

DIGITAL INSTRUCTIONAL CONTENT DEVELOPMENT SKILLS AS PREDICTOR OF SCIENCE TEACHERS' INSTRUCTIONAL PRODUCTIVITY IN SECONDARY SCHOOLS IN OGUN STATE, NIGERIA

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Abstract

The increasing integration of digital technologies in education and the necessity for science teachers' to effectively develop digital instructional content to enhance their instructional productivity is critical in the present digital age. This study investigated digital instructional content development skills as predictors of science teachers' instructional productivity in secondary schools in Ogun State, Nigeria. Two research questions and two hypotheses were raised and posited to guide the study. A correlational survey research design was adopted. The population comprised all science teachers in public secondary schools, from which a sample of 109 teachers was selected using a multistage sampling technique. Data were collected using a researcher developed instrument titled "Digital Instructional Content Development Skills and Instructional Productivity Questionnaire" (DICDSIPQ) with reliability coefficients of .76. Data were analyzed using Pearson Product Moment Correlation and multiple regression analysis at the .05 level of significance. The results revealed significant positive correlations between the components of digital instructional content development skills and instructional productivity, with Technical and Pedagogical Integration Skills showing the highest correlation ($r = .741$). Multiple regression analysis indicated that the predictor variables jointly accounted for 66% of the variance in instructional productivity ($R = .81$, $R^2 = .66$, Adjusted $R^2 = .65$), [$F(5, 103) = 79.21$, $p < .001$]. Technical and Pedagogical Integration Skills ($\beta = .341$, $p < .001$) emerged as the strongest predictor. The implication of the findings is that strengthening science teachers' digital instructional content development skills can significantly enhance their instructional productivity and overall effectiveness in secondary school classrooms. The study concluded that digital instructional content development skills significantly predict science teachers' instructional productivity and recommended targeted professional development interventions.

Keywords: Digital Instruction, Science Teaching, Instructional Productivity, Instructional Content Skills, Secondary School.

Introduction

Educational landscape globally has experienced a deep transformation in recent decades, primarily driven by rapid advancements in digital technologies. This transformation has significantly altered teaching and learning processes across all levels of education especially in the area of science teaching due to its reliance on visualization, experimentation, data interpretation and the representation of abstract concepts. The worldwide shift towards the digitalization of teaching and learning has led to the integration of digital tools, platforms and resources into classroom instruction, with the goal of enhancing instructional effectiveness, learner engagement and educational outcomes (Brugliera, 2024). As a result, the traditional teacher-centered approach

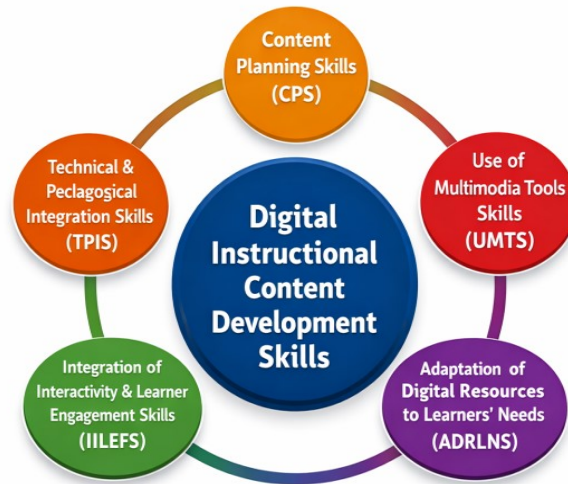
is increasingly being supplanted by digitally supported, learner-centered pedagogies that emphasize interaction, creativity, and problem-solving.

