

ASSESSING THE ROLE OF INSTRUCTIONAL DESIGN AND ICT COMPETENCE IN ENHANCING PRE-SERVICE TEACHER TRAINING

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Abstract

This study examined ICT competence and instructional design skills among pre-service teachers in two Nigerian universities. A descriptive survey research design was adopted, with a sample of 248 Year 2 pre-service teachers selected through stratified random sampling from a population of 700 students at the University of Port Harcourt and Ignatius Ajuru University of Education. Data were collected using a validated structured questionnaire (IDICTCQ) and analyzed using descriptive and inferential statistics, including Pearson correlation and multiple regression, at a 0.05 level of significance. Findings revealed that pre-service teachers demonstrated high competence in basic ICT tools such as word processing, presentation software, and online communication platforms, but showed only moderate competence in Learning Management Systems and multimedia integration. In terms of instructional design, respondents exhibited moderate application of design principles, with strengths in setting learning objectives and aligning materials, but weaker performance in lesson reflection and structured planning. The study concludes that while pre-service teachers possess foundational ICT skills, there is a need to strengthen their advanced technological and instructional design capabilities to enhance classroom effectiveness and professional readiness.

Keywords: ICT competence, Instructional Design, Pre-service Teachers, Lesson Delivery, Professional Readiness, Teacher Education

Introduction

The quick development of information and communication technologies (ICT) has drastically changed educational institutions around the world, especially with regard to teacher preparation. In order to give the pre-service teachers, the tools needed to succeed in digital and blended learning contexts, it is now crucial to integrate instructional design principles and ICT competency into teacher education. The degree to which future educators are prepared to create, carry out, and assess technology-enhanced instruction is becoming more and more important as educational systems move toward learner-centered approaches (Maryuningsih, et al., 2020).

Instructional design refers to the systematic process of planning, developing, and delivering instructional materials and experiences in a way that facilitates effective learning. Models such as ADDIE (Analysis, Design, Development, Implementation, and Evaluation) have been widely adopted in educational settings to ensure that teaching is structured, goal-oriented, and aligned with learners' needs (Kwaah, et al., 2022). In teacher education, instructional design plays a crucial role in helping pre-service teachers understand how to organize content, select appropriate teaching strategies, and assess learning outcomes. When effectively applied, instructional design enhances clarity, engagement, and knowledge retention among learners.

Simultaneously, ICT proficiency has become an essential part of 21st-century teacher readiness. The knowledge, abilities, and attitudes needed to use digital tools including computers, learning management systems, multimedia resources, and online collaboration platforms efficiently are all included in ICT competency (Karakoyun & Lindberg, 2020). In addition to being adept in fundamental digital skills, pre-service teachers are expected to meaningfully incorporate ICT into their educational practices. This is consistent with international frameworks like those put out by UNESCO, which highlight the significance of enhancing teachers' technical pedagogical content knowledge (TPACK) and digital literacy.

In teacher preparation programs, the connection between instructional design and ICT proficiency is very important. Digital technologies must frequently be used into instructional design in order to accommodate a variety of learning styles, encourage interaction, and improve accessibility. On the other hand, a teacher's proficiency using ICT tools is contingent upon their comprehension of strong instructional design principles. As a result, these concepts are interrelated and work together to improve the caliber of instruction and learning opportunities (Johanson et al., 2022).

Developing these qualities is even more important in the context of pre-service teacher training. The responsibility of educating future teachers to meet the demands of today's classrooms, which depend more and more on digital tools, falls on teacher education institutes. However, research indicates that a large number of pre-service teachers are not sufficiently exposed to organized instructional design and real-world ICT integration during their training. When they move into professional teaching roles, this mismatch frequently leads to a lack of confidence and efficacy (Fuchs et al., 2022).

Furthermore, the significance of ICT proficiency and instructional design has been emphasized by the growth of e-learning and blended learning environments, which has been hastened by worldwide disruptions like the COVID-19 epidemic. Teachers had to quickly adjust to teaching online during this time, frequently without the necessary training. This revealed shortcomings in both technological proficiency and the capacity to provide captivating online learning. As a result, the necessity of enhancing these areas in teacher education programs is becoming increasingly apparent (ElSayary et al., 2022).

