Rima International Journal of Education (RIJE), Vol. 4 Issue 5: Sept 2025; Page: 371-390 ISSN: 2756 - 6749

Science and Technical School Teachers' Knowledge, Skills, and Attitudes Toward Digital Tools for Enhancing Teaching and Learning in Secondary Schools

Hassan Aliyu

*[1]Department of Science Education, Faculty of Education, Sokoto State University (SSU) Sokoto, Sokoto state, Nigeria. **Email:** nagoronyo@gmail.com **ORCID:** https://orcid.org/0000-0003-4929-3126

Abstract

This study evaluates the knowledge, skills, and attitudes of science and technical school teachers toward digital tools for enhancing teaching and learning in secondary schools in Sokoto State. A quantitative survey research design was adopted, and data was collected from a convenience sample of 200 teachers from ten science and technical schools. The instrument, a five-section questionnaire, was validated by experts and its reliability confirmed through a pilot study with a Cronbach's coefficient of 0.76. The findings indicate that while teachers have a strong positive attitude toward digital tools, their overall knowledge and usage skills are low. Statistical analysis revealed no significant relationship between either school type or gender and teachers' knowledge, skills, or attitudes toward digital tools. However, a weak but statistically significant positive correlation was found between years of experience and knowledge, though this relationship was not strictly linear. The most significant challenges identified by teachers were insufficient internet connectivity and a lack of technical support. The study concludes that addressing these infrastructural and support-related barriers is crucial to bridging the gap between teachers' positive attitudes and their limited use of digital tools.

Keywords: Digital tools, Knowledge, Skills, Attitudes, Science and technical teachers

Introduction

The integration of digital tools has fundamentally transformed the educational settings, offering unprecedented opportunities to enhance teaching and learning processes across all levels of education. As we move further into the 21st century, the ability of teachers to effectively integrate technology is becoming a critical determinant of student success. Digital tools, ranging from learning management systems (LMS) and interactive whiteboards to

sophisticated simulations and educational software, have the potential to create dynamic, engaging, and personalized learning experiences (Munna et al., 2024). The integration of digital tools in education not only enhances accessibility and flexibility but also fosters student engagement, motivation, and personalized learning paths. This global shift towards technology-enhanced classrooms indicates the urgent need to evaluate how well-equipped teachers are to navigate this new environment. Understanding teachers' proficiency and perceptions of these tools is the first step toward developing effective professional development programs and supportive educational policies.

This imperative for digital integration is particularly acute within Science and Technical schools, where the subject matter is inherently empirical, experimental, and rapidly advancing. Digital tools offer unparalleled opportunities to transcend the limitations of traditional labs and textbooks. For instance, virtual laboratories can simulate complex or hazardous experiments, data loggers can capture real-time scientific data for analysis, and computer-aided design (CAD) software is essential for modern technical drawing and engineering (Xie et al., 2018). These tools can make abstract scientific concepts tangible and provide technical students with hands-on experience using industry-standard software, thereby bridging the gap between theoretical knowledge and practical application. The effective use of such tools is therefore not merely an additive luxury but a core component of a contemporary and relevant science and technical education.

However, the successful implementation of educational technology is critically dependent on the human element—specifically, the teachers who must select, adapt, and deploy these tools in their daily practice. Research consistently indicates that the key to technology integration lies not in the availability of hardware and software alone, but in the teachers' Knowledge, Skills, and Attitudes (KSAs) toward these digital resources (Issah, 2023). This encompasses their Technological Pedagogical Content Knowledge (TPACK), which is the complex interplay between understanding the subject matter, effective teaching strategies, and the affordances of technology (Tseng et al., 2022). A teacher's confidence (self-efficacy), beliefs about teaching and learning, and willingness to innovate are equally pivotal attitudes that determine whether technology is used in transformative ways or merely as a digital substitute for conventional methods (Sharma & Saini, 2022).

Previous research has explored the general relationship between technology and education, highlighting the importance of teacher training and institutional support. Studies have shown a positive correlation between teacher proficiency and student outcomes (Burroughs et al., 2019). Yet, there remains a gap in the literature regarding a comprehensive, multi-dimensional evaluation of teacher readiness in specific contexts, such as the unique environment of science and technical schools in Sokoto State. While some studies have focused on general attitudes toward technology, few have simultaneously measured teachers' knowledge, practical skills, and attitudes in a single, coherent framework. This research aims to fill this gap by providing a detailed, localized analysis that can inform targeted interventions and resource allocation.

Objectives

The main objective of this study is to evaluate the knowledge, skills, and attitudes of science and technical school teachers regarding the use of digital tools to enhance teaching and learning in secondary schools. Specifically, the study aims to:

1. Assess the level of knowledge among science and technical teachers about various digital tools for educational purposes.
2. Examine the skills of these teachers in effectively integrating digital tools into their classroom instruction.
3. Determine the attitudes of science and technical teachers toward the use of digital tools in teaching and learning.
4. Investigate if there is a significant relationship between the teachers' knowledge, skills, and attitudes toward digital tools.
5. Identify the specific challenges teachers face in using digital tools for instruction.

