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Effect of ASSURE-TI Teaching Model on Technological Pedagogical Content Knowledge (TPACK) towards Technology Integration in Kaduna State

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Abstract

The aim of this study was to find out the effect of application of the ASSURE-TI Instructional Model on the Technological Pedagogical Content Knowledge (TPACK) of Pre-Service Technical Education teachers towards Technology Integration in Kaduna state. The researchers used a census technique where the entire population was engaged, the population comprised 347 Technical Education Pre-service teachers from three public tertiary institutions in Kaduna state. Due to some obvious and fundamental weaknesses of ASSURE Model, the researchers created ASSURE-TI Model to ensure seamless technology integration into classroom instruction. To measure the effect of ASSURE-TI Model on Technological Pedagogical Content Knowledge (TPACK), we used Quasi-experimental strategy specifically Pretest-Posttest Nonequivalent Control Group Design. Thus, 63 participants (Control group=32, Experimental group=31) participated in the study, we also used the TPACK Observation Checklist to evaluate the participants' practical teaching. To analyze the data, parametric statistical methods (Independent Samples t-test) was used; the results indicated that ASSURE-TI training intervention was very effective in improving pre-service teachers' practical Teaching skills.

Keywords: Technological Pedagogical Content Knowledge, National Certificate in Education, Technical Education.

Introduction

This era is described as the technology age, technology development in the 21st century transformed the teaching and learning methods. Applying ICT to impart knowledge is not new in the realm of education, but the rate at which technology transforms the teaching and learning processes is highly unprecedented. Every teacher is expected to be technologically literate; it has become an obligation on every teacher to be acquainted with technology and the basic knowledge on how to teach with technology, in a nutshell, Technology Integration. Ibrinke and Jayeola (2025) explained that one of the major challenges of technology integration in Nigeria was insufficient training. Consoli, Désiron, and Cattaneo (2023) defined Technology Integration as the application of technology in educational environment to assist in attaining the educational aims and objectives, or the ways leading to that. Teachers have different ways of integrating technology into their lesson ranging from using the traditional method of lesson plan to using Instructional Design Models (IDM). Using the Instructional Design Models is more authentic because IDM are research based. There are various types of IDM but ASSURE Model is widely accepted and used in Educational Technology, this is because it emphasizes using media to impart knowledge. Moreover, the name ASSURE itself is an acronym that represents each step of the model, helping educators ensure a more engaging and impactful learning experience. The ASSURE stands for: A — Analyze learners, S — State standard and objectives, S — Select media and materials, U — Utilize media and materials, R — Require learner participation, and E — Evaluate and revise. It was drawn from Robert Gagne's framework of instructional events.



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The ASSURE model has proven to be a great way to boost students' involvement and enthusiasm for teaching, classroom activities, enhance educational goals and promote effective learning (Soltani & Shamsi, 2023). Eliana, Wati, and Rahmadona (2024) concluded that using information technology-based learning tools, while following the ASSURE model, significantly enhances both the learning experience and the grades. Thus, one of the major constraints of ASSURE model is that it was developed in the early 1990s when technology was viewed in terms of supplementary, not central to instruction. In view of this, the researchers developed ASSURE-TI model that is fundamental to instruction. Furthermore, turning now to the Technological Pedagogical Content Knowledge (TPACK), the concept of Technological Pedagogical Content Knowledge (TPCK or TPACK) is a relatively new area of study that is still developing a solid theoretical foundation. Over the past decade, it has attracted growing research interest, with many studies building on Shulman's (1986, 1987) idea of Pedagogical Content Knowledge (PCK). The TPACK framework is designed to address the complexities and challenges inherent in contemporary teaching and learning, particularly those arising from the rapid advancement of technology and the widespread use of the internet. Thus, the TPACK framework initially has seven domains of knowledge namely: Content Knowledge (CK), Pedagogical Knowledge (PK), Technological Knowledge (TK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and Technological Pedagogical & Content Knowledge (TPCK) (Mishra & Koehler, 2006). Additionally, Mishra (2019) advocated renaming the external dotted circle in the TPACK model as "Contextual Knowledge (XK)". A number of studies have found that TPACK is very effective in the realm of technology integration (Aldalalah, Wardat, Al-Omari, & Khodair, 2025; Lixia, Choi, & Chen, 2025; Usman, Arafah, Marhum, Munir, & Tadeko, 2024; Uygun, Sendur, Dere, & Ozcakil, 2023; Yang, Fu, & Wu, 2025).