In Nigeria and other developing countries, challenges such as inadequate infrastructure, limited access to digital resources, and insufficient training opportunities further complicate the integration of ICT in teacher education. Despite government efforts and policy initiatives aimed at promoting ICT use in education, the implementation remains inconsistent. Pre-service teachers in many institutions still face barriers that hinder the development of both instructional design skills and ICT competence (Dai, 2023)

Considering these difficulties, it's critical to evaluate how instructional design and ICT proficiency might improve pre-service teacher preparation. Gaining an understanding of how these elements affect the efficacy of teacher preparation can help improve curriculum development, instructional techniques, and the application of policies. According to Çebi and Reisoğlu (2020), this kind of evaluation can also be used to find gaps in existing training programs and guide the creation of interventions meant to produce capable, tech-savvy teachers.

The combination of instructional design and ICT competency in pre-service teacher preparation is becoming more and more important as education continues to change in response to technology improvements. These components guarantee that future teachers are prepared to fulfill the needs of contemporary, digitally-driven classrooms while also improving the caliber of teacher training. Therefore, examining their role in teacher education is both timely and necessary for improving educational outcomes.

Statement of the Problem

Despite the global recognition of ICT as a catalyst for improving educational outcomes, the effective integration of technology into pre-service teacher training remains inconsistent. Many teacher education institutions in Nigeria, including universities such as the University of Port Harcourt (Uniport) and Ignatius Ajuru University of Education (IAUE), struggle to provide pre-service teachers with adequate opportunities to develop both instructional design skills and ICT competence. When it comes to employing technology for lesson preparation, content delivery, and learner assessment, pre-service teachers frequently graduate from their training with theoretical understanding but little practical experience. Because of this disparity, graduates may not be adequately equipped to handle the demands of contemporary classrooms, which increasingly rely on digital resources for instruction. As a result, it is necessary to assess how much ICT proficiency and instructional design principles contribute to pre-service teachers' professional readiness and capacity to provide effective instruction.

Aim and Objectives of the Study

The aim of this study is to assess the role of instructional design and ICT competence in enhancing pre-service teacher training in Nigerian universities. To achieve this aim, the study is guided by the following objectives; to:

- i. examine the level of ICT competence among pre-service teachers in Nigerian universities.
- ii. evaluate the extent to which instructional design principles are incorporated into pre-service teacher training programs.
- iii. determine the relationship between ICT competence and effective lesson delivery among pre-service teachers.
- iv. assess the influence of instructional design skills on the professional readiness of pre-service teachers.

Research Questions

The study seeks to answer the following research questions:

- i. What is the level of ICT competence among pre-service teachers in Nigerian universities?
- ii. To what extent is instructional design principles incorporated into pre-service teacher training programs?
- iii. What is the relationship between ICT competence and effective lesson delivery among pre-service teachers?
- iv. How do instructional design skills influence the professional readiness of pre-service teachers?

Research Hypotheses

The following hypotheses will guide the study, tested at a 0.05 level of significance:

- i. There is no significant relationship between ICT competence and effective lesson delivery among pre-service teachers.
- ii. There is no significant influence of instructional design skills on the professional readiness of pre-service teachers.
- iii. There is no significant difference in ICT competence levels among pre-service teachers based on their year of study.
- iv. There is no significant difference in the application of instructional design principles among pre-service teachers across different universities.

Methodology

This study adopted a descriptive survey research design to systematically collect and analyze data on ICT competence and instructional design skills among pre-service teachers. The population comprised Year 2 pre-service teachers from the University of Port Harcourt (400 students) and Ignatius Ajuru University of Education (300 students), giving a total of 700 students. A stratified random sampling technique was used to ensure proportional representation based on gender and department. Using the Krejcie and Morgan (1970) table, a sample size of 248 respondents was selected, with 142 from Uniport and 106 from IAUE. Data were collected using a structured questionnaire titled Instructional Design and ICT Competence Questionnaire (IDICTCQ), consisting of four sections: demographic data, ICT competence, instructional design skills, and professional readiness. Responses were measured on a 5-point Likert scale. A pilot study involving 20 Year 2 pre-service teachers from another university was conducted to test the instrument. The reliability of the instrument was determined using Cronbach's Alpha, with a coefficient of 0.70 or above considered acceptable. Data were analyzed using descriptive statistics (mean and standard deviation) and inferential statistics including Pearson's Product Moment Correlation, multiple regression, t-test, and ANOVA.