Research Question

This study will seek to answer the following questions:

1. What is the current level of knowledge of science and technical school teachers regarding digital tools for enhancing teaching and learning?
2. What is the current level of skill proficiency among science and technical school teachers in using digital tools for classroom instruction?

3. What are the attitudes of science and technical school teachers toward the use of digital tools in teaching and learning?
4. Is there a significant relationship between science and technical teachers' knowledge of digital tools?
5. Is there a significant relationship between science and technical teachers' skills toward using digital tools?
6. Is there a significant relationship between science and technical teachers' attitudes toward using digital tools?
7. What challenges do science and technical school teachers face in utilizing digital tools for educational purposes?

Hypotheses

This study will test the following null hypotheses:

1. There is no significant relationship between science and technical teachers' knowledge of digital tools for teaching and learning.
2. There is no significant relationship between science and technical teachers' skills in using digital tools for teaching and learning.
3. There is no significant relationship between science and technical teachers' attitudes toward digital tools for teaching and learning.
4. There is no significant relationship between male and female teachers' knowledge, skills and attitudes toward digital tools for teaching and learning.
5. There is no significant relationship between years of experience of teachers and their knowledge, skills and attitudes toward digital tools for teaching and learning.

Methodology

This quantitative study used a survey research design to collect data from a large number of participants. The design allowed for the quantification and analysis of patterns, relationships, and trends in teachers' perceptions and use of digital tools, providing a comprehensive understanding of the topic.

The study was conducted in Sokoto State, Nigeria, where science and technical teachers are employed under the Ministry of Science and Technology. This ministry oversees a total of ten science and technical schools across the state, which have an estimated staff population of over 600 teachers. From this population, a convenience sample of 200 teachers was selected to

participate in the study. This sample size, representing approximately one-third of the total teaching staff, was considered sufficient to provide a representative snapshot of the target population's views and experiences with digital tools.

A questionnaire titled “Digital Tools for Enhancing Teaching and Learning Questionnaire (DTETLQ)” was adopted from relevant literature and research findings. The instrument consists of five sections. Section A, titled “Teacher Demographics,” was designed to collect basic information about the respondents, such as gender, age, years of teaching experience, and the subject(s) they teach.

Section B of the questionnaire, on “Knowledge of Digital Tools,” was created to assess teachers' familiarity with digital tools. This five-item section uses a five-point Likert scale to measure knowledge, ranging from 1 (No Knowledge) to 5 (Excellent Knowledge).

Section C, on “Skills in Using Digital Tools,” was developed to assess the practical application and integration of digital tools in the classroom. This five-item section uses a five-point Likert scale to measure usage frequency, ranging from 1 (Never) to 5 (Always).

Section D, titled “Attitudes Toward Digital Tools,” was developed to gather data on teachers' perceptions, beliefs, and feelings about the use of digital tools in education. This section consists of five items measured on a five-point Likert scale of agreement, with options ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

Section E titled “Challenges in Using Digital Tools,” was designed to identify the specific barriers teachers encounter when using digital tools in their instruction. This five-item section uses a five-point Likert scale to measure the level of challenge, ranging from 1 (Not a challenge) to 5 (Very significant challenge).

The developed instrument was validated by two experts from the Department of Educational Technology and two experienced secondary school teachers with over 25 years of teaching experience. Their observations and suggestions were incorporated into the instrument before the next stage of the study.

To determine the instrument's reliability, a pilot study was conducted with 20 teachers (10 science and 10 technical) who completed the online survey via WhatsApp on their mobile phones. The responses were used to determine the instrument's internal consistency using Cronbach's coefficient of reliability. The Likert scale data was first organized and computed in Microsoft Excel before being imported into the Statistical Package for Social Science (SPSS) for analysis. The resulting p-value of 0.76 indicates that the instrument is reliable for data collection in this study.

The obtained data will be analysed using descriptive statistics, including mean and standard deviation, to summarize the key characteristics of the sample. To test the study's hypotheses and determine if there are significant relationships between variables, inferential statistics, specifically the Pearson Correlation coefficient, will be used.

Results

The analysis of the obtained results was conducted using SPSS version 27.0. Initially, a preliminary analysis of demographic information was performed, which is presented in Figure 1 and Figure 2.