Statement of the Problem

Why is standard of education in Nigeria falling? Rationally, the persistent falling standard of education is not justifiable because there is proliferation of teacher training institutions that graduate professional teachers yearly. The certified teachers were trained with modern technology (ICT) and are expected to use technology to teach. Governments spend a lot of money yearly to purchase Information Communication Technology (ICT) material; yet the result of this disbursement is still unknown. Chukwuemeka, Nsofor, Falode, and Aniah (2019) explained that the methods and practices of teaching have changed and exposed teachers to new digital technologies that they are not conversant with. The computer courses in the teacher training programs train the potential teachers to learn the computer practical as well as theoretical skills, but these skills do not spontaneously turn into pedagogical skills. Chacón-Prado (2023) found that the absence of new technologies and insufficient hardware and software skills of students and teachers are some of the major problems encountered in technology integration. Technology is updated every day, Shambare and Jita (2024) recommended that investigations are needed to track the long-term development of teachers' TPACK and to determine how it can be effectively scaled and sustained. Research showed that several teachers failed to meet the 21st-century teaching prerequisite owing to gaps in the teacher education program; serious among these holes is the problem of the integration of technologies into classroom instruction (Aina, Ayodele, & Adekunle, 2021). Furthermore, a lot of researchers clamored for more researches on ASSURE model, Al-Haydary and Majeed (2021) recommended carrying out various studies in different subjects and at different educational levels in both boys' and girls' schools could help us understand how much the ASSURE model benefits students. Aldalalah et al. (2025) recommended that researches on TPACK should be conducted on different subjects and at various educational levels. Researches have shown that empirical studies to discover the relationships among TPACK components, how the components associate with the TPACK and how TPACK affects technology integration are still scarce (Masry-Herzallah, 2025; Muhammad, Mohd Faiz, & Akhmad, 2024; Sofwan, Yaakob, & Habibi, 2023).

Objectives of the Study

The objectives of the research are:

1. To compare the TPACK scores between pre-service teachers exposed to the ASSURE-TI model and those not exposed.
2. To investigate the relationship between Content knowledge (CK) and Technology knowledge (TK) among Pre-service Technical Education teachers.

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Research Questions

This research has the following questions:

1. Is there a significant difference in the TPACK scores of pre-service teachers exposed to the ASSURE-TI model and those not exposed?
2. Is there a significant relationship between Content knowledge (CK) and Technology knowledge (TK) among Pre-service Technical Education teachers?

Hypotheses

The hypotheses formulated were tested at $P \leq 0.05$ level of significance

- H0:** There is no significant difference in the TPACK scores of pre-service teachers exposed to the ASSURE-TI model and those not exposed.
- H1:** There is significant difference in the TPACK scores of pre-service teachers exposed to the ASSURE-TI model and those not exposed.
- H0:** There is no significant relationship between Content knowledge (CK) and Technology knowledge (TK) among Pre-service Technical Education teachers.
- H1:** There is significant relationship between Content knowledge (CK) and Technology knowledge (TK) among Pre-service Technical Education teachers.

