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Awareness of Pre-Service Teachers Technological Pedagogical Content Knowledge for Instruction in Universities in Ogun State

Justina Ojoma ATTAH[1], Moses Adeleke ADEOYE[2]
University of Ilorin, Nigeria
Al-Hikmah University Ilorin, Nigeria
attahjustina8@gmail.com

ABSTRACT

This research investigates the awareness of Technological Pedagogical Content Knowledge (TPACK) among pre-service teachers in Ogun State, Nigeria universities. Understanding how future educators perceive and utilise technology is crucial for effective teaching and learning in the context of increasing technological integration in education. The primary purpose of this study was to assess the availability of technology resources, evaluate pre-service teachers' awareness of TPACK, and explore potential gender differences in awareness levels. A descriptive survey research design was employed, involving a sample of 150 pre-service teachers from various education faculties, selected through stratified random sampling. Data were collected using a structured questionnaire that assessed the availability of technological resources and the participants' awareness of TPACK. The findings revealed a significant gap in the availability of essential technological resources, with many tools lacking for effective TPACK development. However, participants exhibited a high level of awareness regarding TPACK concepts, indicating their understanding of technology's role in enhancing pedagogy. Notably, no significant gender differences in TPACK awareness were found. In conclusion, while pre-service teachers demonstrate a commendable awareness of TPACK, the scarcity of technological resources hampers their readiness to integrate technology effectively. This research contributes to the ongoing discourse on teacher education by highlighting critical gaps in resource availability and emphasising the need for enhanced training and support for future educators, ultimately aiming to improve the quality of education in Nigeria.
Keywords: Technological Pedagogical Content Knowledge, Pre-Service Teachers, Technology Integration, Teacher Education.

INTRODUCTION

Education is no doubt regarded as the most cogent factor for the national development of any nation, either in the already developed, developing or underdeveloped countries of the world. It is also the primary yardstick for individual, societal, national, and international growth and development. For effective teaching and learning, technology must be integrated. However, effective and efficient integration of technology cannot be achieved until teachers change their mindsets positively towards using technology in their daily educational activities (Chukwuemeka & Iscioglu, 2016). Teachers are critical in any education system because they transmit the subject contents through pedagogical knowledge (Aina & Olanipekun, 2015). Teacher education is a programme related to the development of teacher proficiency and competence that would enable and empower the pre-service teacher to meet the profession's requirements and face the challenges therein (Abanobi & Abanobi, 2017). Ismail (2023) stated that teaching is the process that usually occurs in the classroom. Teachers are critical in any education system because they transmit the subject contents through pedagogical knowledge (Aina & Olanipekun,

2015). The quality of education is directly linked to the quality of teachers, which is influenced by the preservice teacher education program for prospective teachers (Thappa & Baliya, 2021). Pre-service education plays a crucial role in influencing prospective teachers' success in their future teaching careers, particularly in the use of technology (Karaca, 2015).

In the current digital age, technology remains the primary area of emphasis (Handayani et al., 2023). The evolution of technology has led to the establishment of a novel framework within the realm of education, referred to as TPACK (Adnan & Yunisari, 2023). TPACK is a framework that connects science, technology, and content, requiring teachers to master skills in delivering learning materials (Online & Hayani, 2022). TPACK includes pedagogical knowledge (PK), content knowledge (CK), technological knowledge (TK), pedagogical content knowledge (PCK), technological pedagogical knowledge (TPK), technological content knowledge (TCK) and, indeed, technological pedagogical content knowledge (TPACK) (Nepembe & SimujaI, 2023). Pedagogical knowledge encompasses a comprehensive understanding of teaching and learning processes, including educational purposes, values, methods, approaches, assessment, lesson plan development, classroom management, and student learning (Diamah et al., 2022). Content knowledge (CK) is the understanding of the subject matter to be taught or learned, which teachers must possess, including its differences from other content areas, to effectively teach and learn (Koehler & Mishra, 2008). Pedagogical content knowledge (PCK) combines pedagogical and content knowledge, encompassing educators' understanding of curriculum, classroom management, and student characteristics, enhancing teaching effectiveness in specific subjects (Schmidt et al., 2009; Asiyai, 2018).

