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EDUCATION

TEACHERS' TECHNOLOGICAL KNOWLEDGE IN TEACHING AND LEARNING: A CASE OF SELECTED SCHOOLS IN LUWEERO DISTRICT

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ABSTRACT

Purpose of Study: The study examined teachers' technological knowledge in teaching and learning in selected secondary schools in Luweero District, to establish how teachers' preparedness to use Information and Communication Technology (ICT) influences the teaching–learning process.

Problem Statement: In Uganda, the government has demonstrated commitment to ICT integration through initiatives such as the National ICT Policy for Education (2004) and the Education Digital Agenda Strategy (2021–2025). Despite these efforts, national education statistics indicate that ICT use in teaching and learning remains limited. Recent reports show that only about 41% of schools nationally and approximately 37.8% of schools in Luweero District effectively use ICT for instructional purposes. Challenges such as inadequate digital infrastructure, limited internet connectivity, insufficient teacher training, and low technological confidence persist, particularly in rural districts. Consequently, teachers in many secondary schools in Luweero District appear inadequately prepared to integrate ICT into teaching and learning processes. This situation threatens the attainment of national education goals related to digital learning and quality education.

Methodology: The study adopted a cross-sectional survey design, involving 75 teachers drawn from both public and private secondary schools. Data was collected using a structured questionnaire comprising closed-ended items measured on a five-point Likert scale, complemented by key informant interviews to enrich quantitative findings. Data analysis employed descriptive statistics, including frequencies and percentages. In addition, Pearson

correlation analysis was used to establish the nature and the strength of the association between technological knowledge and teaching–learning processes, while linear regression analysis determined the predictive effect of teachers' technological knowledge on learning processes.

Result: The findings revealed a strong and statistically significant positive relationship between teachers' technological knowledge and teaching–learning processes ($r = 0.662$, $p < 0.01$). Regression results further indicated that teachers' technological knowledge significantly predicts effective learning processes in the selected schools.

Conclusion: Teachers' technological knowledge is a critical determinant of effective ICT-supported teaching and learning in secondary schools in Luweero District.

Recommendation: Schools and education authorities prioritize continuous ICT-focused professional development, strengthen access to digital teaching resources, and promote learner centered pedagogical approaches supported by technology to enhance teaching and learning outcomes.

Keywords: *Technological, Pedagogical, Teaching and Learning, Content, Knowledge*

INTRODUCTION

Teaching and learning are interconnected processes that require teachers to continuously update their professional competencies to match evolving educational demands. One of the most significant contemporary developments in education is the integration of Information and Communication Technology (ICT) into teaching and learning processes. Effective ICT integration depends largely on teachers' technological knowledge and their ability to apply digital tools to enhance instruction and learner engagement (Alenezi, 2017). Historically, the use of ICT in education during the 1980s and 1990s was limited to basic computer literacy and administrative functions, with minimal classroom application. Teachers' technological knowledge during this period was generally low due to inadequate infrastructure, limited training opportunities, and a lack of pedagogical focus. In the early 2000s, increased recognition of ICT's educational potential led many governments to introduce policies promoting ICT integration in schools. However, teacher preparedness remained uneven, as training programs were often technical rather than instructional, and many teachers lacked the confidence and skills required for effective classroom use.

By the mid-2010s, attention shifted from access to technology toward meaningful pedagogical integration. Research began emphasizing teachers' technological knowledge as a critical factor influencing successful ICT integration, alongside pedagogical competence, attitudes, and institutional support. Despite this shift, persistent challenges such as inadequate infrastructure, limited professional development, and insufficient leadership support continued to affect ICT use, particularly in rural and under-resourced schools.

Globally, countries such as Malaysia, Peru, and Ghana have invested heavily in ICT integration in education, yet evidence from these contexts demonstrates that access to technology alone does not guarantee improved teaching and learning outcomes without adequate teacher technological competence. These experiences underscore the importance of focusing on teachers' technological knowledge rather than solely on the availability of ICT resources.

PURPOSE OF THE STUDY

The study aimed at assessing teachers' technological knowledge in teaching and learning among Selected Schools in Luweero District, Uganda.

