Pedagogy Knowledge and Technology Integration Strategies among Teachers in Public Secondary Schools within Abuja Municipal Area Council (AMAC)

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ABSTRACT

In the contemporary educational system, integrating technology into pedagogical practices is essential for fostering student engagement, critical thinking, and digital literacy. This study investigates the extent of pedagogical knowledge and technology integration strategies among teachers in public secondary schools within Abuja Municipal Area Council (AMAC). Adopting a descriptive survey and correlational research design, the study assesses teachers' pedagogical competencies, technology adoption strategies, and the effectiveness of professional development programs in supporting technology-enhanced instruction. A stratified random sample of 200 teachers participated in the study, with data collected through a structured 4-point Likert scale questionnaire. Instrument reliability was established through a pilot study, yielding a satisfactory Cronbach's alpha coefficient. Data were analyzed using descriptive statistics, linear regression analysis, and Pearson Product-Moment Correlation Coefficient (PPMC) to examine relationships among key variables. Findings indicate that while teachers possess moderate pedagogical knowledge, significant gaps exist in training and confidence regarding technology integration. Teachers employ diverse technology strategies, including multimedia presentations, online learning platforms, and interactive software, to enhance student engagement and learning outcomes. However, inconsistencies in the effectiveness of these strategies highlight the need for targeted professional development. Administrative support and institutional policies also play a crucial role in facilitating technology adoption in secondary schools. Based on these findings, it is recommended that school administrators implement TPACK-aligned professional development programs, provide access to updated technological resources, and encourage collaborative teaching practices.

1. Introduction

In the ever-evolving contemporary education, the integration of technology and pedagogy has emerged as a fundamental force shaping teaching and learning methodologies. The seamless fusion of technology into pedagogical practices holds immense potential to redefine the educational experience, fostering engagement, critical thinking, and digital literacy among students (Bauer & Kenton, 2005; Mishra & Koehler, 2006). With the rapid advancements in technology, communication, access to information, and modes of learning have undergone profound transformations.

Educators today face the challenge of adapting their pedagogical approaches to harness the opportunities presented by technology, allowing students to engage with content in dynamic and interactive ways. This transition aligns with the global shift toward learner-centered education, emphasizing active engagement, critical thinking, and problem-solving skills (Tondeur et al., 2017). This imperative arises from the recognition that students must be empowered to engage with educational content in increasingly dynamic and interactive ways. Technology, with its multifaceted tools and platforms, catalyzes educational transformation. This paradigm shift mirrors a global trend that places learners at the heart of the educational process. In this framework, the traditional role of the teacher as a dispenser of knowledge is gradually giving way to that of a facilitator, guiding students on a journey of discovery and inquiry (Adebanjo, 2016). Learner-centered education places the student in an active role, encouraging them to explore, question, analyze, and synthesize information (Akande, Oyelami & Ojo, 2021).

In this dynamic learning environment, technology serves as a powerful enabler, offering a multitude of resources and tools that can be harnessed to cater to diverse learning styles and needs. It fosters an ecosystem where students can actively participate in their education, taking ownership of their learning journey (Adebanjo, 2021). Through technology, students can access a wealth of information, collaborate with peers across borders, and engage in problem-solving activities that mirror real-world challenges (Ihuoma & Akande, 2021).

The transition toward learner-centered education, fueled by the integration of technology, signifies a departure from traditional didactic methods (Akande, Oyelami & Ojo, 2021). It underscores the importance of nurturing in students the ability to think critically, to question, and to apply their knowledge in practical scenarios. Essentially, it empowers them with the skills and competencies necessary to thrive in a rapidly changing, knowledge-driven world. Thus, the integration of technology

into pedagogical practices becomes not merely a matter of choice but a strategic imperative for educators committed to fostering the holistic development of their students. The influence of digital technology on education transcends geographical boundaries, reshaping traditional instructional paradigms (Puentedura,2006). As digital tools become increasingly accessible, the distinction between conventional and technology-driven pedagogical approaches becomes more pronounced.