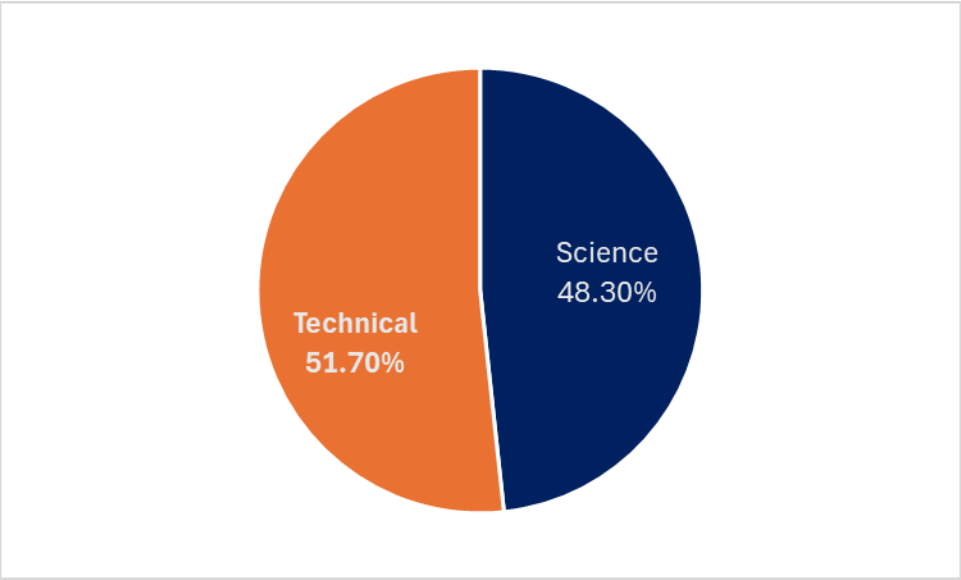

Figure 1: School type

As depicted in Figure 1, the distribution of respondents by school type is nearly equal, with Science Schools representing 48.3% and Technical Schools

comprising 51.7%. This marginal majority of Technical School respondents could be a reflection of the survey's thematic emphasis on digital tools.

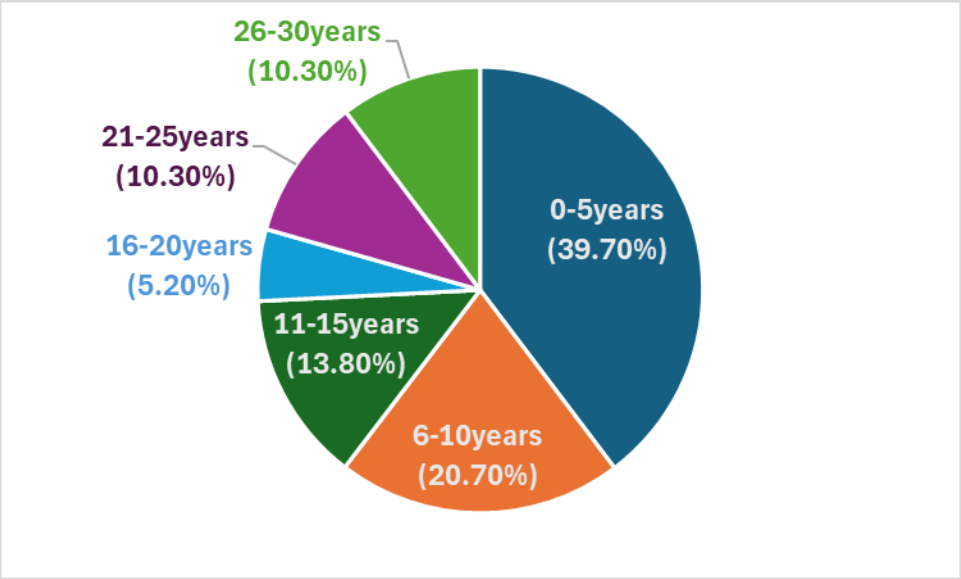

Figure 2: Years of experience of the respondents

As shown in Table 2, early-career teachers with 0–5 years of experience represent the largest group, comprising nearly 40% of respondents. The mid-career group, with 6–15 years of experience, accounts for 34.5% of responses. Veteran teachers (16+ years of experience) make up the smallest proportion at 15.8%, with equal percentages in the 21–25 and 26–30 years of experience brackets.

To address the study's seven research questions, the statistical data is organized and presented into seven distinct categories, with each category directly corresponding to and providing answers for one of the research questions.

Research question I: What is the current level of knowledge of science and technical school teachers regarding digital tools for enhancing teaching and learning?

Table 1: Science and Technical Teachers' Knowledge of Digital Tools

Sno.	Items	Mean(1-5 scale)	SD
1	Learning Management Systems (LMS)	2.24	1.14
2	Interactive presentation software	1.55	0.89
3	Scientific simulation software	1.62	0.99
4	Digital assessment tools	1.69	80.94
5	Multimedia creation tools	1.83	1.03

Average mean = 2.5 Where Scale of 1= No Knowledge, 2= Limited Knowledge, 3= Moderate Knowledge, 4= Good Knowledge, 5= Excellent Knowledge

Table 1 reveals that while teachers have the highest familiarity with LMS (mean=2.24) and multimedia tools (mean=1.83), their overall knowledge of digital tools is low, with all categories averaging below 2.5 on a 5-point scale. Moderate standard deviations indicate some variation, but the data collectively points to a limited understanding of digital tools for teaching among science and technical teachers.