Technology knowledge (TK) constantly evolves, encompassing knowledge about digital technologies like computers, the internet, mobile devices, interactive whiteboards, digital video, and software applications (Charoula & Christodoulou, 2019). Technological content knowledge (TCK) involves understanding how technology can enhance content representations and how ICT and content influence each other, requiring teachers to be proficient in this area (Apau, 2017; Yue et al., 2024). Technological pedagogical knowledge (TPK) involves understanding how various technologies can be utilised in teaching and how these technologies can alter classroom teaching methods (Zhang, 2022). Technological pedagogical content knowledge (TPACK) is a comprehensive understanding of technology, pedagogy, and content, serving as the foundation for effective teaching with technology (Shambare & Simuja, 2024). TPACK is the synthesised form of knowledge to integrate technology into classroom teaching and learning (Chai et al., 2016). TPACK is instrumental in effective technology use in education (Hou et al., 2022); it combines pedagogic competencies, knowledge, and technology to enhance learning effectiveness, innovation, and student outcomes (Annazar et al., 2023). Teachers' proficiency in TPACK varies, requiring technological integration skills and pedagogical expertise, especially for diverse students (Li et al., 2022). The significance of teacher TPACK in the educational landscape is profound and essential for student learning. The primary function of this framework is to promote authentic learning experiences within academic institutions (Aina & Abdulwasiu, 2023). However, the availability of technology, as well as the pedagogical expertise and viewpoints of the teachers, exert authority over the selection of technology and how teachers use it in the classroom (Prestridge, 2016). It is worrisome that e-learning technology resources are scarce and inadequate for teaching vocational subjects in senior secondary schools (Ojo et al., 2021). The government and institutional authorities cannot provide the necessary digital technological tools for teaching and learning art in Higher Education Institutions, leading to their insufficiency (Ajayi & Luckay, 2023). Regrettably, the knowledge and skills of pre-service teachers regarding TPACK are insufficient (Diamah et al., 2022). Pre-service teachers generally have positive attitudes towards ICT in education, but their attitudes towards using ICT in the classroom are more reserved. Chukwuemeka et al. (2019) found a significant difference in self-

efficacy between those with advanced technology knowledge and those with limited technological pedagogical content knowledge. In a study by Adeoye and Ojo (2014) it was reported that half of the teachers surveyed in this study lacked general technology knowledge but could learn quickly. About 50% of them were knowledgeable about technologies that could be used in their subject areas. This spurs that most of the teachers still lack TPACK skills

Additionally, Sadaf et al. (2012) stated that pre-service teachers today generally possess a positive outlook on the potential of information and communication technology (ICT) in the educational sphere. However, this optimism tends to wane regarding the practical use of ICT in classroom environments. Similarly, Brown and Englehardt (2017) indicated that many pre-service teachers feel discomfort with integrating technology into their teaching practices. Thappa and Baliya's (2021) study found that nearly half of the preservice teachers were familiar with technological, pedagogical and content knowledge but unaware of TPACK integration, primarily from their teacher education program. To advance the overall levels of TPACK and create focused strategies for improving different influencing factors, researchers have commenced examinations of the various elements that impact TPACK levels (Ifinedo et al., 2020; Castéra et al., 2020). Furthermore, most studies have revealed that gender does not significantly determine teachers' TPACK levels (Özgür, 2020). Deng et al. (2023) reported that both male and female students exhibited a strong level of proficiency on the comprehensive TPACK scale, revealing no notable gender differences in data-logging TPACK proficiency. Also, both genders possess a certain level of awareness and ability to incorporate data-logging technology in chemistry teaching, but it may not be at an advanced level. Naaz and Khan's (2018) study reveals that while both genders have different technological knowledge, the overall TPACK of pre-service teachers does not differ by gender. However, these studies were done outside the geographical location of this present study; it was therefore deemed necessary to examine the gender difference in the awareness of TPACK skills.

RESEARCH HYPOTHESIS

Ho1: There is no significance between male and female awareness of pre-service Teachers-librarians on (TPACK) for instruction in faculties of education in Nigerian Universities.

RESEARCH METHOD

A descriptive survey research design was utilised to gather data from a representative sample of pre-service teachers across various faculties in selected universities. This approach allowed for data collection regarding the availability of technology resources and the level of awareness of Pre-Service Teachers regarding Technological Pedagogical Content Knowledge (TPACK) for instruction in universities in Ogun State, Nigeria. The study targeted pre-service teachers enrolled in education faculties in universities in Ogun State. One hundred fifty participants were selected through stratified random sampling to ensure a balanced representation of male and female pre-service teachers. The sample consisted of 53 female participants (35.3%) and 97 male participants (65.7%), reflecting the gender distribution within the population. A structured questionnaire was developed as the primary data collection instrument. The questionnaire comprised three sections: Demographic Information: This section collected demographic data, including gender, age, and educational background, to facilitate the analysis of trends related to TPACK awareness and technology integration. Availability of Technology Resources: This section assessed various technological resources necessary for TPACK skills development,