The Nigerian National Policy on Education (2014) recognizes the transformative potential of technology in enhancing effective learning. This policy underscores the pivotal role of teachers in translating educational objectives into meaningful classroom experiences. Consequently, teachers are expected to possess a comprehensive understanding of pedagogical principles while also demonstrating proficiency in utilizing technology to enhance engagement and learning outcomes (Federal Ministry of Education, 2013). Nigeria, with its youthful population and diverse educational landscape, stands at the intersection of technological innovation and educational reform. However, unlocking this potential requires the effective integration of technology and pedagogical expertise, with teachers playing a central role. Global research indicates that the successful integration of technology and pedagogy depends on various factors, including teacher professional development, access to technology infrastructure, alignment with curricula, and supportive administrative policies (Akande, R.M.,2018)In the Nigerian context, challenges such as infrastructural limitations, limited training opportunities, and limited awareness of innovative pedagogical practices are significant obstacles. Additionally, addressing the digital divide to ensure equitable access to technology-enabled education remains a pressing concern.

The demographic diversity of Abuja Municipal Area Council (AMAC) adds complexity to the challenges faced in integrating technology and pedagogy. The local council area encompasses a unique blend of socio-economic backgrounds, cultural contexts, and educational disparities, necessitating a nuanced approach to technology integration. Varied access to technology, differing levels of digital literacy, and disparities in pedagogical training create a multifaceted backdrop against which technology integration efforts unfold. Understanding these dynamics specific to AMAC is essential for shaping effective interventions.

Existing literature predominantly explores the theoretical framework, benefits, and challenges of technology integration (Bauer & Kenton, 2005; Mishra & Koehler, 2006), but there is a paucity of empirical research that delves into the specific context in AMAC and assesses the integration practices of teachers within this setting. Furthermore, the Nigerian National Policy on Education and its directive for technology integration creates an expectation for educators to embrace technology in their teaching. However, limited research exists that examines the degree to which this expectation has been met and the

factors influencing technology integration on the ground (Federal Ministry of Education, 2013). The unique socio-economic, cultural, and infrastructural development of AMAC's public secondary schools necessitates a nuanced examination of these practices within this specific context.

In addition, while some studies have explored factors influencing technology integration in education globally, these findings might not directly translate to the teachers in AMAC due to its unique challenges and opportunities (Ertmer et al., 2012). Factors such as limited technology infrastructure, varying levels of digital literacy, and inadequate professional development might interact differently within AMAC's secondary schools, thereby warranting a localized investigation. Hence, the present study aims to address this gap by conducting a comprehensive evaluation of technology and pedagogy integration practices among teachers in AMAC's public secondary schools. By exploring the challenges and opportunities encountered by teachers in their efforts to integrate technology, this study aims to contribute to the broader discourse on educational reform in Nigeria. As technology increasingly embeds itself in society, educators must be equipped with the skills to create technologically enriched learning environments. Identifying the barriers and facilitators of technology and pedagogy integration can inform targeted interventions, professional development initiatives, and policy decisions (Ertmer et al., 2012).

1.1 Study objectives

The specific objectives of this study are to:

1. Determine the current level of pedagogical knowledge among teachers in public secondary schools within Abuja Municipal Area Council (AMAC).
2. Examine various technology integration strategies employed by teachers in enhancing students' engagement, learning outcomes, and overall educational experience.
3. Determine the extent to which teacher professional development programs and training initiatives address the integration of technology and pedagogy knowledge in public secondary schools within AMAC.

1.2 Research Questions

The following Research Questions were raised

1. What is the current level of technology pedagogy knowledge among teachers in public secondary schools within Abuja Municipal Area Council (AMAC)?
2. What are the various technology integration strategies employed by teachers to enhance students' engagement and overall educational experience?

3. To what extent do teacher professional development programs and training initiatives address the integration of technology and pedagogy knowledge in public secondary schools within AMAC?

1.3 Research Hypotheses

Ho$_1$: Different technology integration strategies employed by teachers do not significantly impact students' engagement, learning outcomes, and overall educational experience.

Ho$_2$: Teacher professional development programs and training initiatives do not significantly address the integration of technology and pedagogy knowledge in public secondary schools within AMAC.

2. Methodology

The study employed a descriptive survey and coronational design to comprehensively investigate the integration of technology and pedagogy knowledge among teachers in public secondary schools within the Abuja Municipal Area Council (AMAC). A descriptive survey design is suitable for capturing the current state of practices, attitudes, and perceptions prevalent in the target population (McMillan & Schumacher, 2019). The population of this study consists of all teachers in AMAC's public secondary schools. Due to the extensive nature of the population, a sample size of 200 teachers was selected using stratified random sampling. Strata were created based on subject areas. The sample size is deemed appropriate to achieve a representative sample while considering feasibility and available resources (Kothari, 2004).