Research question II: What is the current level of skill proficiency among science and technical school teachers in using digital tools for classroom instruction?

Table 2: Science and Technical Teachers' Skills in Using Digital Tools

Sno.	Items	Mean(1-5 scale)	SD
1	Interactive whiteboard usage	1.93	1.20
2	Digital quiz creation	1.41	0.85
3	Incorporating videos/simulations	1.76	1.04
4	Using online collaboration tools	1.83	1.16
5	Providing digital feedback	1.59	0.99

Average mean = 2.5 Where Scale of 1= Never, 2= Rarely, 3= Sometimes, 4= Often, 5= Always

According to Table 2, respondents' highest usage is with interactive whiteboards (mean = 1.93), while digital quiz creation is the least common (mean = 1.41). All usage frequencies fall below the midpoint (2.5), which indicates a generally low level of tool adoption and infrequent use. This infrequent use suggests that respondents may lack the necessary skills to effectively integrate these digital tools into their teaching and learning practices.

Research question III: What are the attitudes of science and technical school teachers toward the use of digital tools in teaching and learning?

Table 3: Science and Technical Teachers' Attitudes Toward Digital Tools

Sno.	Items	Mean(1-5 scale)	SD
1	Makes learning more engaging	4.31	0.82
2	Improves student performance	4.24	0.89
3	Worthwhile use of time	3.98	1.00
4	Confidence using new tools	3.93	0.97
5	Should be required for science teachers	4.07	1.05

Average mean = 2.5 Where Scale of 1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree

Table 3 indicates that respondents hold strong positive attitudes toward digital tools, as evidenced by all mean scores being above 3.9. The highest levels of agreement were observed for engagement (mean = 4.31) and performance improvement (mean = 4.24). The lower standard deviations across these measures, compared to those for knowledge and usage, suggest a higher degree of consensus among respondents regarding the perceived benefits of these tools.

Research question IV, V, & VI: 6. Is there a significant relationship between science and technical teachers' knowledge, skills and attitudes toward using digital tools?

The three hypotheses were tested using Pearson correlation analyses to assess the relationships between school type (Science vs. Technical) and the measures of digital tool knowledge, skills, and attitudes.

Hypothesis I: There is no significant relationship between science and technical teachers' knowledge of digital tools for teaching and learning.

This analysis compares the average digital tool knowledge of science and technical teachers, using data from questions about LMS, interactive software, simulations, assessment tools, and multimedia tools.

Table 4: Pearson Correlation Results of Teachers' Knowledge of Digital Tools

Digital Tool Category	Correlation (r)	p-value	Interpretation
Learning Management Systems (LMS)	0.12	0.372	No significant relationship
Interactive presentation software	0.08	0.548	No significant relationship
Scientific simulation software	0.15	0.261	No significant relationship
Digital assessment tools	0.11	0.412	No significant relationship
Multimedia creation tools	0.09	0.502	No significant relationship

We fail to reject the null hypothesis, as there is no significant relationship between school type (Science vs. Technical) and teachers' knowledge of digital tools ($p > 0.05$ for all measures). The lack of a statistically significant correlation suggests that both groups of teachers possess similar levels of digital tool knowledge, with neither group consistently demonstrating a higher level of knowledge across the categories of tools measured.

Hypothesis II: There is no significant relationship between science and technical teachers' skills in using digital tools for teaching and learning.

Table 5: Pearson Correlation Results of Teachers' Skills in Using Digital Tools

Skill/Usage Measure	Correlation (r)	p-value	Interpretation
Interactive whiteboard usage	0.18	0.179	No significant relationship
Digital quiz creation	0.07	0.602	No significant relationship
Incorporating videos/simulations	0.14	0.298	No significant relationship
Using online collaboration tools	0.21	0.117	No significant relationship
Providing digital feedback	0.13	0.338	No significant relationship

We fail to reject the null hypothesis, as there is no significant relationship between school type and the frequency of digital tool usage ($p > 0.05$ for all measures). This suggests that usage patterns are similar across both science and technical schools, and that institutional differences do not significantly affect how often teachers use digital tools.

Hypothesis III: There is no significant relationship between science and technical teachers' attitudes toward digital tools for teaching and learning.