Aderonmu and Edache (2025) noted that digital instructional content can be defined as a systematically designed teaching and learning resources developed using digital technologies to communicate subject matter concepts, facilitate understanding, and promote active learner participation within formal educational settings. In science teaching and learning, digital instructional content, which involves simulations, animations, virtual laboratories, videos and interactive presentations, has become vital for promoting a meaningful understanding of complex scientific concepts. The advent of digitalization allows science teachers to surpass the limitations of physical resources and time constraints, offering learners enriched, multimodal learning experiences that aid in conceptual clarity and inquiry-based learning (Wahidin, et al., 2025). Educational policies worldwide are increasingly emphasizing the necessity for teachers to cultivate and apply digital instructional content as a core professional competency. Within this evolving educational paradigm, instructional productivity has emerged as a critical indicator of teaching effectiveness, particularly in secondary schools.

Instructional productivity refers to the degree to which teachers efficiently utilize available instructional resources, strategies and time to achieve intended learning outcomes (Agbo, 2025). In science classrooms, instructional productivity is reflected in effective lesson delivery, efficient classroom management, optimal use of instructional time, active student participation, adequate curriculum coverage, and the attainment of prescribed learning objectives. Given the central role of science education in national development, technological advancement, and workforce preparedness, improving science teachers' instructional productivity remains a key concern for education stakeholders in Nigeria.

In science classrooms, instructional productivity is demonstrated through effective lesson delivery, efficient management of the classroom, optimal use of instructional time, active participation from students' thorough curriculum coverage and the achievement of set learning objectives. Considering the crucial role of science teaching in national development, technological innovation and workforce readiness, enhancing the instructional productivity of science teachers is a primary concern for educational stakeholders in Nigeria. Despite the Nigerian government's continuous policy efforts to enhance science teaching via curriculum reforms and teacher professional development, evidence from external examinations like WAEC and NECO still shows inconsistent and frequently unsatisfactory student performance in science subjects (Alanamu, 2025). Scholars have pointed to several interconnected factors contributing to this trend, such as inadequate instructional resources, limited teacher capacity and the ongoing use of traditional teaching methods that do not effectively engage learners (Assey & Babyegeya, 2022). These challenges emphasize the importance of exploring innovative instructional methods that can improve science teachers' productivity and learning outcomes.

One of the most notable advancements in modern education is the increasing acknowledgment of teachers' digital skills as a key factor in instructional effectiveness. Digital competence goes beyond mere computer literacy; it encompasses the ability to design, develop, adapt, and integrate digital instructional materials in a manner that aligns with curriculum goals and meets learners' needs (Asagar, 2025). In contemporary teaching practices, educators are expected not only to utilize pre-existing digital resources but also to actively create contextually appropriate digital content that mirrors local content, learner characteristics and curriculum requirements.



Source: Authors' (2026).

The skills involved in developing digital instructional content include a variety of competencies and components which consist of:

- (i) *Content Planning Skills (CPS)*: Content planning skills involve the systematic organization of learning objectives, instructional materials and learning sequences to ensure coherence and alignment with expected learning outcomes. These skills require teachers to analyze learners' characteristics, structure content logically and select appropriate instructional strategies that enhance understanding and retention (Gameil & Al-Abdullatif, 2023). Effective content planning also ensures that digital instructional materials are purposeful, learner-centered, and aligned with assessment strategies to improve instructional effectiveness (Chanda, et al., 2024).
- (ii) *Use of Multimedia Tools Skills (UMTS)*: The use of multimedia tools skills refers to the ability to integrate elements such as audio, video, animations and simulations into instructional content to enhance learning experiences. According to Aderonmu and Agbesor (2025), multimedia elements support diverse learning styles and help explain complex or abstract concepts through visual and auditory representations. Also, effective use of multimedia tools increases learner engagement, motivation and comprehension when aligned with sound instructional design principles (Désiron et al., 2024).
- (iii) *Integration of Interactivity and Learner Engagement Features Skills (IILEFS)*: This skill involves designing interactive features such as quizzes, simulations, discussion forums and feedback mechanisms that actively involve learners in the learning process. Asagar (2025) commented that interactivity promotes cognitive, behavioral and social engagement, thereby enhancing participation and meaningful learning outcomes. Ismawati, et al., (2024) reiterated that interactive digital environments create opportunities for collaboration, immediate feedback and learner autonomy, which are essential for 21st-century learning.
- (iv) *Adaptation of Digital Resources to Learners' Needs (ADRLNS)*: Adaptation skills refer to the ability of teachers to modify digital instructional materials to suit learners' abilities, interests and learning contexts. This includes personalizing content, ensuring accessibility and addressing diverse learning styles to enhance inclusivity and effectiveness (Soroka, 2018). Such adaptation is critical in digital environments where learners differ in prior