Theoretical Framework

This research focuses and counts on a theoretical background, this is: Technological Pedagogical Content Knowledge (TPCK) as a theoretical framework on its own. The chief proponent of Technological Pedagogical Content Knowledge (TPCK) was Lee S. Shulman in the year 1986, he expounded on two (2) basic areas of knowledge: Pedagogical Knowledge (PK) and Content Knowledge (CK). Koehler & Mishra (2005) extended Shulman's idea (PCK) by adding another construct that is, Technology Knowledge (TK). Eventually, it became Technological Pedagogical Content Knowledge (TPCK); for the purpose of simple pronunciation they changed it to TPACK. Moreover, eventually, Mishra (2019) suggested another construct "Contextual Knowledge (XK)". The Technological Pedagogical Content Knowledge (TPACK) was introduced to the educational research field as a theoretical framework with its different TPACK sub-constructs to accurately comprehend teacher knowledge necessary for operational technology integration (Ifinedo, Saarela, & Hämäläinen, 2019; Mishra & Koehler, 2006). The TPACK consisted eight Sub-constructs namely; Content Knowledge (CK), Pedagogical Knowledge (PK), Technological Knowledge (TK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), Contextual Knowledge (XK) and Technological Pedagogical Content Knowledge (TPACK). Each of the Sub-constructs can be used as an individual construct or in relation to other constructs to conduct a scientific research.

The ASSURE Model

The ASSURE model also known as the Heinich, Molenda, Russell, and Smaldino Model is a framework for designing instructional materials and lessons, The ASSURE model is designed to aid educators in constructing and improving learning experiences for their learners by means of providing a structure to plan and polish their instructional approaches and learning environments. Research has shown that using ASSURE model reinforced with multimedia had unlimited and effective influence on the teachers' speaking skills (Mahmoud, Rehab, & Mina, 2024).

Figure 1. The ASSURE Model

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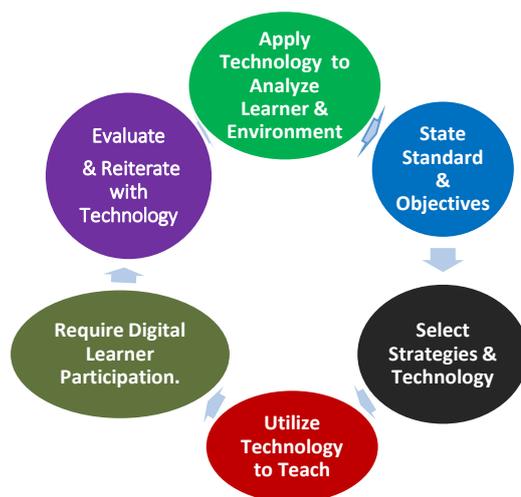
Source: *(Integrating Educational Technology into teaching)*

According to Zahran (2023), the ASSURE model has an optimistic impact on teachers' digital literacy abilities thru building a learning environment that allows teachers to effectively use instructional models, prepare student-centered lessons. Damayanti and Rahmadonna (2025) found that teachers who effectively implement the ASSURE instructional design can really address students' cognitive and engagement needs. Thus, ASSURE Model has some conspicuous weaknesses that sometimes inhibit seamless integration of technology into classroom instruction. As the ASSURE Model is less than 4 decades now, at that time, technology was considered just a complementary, not fundamental to instruction. ASSURE model treats technology as a content delivery instrument therefore limiting the possibilities of using technology to analyze learners and plan collaboration at early stages within the learning design.

ASSURE-TI Model

The ASSURE-TI model is a modernized version of the ASSURE model, it can be observed that in ASSURE model, the integration of technology starts from stage four (4) that is Utilize Media & Material while in ASSURE-TI model the integration of technology starts from the first stage to the end. ASSURE-TI Model emphasizes the integration of technology to support teaching and learning, while maintaining the core principles of the original ASSURE model. ASSURE-TI has the following components:

A - Apply Technology to Analyze Learner & Environment, S - State Standard & Objectives, S - Select Strategies & Technology, U - Utilize Technology to Teach, R - Require Digital Learner Participation, E - Evaluate & Reiterate with Technology and TI - Technology Integration.