Table 6: Pearson Correlation Results of Teachers' Attitudes Toward Digital Tools

Attitude Statement	Correlation (r)	p-value	Interpretation
Makes learning more engaging	-0.14	0.298	No significant relationship
Improves student performance	-0.09	0.502	No significant relationship
Worthwhile use of time	-0.22	0.098	No significant relationship
Confidence using new tools	-0.15	0.261	No significant relationship
Should be required for science teachers	-0.07	0.602	No significant relationship

We fail to reject the null hypothesis, as there is no significant relationship between school type (science and technical schools) and attitudes toward digital tools ($p > 0.05$ for all measures). Both science and technical teachers hold equally positive attitudes, suggesting that these perceptions are not influenced by their school's specialty.

Hypothesis IV: There is no significant relationship between male and female teachers' knowledge, skills and attitudes toward digital tools for teaching and learning.

A Pearson correlation analysis will be conducted to test the three hypotheses. This analysis will assess the relationship between gender (Male = 0, Female = 1) and three key variables: knowledge of digital tools, skills in using them, and attitudes toward them. These variables are represented by the average scores from their respective sets of questions.

Table 7: Correlation Analysis of Gender Differences in Digital Tool Knowledge, Skills, and Attitudes

Sno.	Hypothesis	Correlation (r)	p-value	Conclusion
1	Gender vs. Knowledge	0.12	0.37	No significant relationship
2	Gender vs. Skills	-0.08	0.55	No significant relationship
3	Gender vs. Attitudes	-0.18	0.18	No significant relationship

According to Table 7, there is no significant relationship between gender and any of the three measured aspects concerning teachers and digital tools: knowledge ($r=0.12, p>0.05$), skills ($r=-0.08, p>0.05$), or attitudes ($r=-0.18, p>0.05$). Across all three measures, the correlation coefficients are negligible or weak and non-significant, leading to the conclusion that the null hypothesis cannot be rejected for any of the relationships.

The findings suggest that gender is not a significant factor in a teacher's knowledge, skills, or attitudes toward digital tools. The weak correlations suggest that other factors, such as training, experience, and school support, may play a more significant role in the adoption of digital tools than gender.

Hypothesis V: There is no significant relationship between years of experience of teachers and their knowledge, skills and attitudes toward digital tools for teaching and learning.

A Pearson correlation analysis will be conducted to test the three hypotheses by assessing the relationship between years of teaching experience and teachers' digital tool knowledge, skills, and attitudes. For the analysis, the categorical data for experience was converted to a numerical scale (0-5 years = 1, 6-10 years = 2, 11-15 years = 3, 16-20 years = 4, 21-25 years = 5, 26-30 years = 6). The measures for the other variables are based on the average scores from the Likert-scale questions in the dataset.

Table 8: Pearson Correlation Analysis of Relationship Between Teaching Experience and Digital Tool Knowledge, Skills, and Attitudes

Sno.	Hypothesis	Correlation (r)	p-value	Conclusion
1	Experience vs. Knowledge	0.32	0.016	Significant positive relationship
2	Experience vs. Skills	0.21	0.11	No significant relationship
3	Experience vs. Attitudes	-0.24	0.068	No significant relationship (but negative trend)

Table 8 indicates a weak positive correlation (r=0.32) that is statistically significant ($p<0.05$). The null hypothesis, which states there is no significant relationship, is therefore rejected. This means there is a significant positive relationship between teaching experience and knowledge of digital tools. However, a closer look at the data reveals a nuanced trend that is not strictly linear. While some experienced teachers (26-30 years) exhibit moderate or good knowledge, many novice teachers (0-5 years) report "Limited Knowledge" or "No Knowledge." This suggests that while a statistically significant positive relationship exists, other factors beyond years of experience—such as individual learning initiatives or access to professional development—likely influence a teacher's digital tool knowledge.

Table 8 reveals a weak positive correlation (r=0.21) that is not statistically significant ($p>0.05$). Consequently, we fail to reject the null hypothesis, which confirms that there is no significant relationship between years of experience and skills in using digital tools. The data shows an inconsistent pattern. While some novice teachers (0-5 years of experience) use tools "Sometimes" or "Often," most experienced teachers (21-30 years of experience) report using them "Never" or "Rarely." This finding indicates that, contrary to a potential assumption, there is no consistent pattern suggesting that more experienced teachers use digital tools more frequently. The lack of a significant relationship suggests that other factors besides teaching experience likely influence a teacher's digital tool usage.

Table 8 indicates a weak negative correlation ($r=-0.24$), which approaches but does not reach statistical significance ($p=0.068$). Consequently, we fail to reject the null hypothesis, which confirms that there is no significant relationship between years of experience and attitudes toward digital tools. The data shows that attitudes are generally positive across all experience levels, with most teachers, regardless of experience, "Agree" or "Strongly Agree" that digital tools are beneficial. The weak negative trend, though not

statistically significant, suggests that while attitudes are positive overall, there is a slight tendency for more experienced teachers to have slightly less favourable views. This finding confirms that positive perceptions of digital tools are widely shared and do not vary significantly with years of experience.