knowledge, motivation, and technological proficiency, requiring flexible instructional approaches (Gameil & Al-Abdullatif, 2023).

- (v) *Technical and Pedagogical Integration Skills (TPIS)*: Technical and pedagogical integration skills involve the effective combination of technological tools with appropriate teaching methods to enhance learning outcomes. This skill is grounded in frameworks such as TPACK, which emphasize the interplay between content, pedagogy and technology in instructional design (Jibril & Adedokun-Shittu, 2024). Mastery of this integration can enable teachers to design meaningful digital learning experiences that are not only technologically sound but also pedagogically effective.

These basic skills are fundamental for teachers to seamlessly embed digital content into instructional processes (Ajani, 2024). In science teaching and learning, such skills are particularly valuable for demonstrating abstract concepts, modeling scientific processes and fostering inquiry-based learning environments. The instructional productivity of science teachers in secondary schools is significantly linked to their capacity to effectively utilize digital content. Key indicators of instructional productivity encompass the clarity and effectiveness of lesson delivery, proficient classroom management and time management, sustained student engagement and participation, comprehensive coverage of science curriculum objectives and the attainment of desired learning outcomes (Ayeni, 2022). Well-structured digital instructional content can improve these indicators by simplifying lesson preparation, enabling clearer explanations, fostering active learning and facilitating efficient assessment and feedback mechanisms.

The theoretical foundation for examining teachers' digital instructional content development skills as a predictor of instructional productivity can be anchored in constructivist learning theory. This theory suggests that learners actively construct knowledge through their interactions with their surroundings, their past experiences, and social interactions. Grounded in the theories of Jean Piaget and Lev Vygotsky, constructivism prioritizes learner-centered instruction, active participation and meaningful engagement over the passive absorption of information. In today's digital learning environments, this theory highlights the critical need for designing instructional content that encourages exploration, collaboration, problem-solving and the co-construction of knowledge. Schunk (2020) asserted that digital tools such as simulations, multimedia and interactive platforms are consistent with constructivist principles, as they enable learners to visualize abstract scientific concepts, engage in inquiry-based activities and receive prompt feedback, thereby enhancing understanding and retention.

The Technological Pedagogical Content Knowledge (TPACK) is another important framework that highlights the essential integration of technology, pedagogy and subject matter knowledge for effective teaching. Initially created by Koehler and Mishra (2006), TPACK builds upon idea of pedagogical content knowledge developed by Shulman (1986) by integrating technological knowledge as a vital component for 21st-century education. The framework asserts that effective teaching with technology is achieved when teachers understand not only their subject matter and suitable pedagogical methods but also how to effectively integrate digital tools to enrich learning experiences. Recent research indicates that teachers' mastery of TPACK significantly impacts their capacity to design, implement and assess digital instructional resources that foster active learning, conceptual comprehension and student involvement (Koehler & Mishra, 2005).

In relation to this study, teachers' digital instructional content development skills such as content planning, multimedia integration, interactivity design, adaptation to learners' needs and the alignment of pedagogy with technology are direct manifestations of TPACK competencies. When science teachers possess strong TPACK, they are better equipped to create well-structured,

interactive and learner-centered digital content that enhances instructional delivery and improves students' academic outcomes, thereby increasing instructional productivity. Obviously, inadequate integration of technological, pedagogical and content knowledge may result in ineffective use of digital tools and poorly designed instructional materials, limiting teaching effectiveness. Therefore, the TPACK framework provides a robust theoretical basis for understanding how the mastery of digital content development skills contributes to improved instructional productivity among science teachers in secondary schools (Jibril & Adedokun-Shittu, 2024).