A structured questionnaire was used as the primary data collection instrument. The questionnaire was designed in a 4-point Likert scale format, ranging from "Strongly Agree" to "Strongly Disagree." This format allows for capturing respondents' opinions and attitudes regarding the integration of technology and pedagogy knowledge (Creswell, 2014). Before the main data collection, a pilot test was conducted with a small sample of teachers who were not part of the selected sample. The purpose of the pilot test was to determine the reliability of the questionnaire. Reliability was measured using internal consistency methods such as Cronbach's alpha coefficient. The results of the pilot test indicated the degree of consistency and stability of the questionnaire's items. Permission was sought from relevant authorities before conducting the study. The questionnaires were distributed to the selected teachers in AMAC's public secondary schools.The collected data were analyzed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics such as frequencies, percentages, means, and standard deviations were computed to provide a comprehensive overview of teachers' responses. Inferential statistics, including linear regression analysis and Pearson Product Moment Correlation Coefficient (PPMC), were employed to explore relationships and influences among variables (Leedy & Ormrod, 2019).

Conceptual Framework of TPACK
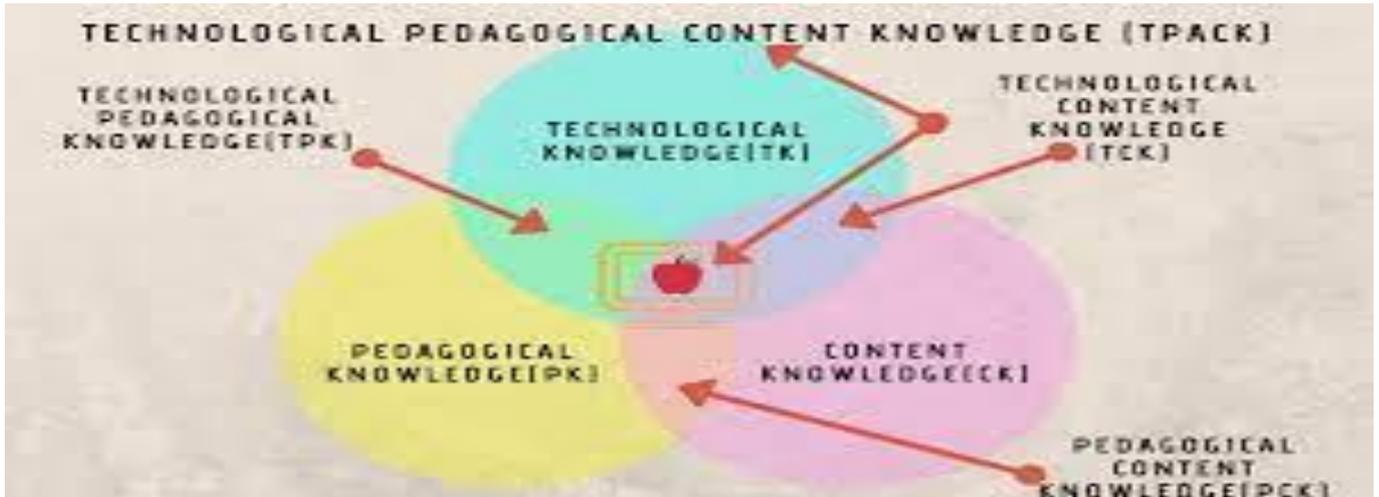
The TPACK framework, which stands for Technological Pedagogical Content Knowledge, was developed to help educators understand and navigate the complex interactions between technology, pedagogy (teaching practices), and content knowledge. It was developed by scholars Punya Mishra and Matthew Koehler in the early 2000s.

The TPACK framework recognizes that effective teaching involves the intersection of three primary types of knowledge:

Technological Knowledge (TK): This refers to knowledge about the tools and technologies available for teaching and learning. It includes an understanding of how to use hardware, software, digital resources, and other technological tools effectively.

Pedagogical Knowledge (PK): This involves knowledge about teaching strategies, methods, and approaches. It encompasses understanding how to design and deliver effective lessons, manage classrooms, and engage students in the learning process.

Content Knowledge (CK): This refers to knowledge about the subject matter being taught. It includes a deep understanding of the concepts, principles, and facts within a particular content area, whether it's mathematics, science, history, or any other subject.