LITERATURE REVIEW

Previous research has shown that teachers' technological knowledge plays a critical role in enhancing student engagement and improving learning outcomes through effective integration of technology in teaching and learning processes (Bauer & Kenton, 2005; Johnson, 2016). However, results remain inconsistent across different educational contexts. Several studies suggest that teachers who possess strong technological knowledge are better able to design engaging, learner-centered, and personalized instructional strategies that positively influence students' academic performance. In contrast, other studies report that despite the availability of technological tools, limited pedagogical integration and insufficient teacher competence hinder meaningful learning outcomes.

One of the hallmarks of contemporary teaching and learning methods is the incorporation of technology into the classroom. This change shows the significance of adjusting to the digital age and marks a substantial divergence from conventional approaches. Teachers' technological expertise is essential to this integration's success. One of the most important factors in raising student engagement and increasing learning outcomes is teachers' capacity to successfully integrate technology into their educational methods (Bauer & Kenton, 2005). Although Bauer and Kenton (2005) recognize the value of teachers' technology expertise in improving learning outcomes and student engagement, there is a noticeable lack of empirical research that explores the ways in which this expertise influences pedagogical practices.

Technology and education have a complicated and multidimensional relationship. The Technological Pedagogical Content Knowledge (TPACK) paradigm has gained popularity as a formal way to examine this junction. This approach, which was put forth by Mishra and Koehler (2006), highlights the intersection of three categories of knowledge: content, pedagogical, and technological. Creating meaningful and successful learning experiences requires the interaction of several knowledge domains.

The TPACK paradigm emphasizes that in order to successfully incorporate technology into their teaching strategies, teachers must also have pedagogical understanding and topic mastery. Nonetheless, the literature identifies a study deficit that particularly examines the ways in which educators' technology and content expertise interact within the framework. To fully understand the complex interactions between different knowledge categories and how they all work together to inform effective teaching strategies, empirical research is necessary. The incorporation of technology has transformed conventional teaching and learning approaches and changed the face of education. The ability of instructors to use technology well has become a key factor in determining students' performance in school in this digital age. Student engagement, individualized learning, and overall educational achievements can all be greatly improved by the capacity to smoothly integrate technology resources into pedagogical methods (Johnson, 2016).

According to the current study, it is beneficial to take this paradigm shift into consideration. However, there is a research gap in that there aren't many comprehensive empirical studies that specifically link teachers' proficiency in integrating technology with enhanced student

engagement, individualized learning, and overall educational outcomes (Johnson, 2016). To provide verifiable proof for these claims, more research is required.

Beyond only being technically proficient, technological knowledge is important for developing key digital literacy abilities. Students need help identifying reliable information sources, assessing digital content, and using the internet sensibly. Teachers who are knowledgeable in these fields can give pupils the tools they need to succeed in the information environment of the twenty-first century (Hobbs, 2010). The literature does not, however, fully explore how teachers' technology expertise influences their capacity to develop abilities like assessing digital content, using online platforms sensibly, and identifying reliable information sources.

The majority of existing literature has focused on the availability of ICT infrastructure, access to digital tools, and general attitudes toward technology use in education, leaving the specific influence of teachers' technological knowledge on pedagogical practices and student learning processes underexplored. Recent studies have highlighted the need for further investigation into how teachers' technological knowledge interacts with pedagogical and content knowledge, as emphasized in the Technological Pedagogical Content Knowledge (TPACK) framework, to support effective teaching and learning.

METHODOLOGY

This study used a quantitative cross-sectional survey approach to examine teachers' preparedness and level of technological knowledge in integrating ICT into the teaching and learning process in selected secondary schools in Luwero District. Data were collected through structured questionnaires and analyzed using descriptive and inferential statistical techniques. The sample consisted of 80 teachers drawn from four public and private secondary schools, selected using simple random sampling. Statistical analysis was carried out using SPSS version 22, employing frequencies, percentages, means, standard deviations, and correlational analysis to test the study hypotheses and examine relationships among key variables.