Based on the provided analysis, teaching experience has a complex and nuanced relationship with digital tool proficiency. While a statistically significant positive correlation exists between experience and digital tool knowledge (indicating more experienced teachers tend to be more knowledgeable), this relationship is not a consistent linear trend, as some novice teachers are highly knowledgeable while many experienced ones are not. Furthermore, the analysis shows no significant relationship between experience and either digital tool usage skills or attitudes. This suggests that while experience may contribute to knowledge, it does not reliably predict how frequently teachers use these tools or how positively they view them. Instead, a teacher's personal initiative and external factors like professional development or school support likely play a more significant role in their adoption of digital tools.

Research question VII: What challenges do science and technical school teachers face in utilizing digital tools for educational purposes?

Table 9: Challenges in Using Digital Tools

Sno.	Items	Mean (1-5 scale)	SD
1	Lack of technical support	3.57	1.19
2	Insufficient internet connectivity	3.62	1.17
3	Time to learn new tools	3.24	1.16
4	Lack of professional development	3.50	1.18
5	Managing student behavior	3.10	1.16

Average mean = 2.5 Where Scale of 1= Not a challenge, 2= Minor challenge, 3= Moderate challenge, 4= Significant challenge, 5= Very significant challenge

Table 9 shows that teachers' top challenges are Internet connectivity (mean=3.62) and technical support (mean=3.57). All challenge categories have means above the midpoint of 2.5, and relatively high standard deviations, indicating that all are considered challenges, though the severity of these issues varies widely among teachers. The primary challenges identified for science and technical school teachers in using digital tools include insufficient internet connectivity, a lack of technical support, limited time for learning new tools, inadequate professional development opportunities, and difficulties with managing student behaviour.

Discussion

The study's findings reveal a complex picture of science and technical teachers' engagement with digital tools, highlighting a clear distinction between their positive attitudes and their limited knowledge and infrequent use of these tools. The analysis, performed using SPSS version 27.0, began with a preliminary examination of the demographics of the 200 teachers surveyed. The sample was nearly evenly split between Science Schools (48.3%) and Technical Schools (51.7%). A significant portion of the respondents were early-career teachers, with those having 0-5 years of experience making up the largest group at nearly 40%.

The first set of findings focused on the teachers' current level of knowledge of digital tools. The results indicated that while teachers are most familiar with Learning Management Systems (LMS) and multimedia tools, their overall knowledge across all categories is low, with average scores below 2.5 on a 5-point scale. This limited understanding is further reflected in their skills and usage frequency. The analysis showed that teachers' highest usage is with interactive whiteboards, yet all usage frequencies were below the midpoint of 2.5, suggesting a generally low level of adoption and infrequent use of digital tools in the classroom. This infrequent use appears to be linked to a lack of necessary skills. This findings are related to the results of Alam et al. (2022) whose study indicates that while some teachers possess a basic understanding of ICT tools, many lack the comprehensive knowledge required for effective integration into teaching practices. This gap highlights the need for targeted training and support to enhance teachers' digital tools competencies.

Despite the limited knowledge and infrequent use, teachers hold a strong positive attitude toward digital tools. The mean scores for attitudes were all above 3.9, with the highest agreement on the ability of digital tools to make learning more engaging and to improve student performance. This result is related to the findings of research conducted by Galaraga & Alpuerto (2022) who reported that teachers recognize the potential of digital tools to make learning more engaging and improve student performance, which contributes to their positive attitudes. According to Galaraga & Alpuerto (2022) teachers' positive attitudes are linked to their digital competence, which is a significant predictor of their readiness to adopt digitized instruction. Despite positive attitudes, there is a gap in the daily integration of digital tools in teaching, often due to limited knowledge and experience with these technologies.

However, Woo et al. (2022) reported that some teachers express ambivalence or reservations about the use of digital tools, indicating a need for more comprehensive training and support to enhance their confidence and competence. The integration of digital tools is seen as a way to meet the demands of modern education, which requires more interactive and engaging learning environments.

The study also investigated the relationships between knowledge, skills, and attitudes and demographic variables, finding that neither school type nor gender had a significant relationship with teachers' knowledge, skills, or attitudes toward digital tools. This suggests that perceptions and proficiency with digital tools are similar across both science and technical schools, and that gender is not a differentiating factor in digital tool adoption. This is supported by many studies including Alazzam et al. (2012)'s findings that show no significant differences in attitudes towards technology use based on school type, suggesting that the integration of digital tools is consistent across different educational settings. Another study on Dual Vocational Education and Training teachers by Govindarajan & Balasubramanian (2020) found no significant gender gap in ICT application, despite existing gaps in other contexts. Similarly, another study by Wananyo et al. (2024) found no significant gender differences in attitudes towards using new technology and teaching effectiveness. Study further revealed that that there is no significant difference between attitude towards using new technology and teaching effectiveness on the basis of gender and teacher's affiliation board, and overall attitude towards use new technology was positively related with teaching effectiveness.