The power of the TPACK framework lies in the intersections of these three types of knowledge:

Technological Pedagogical Knowledge (TPK) represents the knowledge of how to use technology to enhance teaching and learning. This involves knowing which technology tools and strategies are most appropriate for specific pedagogical goals (Mishra & Koehler, 2006). TPK emerges at the intersection of Technological Knowledge (TK) and Pedagogical Knowledge (PK).

Pedagogical Content Knowledge (PCK) is the knowledge of how to teach specific content effectively. It involves understanding how to adapt and present subject matter in a way that is understandable and engaging to students (Shulman, 1986). PCK arises at the intersection of PK and Content Knowledge (CK).

Technological Content Knowledge (TCK) is the knowledge of how to teach specific content using technology. It involves knowing how to integrate technology seamlessly into subject matter instruction (Niess, 2005). TCK emerges at the intersection of TK and CK.

Technological Pedagogical Content Knowledge (TPACK) is the ultimate goal. It represents the knowledge and expertise needed to successfully integrate technology, pedagogy, and content knowledge (Koehler & Mishra, 2009). It's the sweet spot where all three types of knowledge intersect. Teachers with strong TPACK can select the right technology tools, apply effective teaching strategies, and deliver subject matter in a way that optimizes learning outcomes.

In essence, the TPACK framework helps educators understand that technology should not be used in isolation but should be integrated purposefully into teaching and learning, considering the specific content and pedagogical goals. It acknowledges that effective teaching requires a balanced blend of these different knowledge domains, and teachers who master the intersections can provide richer and more engaging educational experiences for their students (Harris, Mishra, & Koehler, 2009).

3. **Results and Analysis**

This section analyzes, interprets, and presents the data obtained in the course of the study. The quantitative data obtained from the field were analysed with the aid of Statistical Package for Service Solution (SPSS) version 23.

3.1 Analysis of Research Questions

The descriptive analysis of the constructs demonstrated the general opinion of the respondents by determining the mean of each item as well as the overall mean of the construct. The researcher made use of a 4-point Likert scale, and as such, remarked that a mean of 0.9-2.4 represents disagree while 2.5-4.0 indicates agree. It is worthy of note that the results are outcomes of the descriptive analysis, therefore, they do not represent the findings of inferential statistics in this study.

Research Question 1: What is the current level of technology pedagogy knowledge among teachers in public secondary schools within the Abuja Municipal Area Council (AMAC)?

The mean rating is as follows; Keys: SD = Strongly disagree (1); D = Disagree (2); A = Agree (3); SA = Strongly agree (4)

Table 1: The current level of technology pedagogy knowledge among teachers

S/N	Items	SA	A	D	SD	X	SD	Decision
1	I am confident in my ability to integrate technology into classroom teaching	45	30	85	40	2.4	1.047	Disagreed
		-22.50%	-15.00%	-42.50%	-20.00%			
2	I have received sufficient training and professional development in technology integration.	40	30	75	55	2.28	1.071	Disagreed
		-20.00%	-15.00%	-37.50%	-27.50%			
3	I regularly incorporate technology tools and resources to enhance student engagement.	45	45	65	45	2.45	1.074	Disagreed
		-22.50%	-22.50%	-32.50%	-22.50%			
4	I feel comfortable using a variety of educational software and digital platforms for instruction	60	65	45	30	2.79	1.041	Agreed
		-30.00%	-32.50%	-22.50%	-15.00%			
5	I believe that technology can significantly improve the learning outcomes of my students	85	50	40	25	2.98	1.063	Agreed
		-42.50%	-25.00%	-20.00%	-12.50%			
6	I actively seek out new technological innovations to enhance my teaching practices	60	65	45	30	2.78	1.039	Agreed
		-30.00	-32.50	-22.50	-15.00			

S/N	Items	%	%	%	%			
7	I collaborate with colleagues to share best practices in technology integration.	85	50	40	25	2.98	1.063	Agreed
		-42.50%	-25.00%	-20.00%	-12.50%			
	Grand Mean					**2.67**		

Field Survey, 2024

Table 1 demonstrates the mean of each item on the opinion of the students regarding the effect of the current level of technology pedagogy knowledge among teachers in public secondary schools within the Abuja Municipal Area Council. The result shows that items 1 to item 7 have mean scores of 2.40, 2.28, 2.45, 2.79, 2.98, 2.78, and 2.98 respectively which indicates a level of agreement to the statements above. Generally, the grand mean for the construct reveals 2.67, and the implication of this is that the majority of the respondents agreed with the above statement.