Several empirical research studies have repeatedly highlighted a positive relationship between the digital skills of teachers and their instructional effectiveness. For example, research indicates that teachers who actively develop and integrate digital instructional materials show higher levels of instructional clarity, enhanced classroom management and increased student engagement (Warsi & Rani, 2024; Razak, et al., 2022). In the specific area of science teaching, the use of digital resources created by teachers has been linked to improved conceptual understanding and greater student achievement (Aderonmu & Edache, 2025). Similarly, Al-Awidi and Aldhafeer (2017) found that secondary school teachers with higher digital competence were more effective in aligning digital content with curriculum goals, resulting in improved lesson delivery and responsiveness to diverse learner needs.

In a study of mathematics teachers, Enikanolaye (2021) observed that the use of teacher-developed multimedia instructional materials significantly enhanced students' problem-solving skills and reduced instructional time, demonstrating a direct connection between digital content developments and teaching efficiency. Research by Maimun and Mohammed (2021) showed that professional development in digital instructional design positively influenced teachers' instructional productivity by increasing adoption of interactive tools and differentiated instructional strategies. Furthermore, Bergdahl, et al. (2020) reported that teachers' ability to adapt digital learning resources to students' needs was strongly associated with higher levels of student engagement and academic performance in science classrooms., Ejekwu and Worlu (2021) documented that training in digital content creation led to measurable improvements in teachers' lesson structure, student participation and formative assessment practices, highlighting the practical impact of digital skills on instructional outcomes.

However, despite the growing body of global evidence, significant gaps persist in the literature, particularly in the context of Nigeria. Most existing research tends to focus on the general ICT competencies of teachers or the availability of digital tools, with limited emphasis on the ability of science teachers to create their own digital instructional content. Against this backdrop, this study seeks to investigate Digital Instructional Content Development Skills as predictor of Science Teachers' Instructional Productivity in Secondary Schools in Ogun State, Nigeria.

Statement of the Problem

Digital instructional content development skills enable teachers to design and implement engaging, interactive and adaptive digital materials that enhance student understanding, support personalized learning, improve instructional efficiency and increase overall teaching productivity. Despite sustained efforts to improve science teaching in Nigeria, persistent concerns remain regarding the low instructional productivity of science teachers in secondary schools. In Ogun State, findings from classroom observations, results of external examinations and various research reports indicate that numerous science lessons continue to be marked by ineffective teaching methods, poor time management, minimal student involvement and insufficient attainment of curriculum goals. These deficiencies in instructional effectiveness have persistently hindered

students' comprehension of scientific principles and their overall performance in science subjects, thus prompting inquiries into the efficacy of current teaching practices in secondary school science classrooms.

Reports have shown that digital technologies and ICT facilities have increasingly been made available in many secondary schools in Ogun State, there appears to be limited emphasis on teachers' capacity to develop digital instructional content that is pedagogically sound and contextually relevant (Abimbola, et al., 2025; Aderonmu & Edache, 2025). Most professional development initiatives focus on basic ICT usage rather than equipping teachers with the skills required to design, adapt, and integrate digital content aligned with science curricula and learners' needs. As a result, science teachers often depend on pre-packaged digital resources or avoid digital tools altogether, leading to an overreliance on traditional, teacher-centered instructional methods even in environments where ICT resources are accessible.

There is a noticeable gap in empirical research examining the relationship between science teachers' digital instructional content development skills and their instructional productivity, particularly within the context of Ogun State. Existing studies in Nigeria largely emphasize general ICT competence or technology availability with little attention given to teachers' content development skills and how these skills influence instructional effectiveness and productivity. This gap necessitates a systematic investigation into digital instructional content development skills as correlates of science teachers' instructional productivity in secondary schools in Ogun State, Nigeria.