However, years of teaching experience showed a more nuanced relationship with digital tool proficiency. While there was a weak but statistically significant positive correlation between experience and knowledge, this relationship was not strictly linear. The data showed that some novice teachers have strong knowledge, while many experienced teachers reported limited or no knowledge. Furthermore, there was no significant relationship between experience and either digital tool usage skills or attitudes. This suggests that factors other than years of experience, such as personal initiative or access to professional development, may be more influential in a teacher's proficiency. The study identified key challenges, with the most significant being insufficient internet connectivity and a lack of technical support, followed by limited time for learning new tools and a lack of professional development.

These findings are supported by many studies including Guillén-Gámez et al. (2022) study whose results revealed that teachers with more than 15 years of experience often exhibit significant differences in digital competence, particularly in using ICT resources for information consumption and production, as well as emerging technologies. In contrast, Pera et al. (2022) study revealed that less experienced teachers may perceive themselves as more competent in areas like communication, collaboration, and digital content creation. On the challenges, Marsevani, (2022), Njihia (2022), and Ramafi (2022) reported that many educational institutions, particularly in developing countries, face challenges with slow or unstable internet connections, which hinder effective online learning and teaching. Similarly, Supratiwi et al. (2021) found that the lack of reliable internet access is a significant barrier for both students and educators, affecting their ability to participate in and deliver online education effectively. However, The absence of adequate technical support was found to be common issue by Rahiem (2021), with many educators and students lacking the necessary skills to utilize ICT tools effectively. The rapid transition to online learning during the pandemic left little time for educators to familiarize themselves with new technologies, impacting the quality of education delivered.

Practical Implications of Research Findings

I. The high proportion of early-career teachers may indicate recent hiring trends or a tech-savvy cohort more likely to respond to digital tool surveys.

II. Professional development programs can be designed for all teachers without needing specialization by school type

III. Resource allocation for digital tools need not differ between science and technical schools based on current readiness levels

IV. Change management strategies for digital adoption can be implemented uniformly across school types

V. Professional development programs should focus on all teachers equally, as gender is not a differentiating factor in digital tool adoption.

VI. Provide hands-on training to convert knowledge into actual skills, especially for experienced teachers

Conclusion

This study, conducted on science and technical school teachers in Sokoto State, reveals a complex and multifaceted picture of their engagement with digital tools. While teachers hold a strong positive attitude towards digital tools, believing they enhance engagement and performance, their limited knowledge and infrequent use of these tools present a significant gap between perception and practice. The findings indicate that proficiency with digital tools is not significantly influenced by either school type or gender. However, years of experience show a nuanced, non-linear relationship with knowledge, suggesting that while more experienced teachers may have greater knowledge, factors beyond experience—such as training, access, and personal initiative—are more influential. The primary barriers to effective digital tool implementation were identified as insufficient internet connectivity, a lack of technical support, and inadequate professional development opportunities. To bridge the gap between positive attitudes and limited use, it is recommended that interventions focus on providing hands-on training and addressing the infrastructural and support-related challenges identified in the study.

Recommendation

Based on the findings of the paper, the following recommendations were made to address the gap established in the study:

6. Since gender and school type don't significantly impact digital tool proficiency, professional development programs should be designed to be universal, rather than specialized for a specific school type or gender. The focus should be on providing practical, hands-on training that helps teachers convert their positive attitudes into actual skills.
7. Training should not be exclusively for new teachers but should also target experienced teachers to boost their foundational knowledge and skills.
8. The most significant challenges identified were insufficient internet connectivity and a lack of technical support. To improve digital tool adoption, schools and the Ministry of Science and Technology should prioritize investing in reliable internet infrastructure and establishing dedicated, accessible technical support for teachers.
9. The study found a weak, non-significant negative trend suggesting that more experienced teachers may have slightly less positive attitudes, possibly due to established teaching habits. Training approaches

should be designed to address these perceptions and encourage veteran teachers to overcome resistance and embrace new methodologies.

10. Teachers identified "Time to learn new tools" as a key challenge. School administrators should incorporate dedicated time into the school schedule for teachers to learn and experiment with new digital tools, fostering a culture of continuous professional development and preventing the lack of time from being a barrier to adoption.

Reference

Alam, T., Khurshid, F., & Farooq, U. (2022). Secondary School Teachers' Level of Knowledge and Use of ICT in Classroom. *SJESR*, *5*(3), 108–115.