including audiovisual facilities, electronic books, e-journals, and online databases. Awareness of TPACK: This section measured the participants' awareness levels regarding TPACK concepts and their perceived confidence in integrating technology into their teaching practices. A Likert scale ranging from "Strongly Disagree" (1) to "Strongly Agree" (5) was used for participants to express their agreement with various statements related to TPACK. The collected data were analysed using descriptive statistics, including mean scores, percentages, and frequency distributions, to summarise the findings. Additionally, inferential statistics, specifically independent t-tests, were employed to examine the differences in TPACK awareness between male and female pre-service teachers. A significance level of $p < 0.05$ was set to determine the statistical significance of the findings. Using a structured questionnaire and robust statistical analysis, the study shed light on the current state of technology integration in teacher education and identified areas for improvement.

RESULTS

Table 1. Distribution of Population by Gende.

S/N	Faculties	Frequency	Percentage
1	Female	53	35.3
2	Male	97	65.7
Total		**150**	**100.0**

Table 1 shows the distribution of the population by gender. Female respondents were 53 (35.3%), while male respondents were 97 (65.7%), for a total of 150 respondents. This implies that there were more male respondents than female counterparts.

Table 2. Availability of Technology Resources for Pre-service Teacher Librarians' TPACK Skills for Instruction.

S/N	**Technology Availability**	**Available**	**Not Available**
1	Audiovisual lecture facilities such as television sets and projector	20(71.4%)	8(28.6%)
2	Electronic Books	20(71.4%)	8(28.6%)
3	E-Journals	3(10.7%)	25(89.3%)
4	C.D Rom	6(21.4%)	22(78.6%)
5	Television Broadcast	11(39.3%)	17(60.7%)
6	E-mail	2(7.1%)	26(92.9%)
7	Learning management system (such as a smart board system)	10(35.7%)	18(64.3%)
8	Inter-linked hypertexts	15(53.6%)	13(46.4%)
9	Online help centers	11(39.3%)	17(60.7%)
10	Experts view	12(42.9%)	16(57.1%)
11	File transfer protocol	10(35.7%)	18(64.3%)
12	E-thesis	7(25%)	21(75%)
13	Online databases	3(10.7%)	25(89.3%)
14	Remote login	9(32.1%)	19(67.9%)

15	World Wide Web (www)	4(14.3%)	24(85.7%)

Table 2 shows the availability of technology resources for pre-service teacher librarians' TPACK instruction skills. Of the listed technology resources, only three were available because they were above the benchmark of 50%. They are audiovisual lecture facilities such as television sets and projectors, electronic books, and interlinked hypertexts. Other resources were below the benchmark of 50%, which implies that they were not available. The implication is that most technology resources for pre-service teacher librarians' TPACK instruction skills were unavailable.

Table 3. Teachers-librarians Level of Awareness on TPACK for Instruction

S/N	Level of awareness on TPACK for Instruction	Mean
1	I possess a good understanding of how technology enhances pedagogy	2.71
2	I am very confident in solving technical issues during a lesson.	3.29
3	As a pre-service teacher, I can articulate the benefits of integrating technology in the classroom.	3.36
4	I can classify instruction with the use of technology to meet the various needs of students.	3.14
5	I am somewhat confident in my proficiency in using technology to assess students' leanings and progress	3.54
6	I can effectively measure students 'technology-related skills based on the content of the lessons.	3.43
7	I understand the subject matter I teach and its relationship to technology integration	3.50
8	I am moderately reflective on my teaching practice to improve technology integration pedagogically.	3.04
9	I do not actively seek professional development opportunities to enhance my TPACK skills and awareness	2.64
10	I do not actively seek out new and innovative educational technologies	2.50

Table 3 shows the teachers' and librarians' awareness of TPACK for instruction. All ten items on the table have mean scores above 2.50, indicating a high awareness of TPACK for instruction by teachers-librarians.

Table 4. t-test result on mean scores of male and female teachers-librarians on (TPACK) for instruction

Gender	N	Mean	SD	Df	F	P-value (2-tailed)	Decision
Male	100	3.2350	.27577	111	1.613	.240	Not Rejected
Female	50	3.0850	.41071				

Table 4 shows no significant difference in the respondent teachers' awareness level of teaching contents and mastery of teaching techniques based on qualification. This is reflected in the findings of hypothesis two tested df (28), F=1.613, p>0.05. Thus, the hypothesis that 'there is

no significance between male and female teachers-librarians on (TPACK) for instruction in Faculties of Education in Nigerian Universities' is not rejected.