Research Question 2: Examine various technology integration strategies employed by teachers in enhancing students' engagement, learning outcomes, and overall educational experience. The mean rating is as follows; Keys: SD = Strongly disagree (1); D = Disagree (2); A = Agree (3); SA = Strongly agree (4)

Table 2: Various technology integration strategies employed by teachers

S/N	Items	SA	A	D	SD	X	SD	Decision
1	Teachers use multimedia presentations and visual aids to make lessons more engaging	60	65	45	30	2.79	1.041	Agreed
		-30.00%	-32.50%	-22.50%	-15.00%			
2	Online platforms and learning management systems are used to share resources and assignments	85	50	40	25	2.98	1.063	Agreed
		-42.00%	-25.00%	-20.00%	-12.50%			
3	Interactive software and educational apps are regularly incorporated into lessons	60	65	45	30	2.78	1.039	Agreed
		-30.00%	-32.50%	-22.50%	-15.00%			
4	Teachers encourage collaborative online projects and discussions	85	50	40	25	2.98	1.063	Agreed

S/N	Items	SA	A	D	SD	X	SD	Decision
	among students							
		-42.50%	-25.00%	-20.00%	-12.50%			
5	Flipped classroom techniques, where students review materials at home and engage in discussions during class, are utilized	50	45	60	45	2.51	1.094	Agreed
		-25.00%	-22.50%	-30.00%	-22.50%			
6	Teachers provide online quizzes and assessments for immediate feedback	45	51	61	43	2.49	1.066	Disagreed
		-22.50%	-25.50%	-30.50%	-21.50%			
7	Gamification and educational games are integrated into the curriculum to enhance learning	60	65	45	30	2.78	1.039	Agreed
		-30.00%	-32.50%	-22.50%	-15.00%			
	Grand Mean						2.76	

Field Survey, 2024

Table 2. Reveals the mean of each item on the opinion of respondents on the impact of peer-pleasure on their students. The result shows that items 1 to 7 have mean scores of 2.79, 2.98, 2.78, 2.98, 2.51, 2.49 and 2.78 each which specifies a level of agreement with the statements. The grand mean for the construct is 2.76 which means that most of the respondents agreed that facilities like the library are important and must be provided by the school authority.

Research Question 3. Determine the extent to which teacher professional development programs and training initiatives address the integration of technology and pedagogy knowledge in public secondary schools within Abuja Municipal Area Council (AMAC).

Table 3: The extent to which teacher professional development programs and training initiatives address the integration of technology

S/N	Items	SA	A	D	SD	X	SD	Decision
1	School leaders actively encourage teachers to explore innovative uses of technology in the classroom	74	66	31	29	2.93	1.01	Agreed
		-	-	-	-			

No	Item					Mean	SD	Remark
		37.00 %	33.00 %	15.50 %	14.50 %			
2	Administrative support is readily available when teachers encounter challenges with technology integration	65	72	37	26	2.88	1.01	Agreed
		32.5%)	- 36.00 %	- 18.50 %	- 13.00 %			
3	School leaders provide opportunities for professional development focused on technology integration	75	64	31	30	2.91	1.078	Agreed
		- 37.50 %	- 32.00 %	-15.5	- 15.00 %			
4	Administrative policies promote a culture of experimentation and innovation in teaching with technology	79	58	40	23	2.97	1.029	Agreed
		- 39.50 %	- 29.00 %	- 20.00 %	- 11.50 %			
5	Teachers feel motivated to integrate technology because they receive recognition and appreciation from school leadership	66	55	38	41	2.73	1.128	Agreed
		- 33.00 %	- 27.00 %	- 19.00 %	- 20.50 %			
6	Institutional support includes access to updated technological resources and tools for teaching	76	69	31	24	2.98	1.017	Agreed
		- 38.00 %	- 34.50 %	- 30.50 %	-12%			
7	School leaders involve teachers in decision-making processes related to technology adoption and integration	75	85	21	19	3.08	0.926	Agreed
		- 37.50 %	- 42.50 %	- 10.50 %	- 9.50%			
	Grand Mean						2.93	

Field Survey, 2024

Table 3. Demonstrates the mean of each item on the opinion of the teachers regarding the effect of depression on the academic performance of their students. The result shows that items 1 to item 7 have mean scores of 2.93, 2.88, 2.91, 2.97, 2.73, 2.98, and 3.08 respectively, each of which indicates a level of agreement with the statements above. Generally, the Grand Mena reveals 2.93, which shows that the majority of the students agreed on the extent to which teacher professional development programs and

training initiatives address the integration of technology and pedagogy knowledge in public secondary schools within Abuja Municipal Area Council (AMAC).