Results

Research Question One: What is the level of ICT competence among pre-service teachers in Nigerian universities?

Table 1: Mean Scores of ICT Competence among Pre-Service Teachers

<i>ICT Competence Items</i>	<i>Mean</i>	<i>SD</i>	<i>Interpretation</i>
Proficiency in word processing software	4.2	0.62	High
Use of presentation tools (PowerPoint)	4.0	0.7	High
Ability to use Learning Management System (LMS)	3.5	0.8	Moderate
Online communication tools (Zoom, Teams)	3.8	0.7	High
Ability to integrate multimedia in lessons	3.6	0.8	Moderate

Overall, pre-service teachers demonstrated high ICT competence in basic office and communication tools but showed moderate competence in LMS use and multimedia integration. This suggests that while students are digitally literate, their advanced ICT application for instructional purposes needs improvement.

Research Question Two: To what extent is instructional design principles incorporated into pre-service teacher training programs?

Table 2: Application of Instructional Design Principles

<i>Instructional Design Components</i>	<i>Mean</i>	<i>SD</i>	<i>Interpretation</i>
Lesson planning following ADDIE model	3.7	0.7	Moderate
Use of learning objectives in lesson design	4.1	0.6	High
Incorporation of assessments in lesson plans	3.8	0.7	Moderate
Alignment of instructional materials with objectives	3.9	0.6	High
Reflection and evaluation of lesson outcomes	3.5	0.8	Moderate

Pre-service teachers moderately apply instructional design principles in their lesson preparation. While they demonstrate strong use of learning objectives and material alignment, reflective evaluation of lessons and structured planning still require attention.

Research Question 3: What is the relationship between ICT competence and effective lesson delivery among pre-service teachers?

Table 3: Pearson Correlation between ICT Competence and Effective Lesson Delivery

<i>Variables</i>	<i>ICT Competence</i>	<i>Effective Lesson Delivery</i>
ICT Competence	1	0.68**
Effective Lesson Delivery	0.68**	1

Correlation is significant at the 0.05 level. There is a strong positive correlation ($r = 0.68$, $p < 0.05$) between ICT competence and effective lesson delivery. This indicates that pre-service teachers with higher ICT skills are more likely to deliver lessons effectively using digital tools.

Research Question Four: What is the Influence of Instructional Design Skills on Professional Readiness?

Table 4: Multiple Regression Analysis of Instructional Design Skills on Professional Readiness

<i>Predictor Variables</i>	<i>B</i>	<i>SE B</i>	<i>Beta</i>	<i>T</i>	<i>p-value</i>
Lesson Planning	0.35	0.08	0.31	4.38	0.001
Use of learning objectives	0.42	0.07	0.38	6.00	0.000
Incorporation of assessments	0.28	0.09	0.24	3.11	0.002
Reflection on lesson outcomes	0.20	0.08	0.18	2.50	0.013

$R^2 = 0.62$, $F(4,243) = 98.5$, $p < 0.05$. Instructional design skills significantly predict professional readiness among pre-service teachers ($R^2 = 0.62$, $p < 0.05$). Use of learning objectives had the strongest influence, followed by lesson planning and incorporation of assessments. Reflective evaluation also contributed significantly but to a lesser degree.

Hypotheses

H₀₁: There is no significant relationship between ICT competence and effective lesson delivery among pre-service teachers.

Table 5: Pearson Correlation Between ICT Competence and Effective Lesson Delivery

<i>Variables</i>	<i>ICT Competence</i>	<i>Effective Lesson Delivery</i>
ICT Competence	1	0.68**
Effective Lesson Delivery	0.68**	1

Significance: $p < 0.05$ Rejected. There is a significant positive relationship between ICT competence and effective lesson delivery among pre-service teachers.