Purpose of the study

The purpose of the study was to investigate digital instructional content development skills as predictor of science teachers' instructional productivity in secondary schools. Specifically, the study sought to:

- (i) determine the relative predictive influence of the components of digital instructional content development skills on science teachers' instructional productivity in secondary schools.
- (ii) examine the composite effect of the components of digital instructional content development skills to science teachers' instructional productivity in secondary schools.

Methodology

The study adopted a correlational survey research design. This design was considered appropriate because the study sought to examine the predictive relationships between digital instructional content development skills and science teachers' instructional productivity without manipulating any variables. The correlational design enables the determination of both relative and composite predictive effects of the components of digital instructional content development skills on instructional productivity, which is consistent with the objectives and hypotheses of the study.

The population of the study comprised 5,482 science teachers (Biology, Chemistry, Physics, and Basic Science) teaching in 471 public secondary schools in Ogun State, Nigeria (Ogun State Teaching Service Commission, TESCO, 2025). A sample size of 109 was employed for the study. A multistage sampling technique was employed for the study. In the first stage, Ogun State was stratified into its three senatorial districts (Ogun East, Ogun Central, and Ogun West). In the second stage, a proportionate number 15 of public secondary schools were randomly selected from each senatorial district to ensure geographical representation. In the third stage, science teachers in the selected schools were selected using simple random sampling.

Data were collected using a structured questionnaire developed by the researchers titled Digital Instructional Content Development Skills and Instructional Productivity Questionnaire (DICDSIPQ). The instrument consisted of two sections: Section A was designed to obtain demographic information of the respondents (such as gender, teaching experience, subject specialization, and educational qualification). Section B was a four-point scale of Digital Instructional Content Development Skills Scale ranging from Strongly Agreed (SA) to Strongly Disagreed (SD) designed to measure teachers' competencies across the Digital instructional content development skills.

The instrument was subjected to content and face validity by experts in science education, educational technology and measurement and evaluation. Their comments and suggestions were used to refine the instrument to ensure clarity, relevance and adequate coverage of the study variables. The instrument items were aligned with the study objectives and hypotheses.

The reliability of the instrument was determined using the Cronbach's Alpha method after a pilot test conducted among science teachers outside the study sample but within a similar educational context. Reliability coefficients of .76 and above were considered acceptable for the study.

Data collected were analyzed Pearson Product Moment Correlation to examine Intercorrelation Matrix of Predictor Variables to determine the relative predictive influence of the components of digital instructional content development skills on instructional productivity and Multiple regression analysis to examine the composite effect of the components of digital instructional content development skills on instructional productivity.

Results

Ho₁: The components of digital instructional content development skills do not have any significant relative predictive influence on science teachers' instructional productivity in secondary schools.

Table 1

Intercorrelation Matrix of Predictor Variables and Instructional Productivity

Variables	CPS	UMTS	IILEFS	ADRLNS	TPIS	IP
Content Planning Skills (CPS)	1					
Use of Multimedia Tools Skills (UMTS)	.584	1				
Integration of Interactivity and Learner Engagement Features Skills (IILEFS)	.617	.651	1			
Adaptation of Digital Resources to Learners' Needs (ADRLNS)	.542	.595	.636	1		
Technical and Pedagogical Integration Skills (TPIS)	.661	.701	.726	.682	1	
Instructional Productivity (IP)	.624	.648	.677	.603	.741	1.000

Table 1 shows the Intercorrelation Matrix correlation coefficients among the predictor variables and instructional productivity. The study revealed that all predictor variables were positively and significantly correlated with instructional productivity. Technical and Pedagogical Integration Skills demonstrated the strongest relationship with instructional productivity ($r = .741$) followed by Integration of Interactivity and Learner Engagement Features Skills ($r = .677$), Use of Multimedia Tools Skills ($r = .648$), Content Planning Skills ($r = .624$) and Adaptation of Digital Resources to Learners' Needs ($r = .603$),