3.2 Test of Hypotheses

Hypothesis One

HO_1 - Different technology integration strategies employed by teachers do not significantly impact students' engagement, learning outcomes, and overall educational experience.

Table 3: Linear Regression Analysis Results of different technology integration strategies employed by teachers do not significantly impact students' engagement, learning outcomes, and overall educational experience.

Model summary								
R= .967[a]								
$R^2 = .935$								
R^2 (Adjusted) = .935								
Standard Error of Estimate = .25967								
F=1360.478, P <0.05								
Model		Unstandardized Coefficients				Standardized Coefficients	T	p. **Decision**
		B	Std. Error			Beta		
1	(Constant)	-0.203	0.056				-3.398	.140 **Reject**
	Difference Technology Strategy	0.972	0.01			0.967	53.412	.000 HO_1
a. Predictors: (Constant), VTI								
b. Dependent Variable: Difference Technology Strategy								

The result from Table 4. revealed that different technology integration strategies employed by teachers had a strong positive correlation with students' engagement, learning outcomes, and overall educational experience (R=.967). The R square value of .935 indicated that the different technology integration strategies employed by teachers contributed 93.5% to the variability of students' engagement, learning

outcomes, and overall educational experience. This implies that for every small change in technology integration strategies employed by teachers, there is 93.5% change leading to an increase in students' engagement, learning outcomes, and overall educational experience. Hence, this gives the reason the predictor variable which is different technology integration strategies employed by teachers is statistically significant with students' engagement, learning outcomes, and overall educational experience rate given (β=.967, t=53.412, p=.000<.005). This means that the null hypothesis is rejected, while the alternate hypothesis is accepted. Hence, different technology integration strategies employed by teachers significantly impact students' engagement, learning outcomes, and overall educational experience.

Hypothesis Two

Ho$_2$: Teacher professional development programs and training initiatives do not significantly address the integration of technology and pedagogy knowledge in public secondary schools within AMAC.

Table 5: Teacher professional development programs and training initiatives

Variable	Mean	SD	N	Df	r*	P	Remark Decision
Teacher professional development programs	43.61	10.7					
				198	0.94	0	Sig. Accept H$_2$
Training initiatives	45.15		200				
		12.4					

p<0.05

The correlation coefficient is .940. This means that there is a strong positive teacher professional development programs and training initiatives. Since the *p-value* .000 is less than the level of significance of 0.05 (*p*<0.05), the null hypothesis is rejected while the alternate hypothesis is accepted which means teacher professional development programs and training initiatives significantly address the integration of technology and pedagogy knowledge in public secondary schools within AMAC.

4. Discussion

The results indicate a mixed perception among teachers regarding their confidence in integrating technology into classroom teaching and the sufficiency of their training in technology integration. While some aspects, such as feeling comfortable using educational software and believing in the potential of technology to improve learning outcomes, received relatively higher agreement scores, other areas like receiving sufficient training and incorporating technology tools into lessons showed lower agreement scores. The findings align with research by Ertmer et al. (2012), which highlights the variability in teachers' confidence and proficiency in technology integration. They emphasize the importance of targeted professional development to address gaps in technology pedagogy knowledge and enhance teachers' capacity to integrate technology effectively. Additionally, Mishra & Koehler (2006) advocate for a comprehensive understanding of the TPACK framework to navigate the complexities of technology integration. The study's findings suggest a need for more targeted training aligned with the TPACK framework to enhance teachers' confidence and proficiency in technology integration. Also, the findings reveal that teachers commonly utilize various technology integration strategies to enhance student engagement, learning outcomes, and overall educational experience. Strategies such as using multimedia presentations, online platforms, interactive software, and collaborative projects are widely adopted. However, there are differences in the level of agreement across strategies, with some, like online quizzes and assessments, receiving lower agreement scores. The widespread adoption of technology integration strategies reflects the findings of studies by Tondeur et al. (2017) and Koehler & Mishra (2008), which emphasize the importance of diversifying instructional approaches to cater to different learning styles and preferences. However, discrepancies in the level of agreement across strategies underscore the importance of contextual factors and individual preferences in technology integration, as noted by Selwyn (2016). This highlights the need for ongoing support and professional development tailored to individual teacher needs.