Ho₂: There is no significant influence of instructional design skills on professional readiness of pre-service teachers.

Table 6: Multiple Regressions of Instructional Design Skills on Professional Readiness

<i>Predictor Variables</i>	<i>B</i>	<i>SE B</i>	<i>Beta</i>	<i>T</i>	<i>p-value</i>
Lesson Planning	0.35	0.08	0.31	4.38	0.001
Use of learning objectives	0.42	0.07	0.38	6.00	0.000
Incorporation of assessments	0.28	0.09	0.24	3.11	0.002
Reflection on lesson outcomes	0.20	0.08	0.18	0.50	0.013

$R^2 = 0.62$, $F(4,243) = 98.5$, $p < 0.05$; Rejected. Instructional design skills significantly predict professional readiness among pre-service teachers. Learning objectives and lesson planning are the strongest predictors.

Ho₃: There is no significant difference in ICT competence levels among pre-service teachers based on university.

Table 7: t-test of ICT Competence by University

<i>University</i>	<i>N</i>	<i>Mean</i>	<i>SD</i>
UNIPORT	142	3.85	0.60
IAUE	106	3.78	0.62

$t = 0.92$, $p = 0.36$ ($p > 0.05$). Not rejected, there is no significant difference in ICT competence between pre-service teachers from Uniport and IAUE.

Ho₄: There is no significant difference in the application of instructional design principles among pre-service teachers across universities.

Table 8: t-test of Instructional Design Application by University

<i>University</i>	<i>N</i>	<i>Mean</i>	<i>SD</i>
UNIPORT	142	3.80	0.65
IAUE	106	3.76	0.68

$t = 0.55$, $p = 0.58$ ($p > 0.05$). Not rejected, the application of instructional design principles is statistically similar across pre-service teachers from both universities.

Discussion of Findings

Research Question One: What is the level of ICT competence among pre-service teachers in Nigerian universities?

The study found that pre-service teachers demonstrated high competence in basic ICT tools such as word processing, presentation software, and online communication platforms. However, their competence in Learning Management Systems (LMS) and multimedia integration was moderate. This suggests that while students are digitally literate, advanced ICT skills for instructional purposes remain an area requiring improvement.

According to Udo, and Jackson (2023), pre-service teachers at Nigerian institutions show confidence in utilizing basic digital tools, but many have difficulty incorporating technology into pedagogical practices. This conclusion is further supported by their findings. Their research highlighted how ICT proficiency is frequently restricted to personal rather than educational use.

In a similar vein, Chukwudum et al. (2024) discovered that although pre-service teachers have a solid foundation in digital literacy, they are still unable to effectively use sophisticated teaching tools including virtual classrooms, instructional software, and multimedia resources. Inadequate access to ICT resources and little hands-on training were blamed for this disparity.

Furthermore, Okoye and Ekoyo (2024) noted that the growth of ICT competence depends heavily on institutional assistance. According to their findings, pre-service teachers from universities with organized digital training programs and well-equipped ICT labs had much better levels of competency. This implies that the acquisition of ICT skills is significantly influenced by environmental and infrastructure factors.

Research Question Two: To what extent is instructional design principles incorporated into pre-service teacher training programs?

The analysis revealed that pre-service teachers moderately apply instructional design principles in their lesson preparation. Strong adherence was observed in areas such as the formulation of learning objectives and alignment of materials with lesson goals. However, reflective evaluation of lessons and systematic lesson planning were only moderately practiced.

According to Okafor & Obikwelu (2025), pre-service teachers' instructional design competency frequently remains theoretical because there are little possibilities for practical implementation. Their research revealed that although students are able to recognize the elements of a successful lesson plan, they find it difficult to apply them methodically in classroom environments. Similarly, Oguezie & Osuafor (2022) discovered that pre-service instructors usually ignore important phases of instructional design like evaluation and feedback, concentrating more on delivering information than on evaluating learning outcomes. The current finding of moderate applicability, especially in reflective techniques, is supported by this.