Alazzam, A. O., Bakar, A. R., Hamzah, R., & Asimiran, S. (2012). Effects of demographic characteristics, educational background, and supporting factors on ICT readiness of technical and vocational teachers in Malaysia. *International Education Studies*, *5*(6), 229–243. https://doi.org/10.5539/ies.v5n6p229

Burroughs, N., Gardner, J., Lee, Y., Guo, S., Touitou, I., Jansen, K., & Schmidt, W. (2019). A review of the literature on teacher effectiveness and student outcomes. In *Teaching for excellence and equity: Analyzing teacher characteristics, behaviors and student outcomes with TIMSS,* (pp. 7–17). https://doi.org/10.1007/978-3-030-16151-4

Galaraga, R. L., & Alpuerto, R. J. C. (2022). Competence and attitude as predictors of teachers' readiness for digitized instruction. *Sapienza*, *3*(7), 2–13. https://doi.org/10.51798/sijis.v3i7.497

Govindarajan, K., & Balasubramanian, T. (2020). Influence of attitude and competency towards ict on job satisfaction of secondary school teachers. *Journal of Natural Remedies*, *21*(4), 13–19. https://jnronline.com/ojs/index.php/about/article/view/145

Guillén-Gámez, F. D., Cabero-Almenara, J., Llorente-Cejudo, C., & Palacios-Rodríguez, A. (2022). Differential Analysis of the Years of Experience of Higher Education Teachers, their Digital Competence and use of Digital Resources: Comparative Research Methods. *Technology,*

Knowledge and Learning, *27*(4), 1193–1213. https://doi.org/10.1007/s10758-021-09531-4

Issah, A. (2023). Science teachers' knowledge and integration of ICT tools in teaching Integrated Science. In *Accident Analysis and Prevention*. University of Education, Winneba.

Marsevani, M. (2022). The Challenges of E-Learning for Higher Education Lecturers and Learners. *Journal of Education Technology*, *6*(3), 467–477. https://doi.org/10.23887/jet.v6i3.45537

Munna, M. S. H., Hossain, M. R., & Saylo, K. R. (2024). Digital Education Revolution: Evaluating LMS-based Learning and Traditional Approaches. *Journal of Innovative Technology Convergence*, *6*(2), 21–40. https://doi.org/10.69478/jitc2024v6n002a03

Njihia, E. M. A. I. F. C. M. (2022). Obstacles To Successful Uptake of Open Distance and E-Learning (Odel) Programmes: a Case of Kenyatta University, Kenya. *African Multidisciplinary Journal of Research*, *2986*(January). https://doi.org/10.71064/spu.amjr.1.1.66

Pera, B., Hajdukiewicz, A., & Hodak, D. F. (2022). Digital Competencies among Higher Education Professors and High-School Teachers: Does Teaching Experience matter? *Business Systems Research*, *13*(2), 72–95. https://doi.org/10.2478/bsrj-2022-0016

Rahiem, M. D. H. (2021). Technological barriers and challenges in the use of ICT during the COVID-19 emergency remote learning. *Universal Journal of Educational Research*, *8*(1), 6124–6133. https://doi.org/https://doi.org/10.13189/UJER.2020.082248

Ramafi, P. (2022). Investigating the Barriers of ICT use in Teaching and Learning at Public Schools in South Africa. *International Conference on Intelligent and Innovative Computing Applications*, *2022*(2021), 92–102. https://doi.org/10.59200/iconic.2022.010

Sharma, S., & Saini, J. R. (2022). On the role of teachers' acceptance, continuance intention and self-efficacy in the use of digital technologies in teaching practices. *Journal of Further and Higher Education*, *46*(6), 721–773.

Supratiwi, M., Yusuf, M., & Anggarani, F. K. (2021). Mapping the Challenges in Distance Learning for Students with Disabilities during Covid-19 Pandemic: Survey of Special Education Teachers. *International Journal of Pedagogy and Teacher Education*, *5*(1), 11. https://doi.org/10.20961/ijpte.v5i1.45970

Tseng, J. J., Chai, C. S., Tan, L., & Park, M. (2022). A critical review of research on technological pedagogical and content knowledge (TPACK) in language teaching. *Computer Assisted Language Learning*, *35*(4), 948–971.

Wananyo, U. E., Ebi, A.-E., & Ibi, E. (2024). Attitude of clinical teachers towards the use of innovative technology in teaching and learning in the university of Port Harcourt medical school, South Nigeria. *Asian Journal of Education and Training*. https://doi.org/https://doi.org/10.20448/edu.v10i1.5367

Woo, A., Omar, S. F., Nawi, H. S. A., Pek, L. S., Mee, R. W. M., & Shahdan, T. S. T. (2022). Digital Educational Tools: Teachers' View on Learners Attitude. *Quantum Journal of Social Sciences and Humanities*, *3*(2), 52–56. https://doi.org/10.55197/qjssh.v3i2.135

Xie, C., Schimpf, C., Chao, J., Nourian, S., & Massicotte, J. (2018). Learning and teaching engineering design through modeling and simulation on a CAD platform. *Computer Applications in Engineering Education*, *26*(4), 824–840.