Table 2

Digital Instructional Content Development Skills Predicting Instructional Productivity

Predictor Variables	Unstandardized Coefficients Beta	Standardized Coefficient Std. Error	Beta (β)	t	p	Variance Inflation Factor VIF
(Constant)	.842	.231	—	3.65	.000	—
Content Planning Skills (CPS)	.142	.058	.156	2.45	.015	1.79
Use of Multimedia Tools Skills (UMTS)	.168	.061	.182	2.75	.007	2.04
Integration of Interactivity and Learner Engagement Features Skills (IILEFS)	.191	.063	.205	3.03	.003	2.27
Adaptation of Digital Resources to Learners' Needs (ADRLNS)	.117	.055	.131	2.13	.034	1.89
Technical and Pedagogical Integration Skills (TPIS)	.286	.066	.341	4.33	.000	2.44

Model Summary:

R = .81

R² = .66

Adjusted R² = .65

F(5, 103) = 79.21, p < .001

Table 2 presents the multiple regression analysis conducted to examine the relative predictive influence of digital instructional content development skills on science teachers' instructional productivity. The overall model was statistically significant, $F(5, 204) = 79.21$, $p < .001$, explaining 66% of the variance in instructional productivity ($R^2 = .66$, Adjusted $R^2 = .65$). The study also showed that all predictor variables significantly contributed to instructional productivity. Technical and Pedagogical Integration Skills was the strongest predictor ($\beta = .341$, $t = 4.33$, $p < .001$), followed by Integration of Interactivity and Learner Engagement Features Skills ($\beta = .205$, $t = 3.03$, $p = .003$), Use of Multimedia Tools Skills ($\beta = .182$, $t = 2.75$, $p = .007$), Content Planning Skills ($\beta = .156$, $t = 2.45$, $p = .015$), and Adaptation of Digital Resources to Learners' Needs ($\beta = .131$, $t = 2.13$, $p = .034$). The findings of the study indicated that the components of digital instructional content development skills significantly and relatively predict instructional productivity in secondary schools.

Discussion of Findings

The findings of this study revealed that digital instructional content development skills significantly and positively predicted science teachers' instructional productivity in secondary schools, confirming that skillful digital design and implementation enhance teaching outcomes. Related empirical evidence supports the finding that digital instructional content development skills significantly enhance teachers' instructional productivity. Caberos and Dioso (2025) found that teachers with strong digital design and content creation competencies demonstrated more effective lesson delivery, improved classroom organization and higher levels of student engagement in technology-enhanced environments. Similarly, Redecker (2020) through the European framework for digital competence of educators (DigCompEdu), emphasized that teachers' ability to create and adapt digital resources is a key determinant of effective teaching performance and learning outcomes. In another study, Falloon (2022) reported that teachers who actively developed and implemented digital instructional materials were better able to facilitate learner-centered instruction and formative assessment practices, leading to improved instructional efficiency and productivity. These findings collectively reinforce the current study's result by

establishing that the capacity to design and utilize digital instructional content is not only a technical skill but a critical pedagogical competence that directly influences teachers' effectiveness and productivity in contemporary classrooms

The strong correlations between the predictor variables and instructional productivity particularly Technical and Pedagogical Integration Skills ($r = .741$) suggest that teachers who effectively combine technological tools with sound pedagogical principles tend to demonstrate higher instructional productivity. This result aligns with the Technological Pedagogical Content Knowledge (TPACK) framework, which emphasizes that effective teaching in the digital age requires the intersection of content knowledge, pedagogy, and technology (Koehler & Mishra, 2006). Research in comparable contexts supports this linkage as the study of Ayo-Vaughan, et al. (2023) found that Nigerian secondary school teachers with stronger TPACK competencies exhibited clearer lesson delivery, greater responsiveness to learner needs, and improved classroom performance. Similarly, Chandana (2023) reported that teachers who were proficient in integrating digital tools pedagogically demonstrated enhanced instructional management and better utilization of instructional time, which are key indicators of instructional productivity.