Additionally, Oguezie (2025) emphasized that the use of instructional design principles is greatly enhanced by mentoring and supervised teaching practice. According to their research, pre-service instructors were more likely to create lessons that were cohesive and goal-oriented when they received regular input from supervisors.

Research Question Three: What is the relationship between ICT competence and effective lesson delivery among pre-service teachers?

A strong positive correlation ($r = 0.68$, $p < 0.05$) was found between ICT competence and effective lesson delivery. This indicates that pre-service teachers with higher ICT competence are more capable of delivering lessons effectively using digital tools.

According to Nafiu et al. (2025), ICT proficiency on its own is insufficient unless it is effectively incorporated into instructional techniques. Likewise, Nafiu & Olaitan (2025b) discovered that instructors with more ICT proficiency typically use student-centered teaching strategies, which increase comprehension and engagement. According to their research, using digital tools like interactive media and simulations improves student engagement and instructional clarity.

ICT-competent pre-service teachers are more self-assured, creative, and adaptable in their teaching approaches, according to Nafiu & Olaitan (2025a). They are more adept in modifying classes to suit the needs of a wide range of students, which raises the effectiveness of instruction as a whole.

Research Question Four: How do instructional design skills influence the professional readiness of pre-service teachers?

Multiple regression analysis revealed that instructional design skills significantly predict professional readiness ($R^2 = 0.62$, $p < 0.05$), with learning objectives, lesson planning, and assessment integration being the strongest predictors.

The finding indicates that pre-service teachers who can effectively apply instructional design principles are more prepared to manage classrooms and deliver structured lessons. This aligns with the assertion

Bolaji & Ajia (2023) highlighted that instructional design offers a methodical approach to teaching that improves teachers' readiness and confidence in classroom management, which supports this finding. For effective teaching, their model emphasizes how crucial it is to match objectives, instruction, and assessment.

Furthermore, pre-service teachers who receive training in instructional planning and evaluation techniques have greater levels of professional competence and classroom readiness, according to Adebayo & Ayorinde (2022). According to their research, these educators are more capable of managing a variety of classroom circumstances and creating engaging learning opportunities.

Moreover, Caingcoy, (2021) reported that strong instructional design skills enable pre-service teachers to transition smoothly from training to professional practice. They noted that teachers who can plan, implement, and evaluate lessons effectively are more adaptable and resilient in real classroom environments.

Conclusion

In Nigerian universities, namely the University of Port Harcourt (Uniport) and Ignatius Ajuru University of Education (IAUE), the study looked at how instructional design and ICT proficiency could improve pre-service teachers' professional readiness. According to the study's findings, pre-service teachers often have strong foundational ICT abilities but only mediocre competency with more complex programs like multimedia integration and learning management systems (LMS).

The application of instructional design principles is modest, with less emphasis on lesson reflection and systematic evaluation but high adherence to learning objectives and alignment of teaching materials. Crucially, the study demonstrates that good course delivery and ICT proficiency are positively correlated, and that instructional design abilities have a major impact on professional preparedness. ICT proficiency and instructional design application did not significantly differ between the two colleges, suggesting that training experiences are generally equivalent.

The study concludes by confirming the importance of instructional design and ICT proficiency in preparing pre-service teachers for successful classroom practice. Pre-service teachers are more likely to provide excellent education and run classrooms effectively if they can incorporate technology into well-planned sessions. To improve professional preparedness and adaptation to contemporary educational environments, teacher education programs must expand both ICT training and hands-on instructional design experiences.

Recommendation

Based on the findings of the study, the following recommendations are made:

- i. Universities should strengthen ICT training by including advanced courses on LMS use, multimedia lesson design, online assessment tools, and virtual classroom management, supported by regular workshops and practical sessions.
- ii. Pre-service teachers should be given opportunities to apply instructional design models such as ADDIE and Backward Design through practical lesson planning, including setting objectives, designing assessments, integrating multimedia, and reflecting on outcomes.
- iii. Teaching practice supervisors should promote and assess the effective integration of ICT tools in real classroom settings, alongside lesson delivery.
- iv. Universities should collaborate to share ICT resources, best practices, and expertise to improve access and enhance training quality for pre-service teachers.

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