Nevertheless, the ASSURE-TI model is basically for Technology Integration that has the capacity to improve the old ASSURE instructional design model. It was created to react to the increasing appeal for a model that allows initial use of technology in classroom instruction from planning stages and continues to the evaluation stage to suite the 21st-century teaching. ASSURE-TI has the following advantages that places it high in the realm of teaching in the 21st-century teaching:

1. Early Integration of Technology

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ASSURE-TI Model places strong emphasis in using technology and media at introductory stage that is, Apply Technology to Analyze Learner & Environment the traditional ASSURE model initiate the use of technology at stage 4 (Utilize Media and Materials).

2. ASSURE-TI Model is Responsive to Digital Learners

Traditional ASSURE Model ignores learner analysis that examines the readiness of the learner to use technology in classroom environment. On the other hand, the ASSURE-TI Model examines Learners' digital habits, learners' access to the use of technology and above all their initial technological skills.

3. Technology-Enhanced Objectives

Another serious challenge against the ASSURE Model is that its objectives may not involve technological related performance of the learner which is very central to the overall idea of technology integration. However, using digital tools to attain educational objectives is one of the cardinal aims of ASSURE-TI Model, frankly this seriously promotes 21st-century skills and digital literacy.

4. Flexible Tool and Method Selection

To inspire invention through blended and active learning, ASSURE-TI Model use tools, and content to plan together based on technological opportunities whereas in ASSURE Model tools are selected to support pre-decided methods and content.

5. Digital Learner Participation

As ASSURE Model was over 3 decades now its engagement style is usually via traditional classroom meeting, this does not promote motivation that will lead deeper students' engagement. ASSURE-TI Model promotes students' involvement using tools for collaboration, reflection and content creation in form of Learner-Learner interaction or Learner-Tutor interaction.

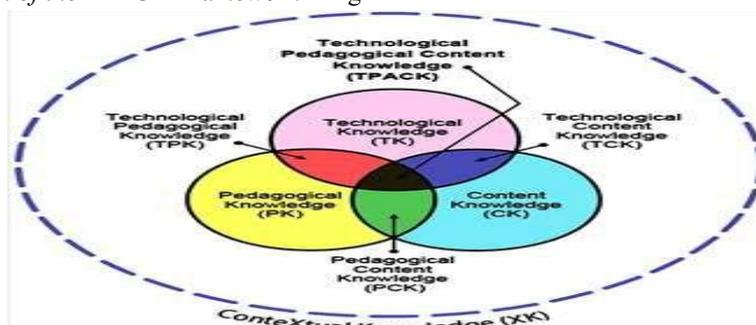
6. Technology-Based Evaluation and Feedback

One of the great features of ASSURE-TI Model is that it uses digital assessments and real-time feedback, this allows for both formative and summative evaluation to take place, it also allows faster feedback and instructional adjustments where necessary. Whereas, ASSURE Model frequently relies on paper tests and fixed rubrics evaluation that hardly give room for formative evaluation. ASSURE-TI enhances the ASSURE model by decisively integrating technology from the foundation, it is up-to-date to meet the challenges of the dynamic needs of modern classrooms, it champions teachers to tactically use digital tools, and prepares students for an interconnected digital world.

Technological Pedagogical and Content Knowledge (TPACK)

It is not exaggeration to say that some topics cannot be taught effectively without the use of technology, but technology integration is still a problem. Ifinedo et al. (2019) established that TPACK framework is significant for understanding how teachers integrate technology into their classrooms. TPACK has been used to refer to as teachers' formula for technology integration.