FINDINGS AND DISCUSSION

The results show that teachers' level of technological knowledge is significantly related to learning processes in selected secondary schools in Luwero District. The analysis indicates that teachers' technological proficiency increased the effectiveness, interactivity, and engagement of teaching and learning processes across the study period. Quantitative findings revealed a strong positive correlation between teachers' technological knowledge and learning processes ($r = 0.662$, $p < 0.01$), while regression analysis confirmed that technological knowledge accounted for 72.5% of the variation in learning processes, indicating a substantial predictive effect. Contrary to expectations, a small proportion of teachers were not found to have adequate practical skills in classroom ICT presentation, despite generally positive attitudes toward technology use. The main outcome of the study is that teachers' technological knowledge is a critical determinant of effective learning processes, and enhancing ICT competencies among teachers can significantly improve student engagement, teaching effectiveness, and overall learning outcomes in Luwero District schools.

Table 1: Analysis of Factors for Teacher Technological Knowledge

Response	Agree		Undecided		Disagree	
	F	%	F	%	F	%
I concur that the integration of technology in education has significantly changed teaching and learning methods.	75	100	00	00	00	00
I believe that the ability of teachers to effectively incorporate technology into pedagogical practices enhances student engagement and learning outcomes.	70	93.3	00	00	5	6.7
Teachers should possess both content expertise and technological skills to successfully integrate technology into their teaching methods.	73	100	00	00	00	00
Technological knowledge enables educators to create dynamic and interactive learning experiences that enhance student engagement.	75	100	00	00	00	00
I use at least a computer to prepare my lessons.	68	90.7	00	00	7	9.3
I know how to use a computer to present the lesson to the learners	65	86.7	00	00	10	13.3

Table 1 generally, depicts that indeed technological knowledge of a teacher is a vital recipe for teaching learning process in most secondary schools in Luwero.

Table 2: Correlation Analysis

		Teaching Learning processes	teachers' level of technological knowledge
Teaching Learning processes	Pearson Correlation	1	.662**
	Sig. (2-tailed)		.000
	N	80	80
Teachers' level of technological knowledge	Pearson Correlation	.662**	1
	Sig. (2-tailed)	.000	
	N	75	75

**. Correlation is significant at the 0.01 level (2-tailed).

Table 2 shows a positive and strong relationship between teacher's technological knowledge and teaching learning process in secondary schools in Luwero.

Table 3: Model Summary of Teachers' Level of Technological Knowledge

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.662[a]	.725	.724	.15216

a. Predictors: (Constant), Teachers' level of technological knowledge

Table 3 shows that teacher's technological knowledge influences teaching learning process by about 72.4%.

Table 4: Regression output summary

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.385	.134		2.882	.005
teachers' level of technological knowledge in teaching	.921	.030	.662	30.953	.000

a. Dependent Variable: Learning processes

Table 4 shows that for every unit change in the teacher's technological knowledge teaching learning process is enhanced by about 92.1% (B=0.921). Furthermore, the study revealed that there are other factors that contributing 38.5%.

DISCUSSION

These findings are consistent with previous studies that reported a strong positive relationship between teachers' technological knowledge and effective teaching and learning processes, particularly in enhancing student engagement, interactive learning, and improved learning outcomes (Kyeyune, et.al. 2025; Buluma, 2023; Bauer & Kenton, 2005; Johnson, 2016). The results differ from earlier work, which suggested that technological proficiency alone is insufficient to influence pedagogical practices unless accompanied by strong pedagogical and content knowledge, as emphasized in the TPACK framework (Mishra & Koehler, 2006). One possible explanation for the findings is that teachers in the selected Luweero District schools possess not only basic ICT skills but also practical experience in integrating technology into lesson preparation and delivery, enabling technology to directly support instructional effectiveness (Koyuncuoglu, 2021; Kyeyune, et.al. 2025). The study contributes to the literature by providing new empirical evidence from a Ugandan context on how teachers' technological knowledge significantly predicts learning processes, addressing a gap identified in earlier studies that lacked localized and comprehensive empirical validation. Implications of the results include the need for targeted professional development programs focusing on advanced ICT integration, digital pedagogy, and classroom application of technology, and they suggest directions for future research

to explore how technological knowledge interacts with pedagogical and content knowledge in influencing learner-centered outcomes across diverse educational settings.

CONCLUSION AND RECOMMENDATIONS

This study concluded that teachers' technological knowledge has a significant and positive influence on teaching and learning processes in secondary schools in Luwero. Therefore, we recommend that schools should invest in Technology in class and keep teachers a breast of new trending in teaching with these technologies.

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