The significant predictive influence of Integration of Interactivity and Learner Engagement Features Skills and Use of Multimedia Tools Skills highlights the importance of interactive and multimedia-rich instructional design in enhancing quality teaching. These findings are consistent with the Cognitive Theory of Multimedia Learning, which posits that learners understand and retain information better when words and visuals are meaningfully combined (Agbarakwe & Ossai-Chidi, 2025). In support of this, Akinoso (2018) demonstrated that mathematics teachers who incorporated interactive animations and instructional videos into lessons significantly improved students' problem-solving abilities compared to traditional instruction. Teachers who skillfully incorporate animations, simulations, audio and video elements into instruction are therefore more likely to enhance students' engagement, understanding, and overall learning outcomes, which contribute to greater instructional productivity (Bergdahl, et al., 2020).

Beyond pedagogical integration and multimedia use, the adaptability of digital content to diverse learner needs emerged as a key predictor of instructional productivity. This finding aligns with earlier studies that highlight the importance of personalized digital instruction in promoting effective teaching. For instance, Akinsola and Aderonmu (2025) reported that science teachers who adapted digital resources to accommodate learner differences recorded higher student engagement and improved retention of science concepts. Likewise, Ahmed and Abdulrahman (2024) found that differentiated digital learning materials supported students with varying achievement levels more effectively than uniform instruction, leading to enhanced classroom outcomes. These results suggest that digital content that is appropriately tailored to learners' abilities and interests not only fosters inclusion but also enhances teachers' instructional efficiency and productivity.

The regression results showed that all components collectively explained 66% of the variance in instructional productivity ($R^2 = .66$), indicating a substantial effect size and reaffirming the central role of digital instructional content development skills in shaping contemporary teaching practice. This finding corroborates diffusion and technology adoption theories, which emphasize that the successful uptake of digital innovations in education depends on teachers' competence, perceived usefulness, and contextual supports (Ismawati, et al., 2024). Caberos and Dioso (2025) reported that targeted training in digital content development enhanced teachers' lesson organization, formative assessment practices, and overall instructional productivity. These findings suggest that strengthening teacher' competencies in digital instructional planning, multimedia utilization, learner-centered interactivity, adaptive content delivery and

pedagogical-technical integration can significantly enhance instructional productivity in secondary school science teaching and learning.

Conclusion and Recommendations

This study has established that digital instructional content development skills are significant predictors of science teachers' instructional productivity in secondary schools. The findings demonstrated that all identified components such as Content Planning Skills, Use of Multimedia Tools Skills, Integration of Interactivity and Learner Engagement Features Skills, Adaptation of Digital Resources to Learners' Needs and Technical and Pedagogical Integration Skills both relatively and collectively contributed significantly to instructional productivity. Notably, Technical and Pedagogical Integration Skills emerged as the strongest predictor, highlighting the centrality of effectively combining technological tools with sound pedagogical strategies in enhancing teaching efficiency and classroom effectiveness. The positive and significant interrelationships among the predictor variables and instructional productivity further reinforce the argument that digital competence in instructional content development is not peripheral but foundational to effective science teaching in contemporary classrooms. Given the increasing demand for digitally mediated instruction and the persistent concerns about science education outcomes in Nigeria, the study concludes that strengthening science teachers' competencies in developing, adapting, and integrating contextually relevant digital instructional content is essential for improving instructional productivity.

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

1. Ministries of Education and relevant stakeholders should organize continuous, hands-on professional development programmes to equip science teachers with advanced digital instructional content development skills beyond basic ICT literacy.
2. Teacher education institutions should integrate digital instructional content design and pedagogical-technical integration competencies into pre-service science teacher training curricula.
3. School administrators should provide adequate digital infrastructure and establish monitoring mechanisms to support and sustain effective use of teacher-developed digital instructional content in science classrooms

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