Figure 3. Revised version of the TPACK Framework image



Source: <http://tpack.org>

The TPACK framework puts emphasis on the dynamic interactions and interdependencies among content, pedagogy, and technology; acknowledging that effective teaching entails a profound understanding of how these three parts overlap and sway one another. Rather than handling content, pedagogy, and technology as distinct knowledge areas, TPACK emphasizes the significance of balancing these three areas to make an interconnected and authoritative teaching approach. Jiménez Sierra, Ortega Iglesias, Cabero-Almenara, and Palacios-Rodríguez (2023) emphasized that the major TPACK



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subcomponents were developed distinctly, but are combined together to promote effective means of teaching. Mishra and Koehler (2006) explained that TPACK framework has seven (7) essential elements and relationships, while Mishra added 1 in 2019 they are:

- 1. Content Knowledge:** Content knowledge (CK) This knowledge is vital for successful teaching and communicating the subject matter to learners, if teachers are not well versed in their subject areas, they can mislead students.
- 2. Pedagogical Knowledge:** Pedagogical Knowledge (PK) connotes adequate knowledge about the principles and practices of teaching and learning and how it incorporates the generally educational purposes, values, and aims.
- 3. Technology Knowledge:** Technology knowledge (TK) is information about standard technologies such as books, chalk and blackboard, and more advanced technologies, such as the computer, internet, and digital video.
- 4. Pedagogical Content Knowledge:** Pedagogical Content Knowledge (PCK) refers to the distinctive intermingling of subject matter expertise and teaching talents that teachers have.
- 5. Technological Content Knowledge:** Technological content knowledge (TCK) is knowledge about the method in which technology and content are mutually interconnected.
- 6. Technological Pedagogical Knowledge:** Technological Pedagogical Knowledge (TPK) is knowledge of the existence, components, and capabilities of various technologies as they are used in teaching and learning settings.
- 7. Technological Pedagogical and Content Knowledge:** Technological Pedagogical and Content Knowledge (TPACK) is an evolving form of knowledge that surpasses all the three components (content, pedagogy, and technology).
- 8. Contextual Knowledge:** Contextual Knowledge (XK) is concerned with the teacher's acquaintance with technologies available for him/her to the teacher's knowledge regarding the school, district, or country policy where he/she is teaching.

Methodology

This research is designed to take place in three (3) senatorial areas of Kaduna state: Zaria, Kaduna and Kafanchan zones Three hundred and forty-seven (347) Pre-Service Technical Education teachers, males and females who must have registered or already passed courses like the Micro-Teaching Practicum, Educational Technology: Theory and Practice etc. volunteered to participate in this study. Moreover, the Participants were students enrolled in NCE program, all the participants took part in the survey in order to identify their TPACK statuses, while only the 63 participated in the Quasi-experimental strategy precisely *Pretest-Posttest Nonequivalent Control Group Design* was used. The researchers used questionnaire adapted and modified from Schmidt, Baran, Thompson, Mishra, Koehler & Shin to identify the TPACK of the participants. The items on the questionnaire were on a five-point Likert-scale with numerical weights scale of: Strongly Disagree (SD) = 1 points, Disagree (D) = 2 points, Neither Agree or Disagree (NA/D) = 3 points, Agree (A) = 4 points, and Strongly Agree (SA) = 5 points. Therefore, mean value of 3.10 and above means respondents' agreement to the items whilst a mean score of 3.00 and below means disagreement to the items on the questionnaire. The validity of the amended instruments, particularly the face and content validity, was ascertained by a panel of experts in Educational Technology and Pedagogy. The instrument was pilot tested, reliability test was carried out, the result of the reliability test revealed high internal consistency level with Overall Cronbach's Alpha TPACK .81. The study also used the TPACK Observation Checklist to observe and collect data during pretest and posttest of the quasi-experimental exercise. The data was analyzed using a combination descriptive statistics and correlation analysis. The study employed quasi-experimental and correlational strategies to conduct the research, the research used *Pretest-Posttest Nonequivalent Control Group Design* in order to find out the effect of the ASSURE-TI Instructional Model on the Technological Pedagogical Content Knowledge (TPACK) of Pre-Service Technical Education teachers towards Technology Integration, the participants were trained for four (4) weeks on the new ASSURE-TI Model, Spearman's Rank-Order Correlation was used to investigate the correlation between Content Knowledge (CK) and Technology Knowledge (TK).

