their effectiveness. Such initiatives will foster innovation, enhance teachers' confidence, and promote the effective classroom integration of DLRs across both Ogun and Rivers States.

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