DISCUSSION

The analysis in question one revealed that many technological resources necessary for enhancing pre-service teacher librarians' TPACK skills for instructional purposes were largely unavailable. This lack of access suggests that insufficient technological resources may hinder teachers' job performance and ability to engage with innovative teaching and learning methodologies. This finding contrasts with the observations made by Okunoye and Okunoye (2022), who reported a high availability of ICT facilities. Similarly, Ambe et al. (2024) noted that while e-learning technologies for environmental education pedagogy were generally accessible, lecturers reported specific tools such as multimedia projectors and data processing software as unavailable. However, Ambe et al. (2024) also pointed out that the availability of e-learning technologies was primarily due to lecturers procuring these resources independently. This situation underscores the ongoing challenge of technology availability in Nigerian educational institutions, which remains a significant concern in an era of rapid technological advancements. Consequently, this deficiency restricts Nigeria's competitiveness in the global educational landscape. Moreover, the fundamental infrastructural development associated with technology availability is still lacking, resulting in students' limited access and proficiency in utilising these essential technological resources. The result of the analysis on question two shows that there is a high level of awareness of TPACK for instruction by teachers-librarians. This implies that the pre-service teachers know the significance of using technology in the classroom. This finding agrees with Diamah et al. (2022), who reported that pre-service teachers understand the role of technology integration in the TPACK framework for creating meaningful learning experiences. Additionally, the finding agrees with Danyaro et al. (2024), who reported that pre-service teachers had a good awareness of the existence of OER. However, this finding does not agree with Adeoye and Ojo (2014), who reported that half of the teachers surveyed in this study lacked general technology knowledge but could learn quickly. Also, the hypothesis results show no significance between male and female teachers-librarians on (TPACK) for instruction in Faculties of Education in Nigerian Universities; this indicates that the gender divide in the use of technology is gradually closing. This result agrees with Deng et al. (2023), who reported that both male and female students exhibited a strong level of proficiency on the comprehensive TPACK scale.

CONCLUSION

This study examines the awareness of Technological Pedagogical Content Knowledge (TPACK) among pre-service teachers in universities in Ogun State, Nigeria, explicitly focusing on the availability of technology resources, the level of awareness of TPACK, and potential gender differences in these areas. The findings reveal several critical insights that contribute to understanding the current landscape of teacher education about technology integration. The analysis highlighted a significant gap in the availability of essential technological resources necessary for effective TPACK development among pre-service teachers. Although some resources, such as audiovisual facilities and electronic books, were reported as available, many others—like e-journals and online databases—were lacking. This scarcity of technological tools poses a considerable challenge for pre-service teachers, potentially hindering their ability to cultivate the necessary skills and competencies for integrating technology into their future classrooms. The study found a high awareness of TPACK concepts among the pre-service teachers. Participants demonstrated a solid understanding of how technology can enhance pedagogy and expressed confidence in their ability to articulate the benefits of technology integration in educational settings. This awareness is encouraging, as it suggests that pre-

service teachers are cognizant of the importance of TPACK in fostering meaningful learning experiences. Furthermore, examining gender differences in TPACK awareness revealed no significant disparities between male and female pre-service teachers. This finding indicates a positive trend toward equality in technological proficiency and pedagogical knowledge among genders. It suggests that male and female pre-service teachers possess similar capacities to utilise technology effectively in their teaching practices. The results of this study underscore the necessity for educational institutions to prioritise providing adequate technological resources and training for pre-service teachers. By ensuring that future educators have access to the necessary tools and support, universities can enhance the quality of teacher education and better prepare graduates for the demands of modern classrooms. Additionally, teacher education programs should continue to emphasise the importance of TPACK in their curricula. Integrating hands-on training with technology and pedagogical strategies will empower pre-service teachers to incorporate digital tools into their instructional practices confidently. Based on the findings, several recommendations can be made:

1. Universities should invest in acquiring and maintaining up-to-date technological resources to facilitate effective TPACK instruction for pre-service teachers.
2. Teacher education programs should incorporate comprehensive training on TPACK, focusing on practical technology applications in pedagogy to enhance learning outcomes.
3. Institutions should provide ongoing professional development opportunities for pre-service and in-service teachers to keep pace with technological advancements and pedagogical best practices.

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