Presentation of Results

Is there a significant difference in the TPACK scores of Pre-service Technical Education teachers exposed to the ASSURE-TI model and those who are not?

The result is presented in table 1:

Table 1

Pre-test Independent Sample t-test



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Group	N	Mean	SD	df	t	p
Control Group	32	28.2	4.8	61	0.40	.693
Experimental Group	31	27.5	5.2			

Table 1 presents Pre-test information, it shows that the Mean scores of Control Group was 28.2 while the Experimental Group had 27.5 while the P-value was .693.

Table 2

Post-test Independent Sample t-test

Group	N	Mean	SD	Df	t	p
Control Group	32	30.3	5.1	61	3.21	0.02
Experimental Group	31	82.7	7.3			

Table 2 presents Posttest information, it indicates that the Mean scores of Control Group was 30.3 while the Experimental Group had 82.7 whereas the P-value was 0.02.

Correlation Result

A Spearman's rank-order correlation was carried out to ascertain the relationship between Content Knowledge (CK) and Technology Knowledge (TK) among Preservice Technical Education teachers. The correlation involved Three hundred and forty seven (347) participants, providing valuable insights into how these two types of knowledge intersect in their training.

Table 3

Spearman's Rank-Order Correlation between CK and TK

Variables	Content Knowledge (CK)	Technology Knowledge (TK)
Content Knowledge (CK)	1.00	0.71**
Technology Knowledge (TK)	0.71**	1.00

Note: **rho = 0.71, n = 347, p < 0.01 (2-tailed)**

The Spearman's Rank-Order Correlation results displayed a concrete connection between Content Knowledge and Technology Knowledge with a correlation coefficient of 0.71 and a p-value of less than 0.01

Discussion of Findings

The Pre-test information shows that the mean scores of Control Group is 28.2 while the Experimental Group has 27.5 both the groups show low experience, precisely below proficiency threshold, the Standard Deviation indicates tight position, a constant low starting point expertise. The table demonstrates that the calculated statistics is 0.40 with p-value .693 the hypothesis formulated was tested at $P \leq 0.05$ level of significance. The information in this table indicates that there is no significant group difference; therefore, we can conclude that the Control Group and the Experimental Group are statistically equal at pretest which is correct for Quasi-Experimental Independent Sample. The Posttest result reveals that the Mean scores of Control Group is 30.3 while the Experimental Group has 82.7. This shows that the Experimental Group displays considerably greater Post-test scores than the Control Group. The Experimental Group reached near-proficiency scores but the Control Group shows insignificant development. In conclusion, the ASSURE-TI Model made unprecedented improvements in pre-service teachers' Instructional Design competency.

This research is consistent with the research of Aldalalah et al. (2025) who used the quasi-experimental approach to study the effectiveness of interactive digital content based on the TPACK model. They found that using digital content based on the TPACK model supported the development of the skills of making instructional facilities and increasing the cognitive success in the creation of teaching aids. This finding is also in agreement with the finding of Usman et al. (2024) who examined the effect of differences between TPACK and conventional learning models on learning outcomes of descriptive text writing skills in English. Their result established a significant difference between students who learned with TPACK and DL models based on the influence on learning outcomes of writing English descriptive text. In another fascinating research Yang et al. (2025) conducted a survey with 102 Art Education teachers to examine the impact of Art teachers' Technological Pedagogical Content Knowledge (TPACK) on Art students' online learning engagement. To analyze the