The results also demonstrate a high level of agreement among teachers regarding the support and opportunities provided by school leaders and administrative policies for professional development in technology integration. Factors such as encouragement from school leaders, availability of administrative support, provision of professional development opportunities, and institutional support contribute to creating a conducive environment for technology integration. The findings corroborate the importance of administrative support and institutional policies in fostering a culture of innovation and experimentation in technology integration, as advocated by Stone (2015) and Colvin (2010). They emphasize the role of leadership in creating an enabling environment for teacher professional development.

Moreover, the positive perception of teacher training initiatives aligns with the literature on effective professional development models, emphasizing hands-on experiences, collaborative learning, and ongoing support (Darling-Hammond et al., 2009). This suggests that the design and implementation of professional development programs are critical determinants of their effectiveness in addressing the integration of technology and pedagogy knowledge.

The results of the regression analysis also reveal a strong positive correlation between technology integration strategies and student outcomes, as indicated by the high coefficient of determination ($R^2 =$ .935) and statistically significant F-value (F = 1360.478, $p < 0.05$). This suggests that variations in technology integration strategies lead to corresponding changes in student engagement and learning outcomes, emphasizing the pivotal role of strategic technology use in education. This finding is consistent with existing literature, which highlights the potential of technology to enhance teaching and learning outcomes (Bauer & Kenton, 2005; Mishra & Koehler, 2006).

The results of the correlation analysis also demonstrate a strong positive correlation between teacher professional development programs/training initiatives and technology integration efforts, as evidenced by the high correlation coefficient (r = .940) and statistically significant p-value ($p < 0.05$). This indicates that investments in teacher training positively influence technology integration efforts, underscoring the importance of ongoing professional development in enhancing pedagogical practices. This finding aligns with previous research, which emphasizes the role of teacher training in facilitating effective technology integration in educational settings (Ertmer et al., 2012; Selwyn, 2016).

5. Conclusion and recommendations

The study provides valuable insights into the integration of technology and pedagogy knowledge among teachers in public secondary schools within the Abuja Municipal Area Council (AMAC). The findings highlight both the opportunities and challenges associated with technology integration in education. While teachers demonstrate a willingness to adopt various technology integration strategies and perceive professional development initiatives positively, there are areas where further support and targeted interventions are needed.

The study reveals that while some teachers feel confident in their ability to integrate technology into classroom teaching and actively seek out innovative technological solutions, others express concerns about the sufficiency of their training and support in this area. Discrepancies in the level of agreement across different technology integration strategies suggest the importance of tailored professional development programs that address the diverse needs and preferences of teachers.

Furthermore, the study underscores the critical role of school leaders and administrative policies in fostering a conducive environment for technology integration. Supportive leadership, encouragement from school leaders, and access to updated technological resources are essential factors that contribute to the successful integration of technology and pedagogy knowledge in education.

Recommendations

From the study, the following recommendations were provided:

1. School administrators should design and implement professional development programs that are aligned with the TPACK framework and tailored to the specific needs and preferences of teachers. Offer hands-on training, workshops, and collaborative learning opportunities to enhance teachers' confidence and proficiency in technology integration.

2. Culture of innovation and experimentation should Fostered by providing leadership support, encouragement, and recognition for teachers who demonstrate excellence in technology integration. Involve teachers in decision-making processes related to technology adoption and integration to promote ownership and accountability.

3. Teachers should be provided access to updated technological resources, hardware, software, and digital platforms to support technology integration efforts. Invest in the development of technology infrastructure and provide ongoing technical support to address any challenges or barriers faced by teachers.

4. Encourage collaboration among teachers to share best practices, resources, and innovative approaches to technology integration. Establish professional learning communities or online platforms where teachers can collaborate, exchange ideas, and support each other in their technology integration efforts.

5. There should be regularly evaluation of the effectiveness of technology integration efforts through surveys, assessments, and feedback mechanisms.

Data availability

No datasets were generated or analyzed during the current study.

Declarations

Ethics approval and consent to participate

The author(s) declare that it is not applicable.

Consent for publication

The author(s) declare that this is not applicable.

Competing interests

The author(s) declare that they have no competing interests.

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