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data, they used Structural Equation Modeling. The result revealed that higher levels of TPACK in Art teachers lead to improved student engagement in online learning, their finding is consistent with the present research. However, in contrast to the earlier findings, Agustini, Santyasa, and Ratminingsih (2019) used a mixed method to study and analyze the competence of Technology, Pedagogy, and Content Knowledge (TPACK) of Education Technology alumni. The result showed that Content Knowledge and Pedagogical Knowledge had high average compared to Technological Constructs, while the Technology Knowledge had low average this research is inconsistent with the current study. Roig-Vila, Mengual-Andrés, and Quinto-Medrano (2015) also conducted quantitative non-experimental research with 224 Preschool and Primary Education teachers. Their results revealed that they have insufficient Technological Knowledge and skills to incorporate technology into their instruction. Thus, a lot of researches established that TPACK has influence in academic performance and beyond (Ismaniati, Khairaty, Yusuf, & Supramono, 2025; Yang et al., 2025).

In reviewing the literature, there were a quite number of studies that found the relationship between Content Knowledge and Technology Knowledge. The result of this study shows that there is a strong association between Content Knowledge (CK) and Technology Knowledge (TK). The results shows a solid connection between Content Knowledge (CK) and technology knowledge (TK), with a correlation coefficient of 0.71 and a p-value of less than 0.01. There are several possible explanation for this result, scientifically, the preservice teachers understood their subject very well they were also more skilled with technology and therefore, the relationship is statistically significant. Another possible explanation for this strong relationship might be due to the fact that all the participants have been participating in practical teaching right from their departments. Therefore, we can conclude that this is not just a coincidence, these findings suggest that improving one area of knowledge, like Content Knowledge, can enhance understanding in another area, such as Technology Knowledge. This association is important for developing well-versed teaching skills in teacher training programs. Furthermore, the present research established that there is a strong association between Content Knowledge and Technology Knowledge. Shambare and Jita (2024) used a quantitative analysis of data collected from 186 Life Sciences teachers in a descriptive research, they found that the overall, respondents displayed low levels of TPACK, but individual analysis of TPACK components has shown a distinguished proficiency of Content Knowledge, Pedagogical Knowledge and Pedagogical Content Knowledge; these individual performances support the current study. However, Amri, Zubaidi, & Aziz conducted a research to determine whether a considerable correlation exists between TPACK level and grades. They used nonparametric analysis precisely Chi-Square and Spearman Coefficient Correlation to analyse the data. The results revealed that there was a substantial relationship between pre-service teachers' academic achievement and their TPACK (Amri, Zubaidi, & Aziz, 2024). Lixia et al. (2025) used 506 teachers in a cross-sectional survey to study the role of Technological Pedagogical Content Knowledge (TPACK) in Technology integration among in-service Chinese language teachers in rural China. Their findings revealed that domains like Content Knowledge and Pedagogical Knowledge showed limited significance. Moreover, their finding is inconsistent with the current research where Content Knowledge and Pedagogical Knowledge have tremendous scores. In another research Hawraa Oudah, Basma Mohammed, and Laith Mohammed (2025) established a deficiency in Educational Knowledge, Technological Knowledge, Knowledge of Technology and Content, and Knowledge of Technology and Education.

Conclusion

This research contributes in addressing technology integration by enhancing our understanding of how pre-service teachers can better prepare for technology integration. The training for ASSURE-TI produced a wonderful result to participants' instructional design skills. The research also laid a base to build other studies by replication or bringing their innovations, example using ASSURE-TI model in mixed mode or participatory approach could yield richer results. To implement the recommendation of this study, the findings should be incorporated in the teacher training institution syllabuses, this will enable the pre-service teachers to be conversant with the findings. Workshops and conferences should be organized to train the in-service teachers.

Recommendations

1. The findings of this study have a number of important implication for future practice, there is therefore, a definite need for Federal Ministry of Education to mandate ASSURE-TI model in all higher institutions where NCE programs are run.



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2. Thus, it is therefore recommended that Federal Ministry of Education funds should be made available for ASSURE-TI model implementation.

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